The market liquidity of designated 2B equity securities under the Basel accord: Empirical evidence from South African Commercial Banks

By

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DECLARATION

I, Samuel Tabot Enow, declare that the contents of this thesis represent my own unaided work, and that the thesis/dissertation has not previously been submitted for academic examination towards any qualification. Furthermore, it represents my own opinions and not necessarily those of the Cape Peninsula University of Technology.

_____ _____08-12-2021__

Signed **Date**

ABSTRACT

The financial market liquidity of an asset has always been an important concept in banking and financial markets because it keeps leveraging in check. From a regulatory perspective, liquid assets reduce herding where market participants can easily trade reducing violent pricing. Despite the abovementioned relevance, the challenge has always been to effectively determine the liquidity state of an asset using an appropriate approach in other to make informed decision or develop suitable policies. In the case of the Basel III framework, estimating the financial market liquidity of the supposed level 2B common equity high quality liquid assets (HQLA) and estimating whether the liquidity coverage ratio (LCR) and Net stable fund ratio (NSFR) needs to be improved remains an unresolved issue. Proper representation of the above liquidity standard measures will ensure effective corporate investment strategies in addition to meeting short term obligations. Acquiring a pool of assets to act as cushion against short term obligations depends on the extent to which these assets can be sold without significant price movements. In other words, exotic assets should not be considered as collateral for meeting short term obligations, or some form of elusive risk measure should be assigned for these assets. This is the premise on which the LCR and NSFR should be based.

Therefore, the objective of this study was to test and validate the market liquidity of the level 2B common equity in the LCR and NSFR. Market liquidity measures where modelled and tested empirically to rebuff or validate whether the LCR and NSFR needs to be improved. This was achieved by regressing specific indicators against widely accepted cognitive measures of liquidity. This study used a panel data spanning over a period of 5 years from May 2016 – May 2021 to investigate the liquidity state.

Using a fixed effect model, the findings of this study indicates that the common equity securities that qualifies to be included in level 2B HQLA category lack market depth and market resilience displaying low levels of market tightness. This was evident in the significant relationship between the specific independent and dependent variables used in this study although there was no significant relationship between transaction cost and price effect. Therefore, there was sufficient evidence that the LCR and NSFR measures for liquidity management in the banking sector needs to be improved which can also be extended to other markets. An improved LCR and NSFR was suggested in addition to a specialist system in order to capture the volatility of the level 2B equity securities and improve the market liquidity of these assets. It was also suggested that the Basel Committee for Banking Supervision (BCBS) should amend their current approach of estimating liquidity to include the model that integrates the short run and long run effect and the contingency funding plan in the banking sector. Finally, because the new LCR and NSFR framework introduced in this study provides a pragmatic standard for liquidity management, it should be included in Basel IV.

Keywords: Financial market liquidity, market depth, market tightness, market resilience, Basel III, liquidity management, price continuity theory of liquidity preference.

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DEDICATION

I dedicate this study to my parents Enow John Mbi and Enow Sophie Tabe for their love, care and support throughout all these years. May God Almighty continue to guide and protect them. May they live long enough to see all the plans of God in their lives

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ABBREVIATIONS AND ACRONYMS

ADF	Augmented Dickey-Fuller test
ADRL	Autoregressive Distributed Lag
ASF	Available Stable Funding
BCBS	Basel Committee for Banking Supervision
BESA	Bond Exchange of South Africa
BIS	Bank for international settlement
BIT	Buyer Initiate Trades
CET1	Common Equity Tier 1
CFP	Contingency Funding Plan
CRM	Comprehensive Risk Measures
CV	Coefficient of Variation
DF	Dickey-Fuller
EAD	Exposure at Difficult
FSB	Financial Service Board
GDP	Gross Domestic Product
HDC	Higher Degree Committee
HQLA	High Quality Liquid Assets
IMF	International Monetary Fund
IRC	Incremental Risk Charge
JSE	Johannesburg Stock Exchange
KPMG	Klynveld Peat Marwick Goerdeler
KPSS	Kwaitkowshi, Phillips, Schimdt and Shin
LCR	Liquidity Coverage Ratio
MEC	Market Efficiency Coefficient

NSE	Nairobi Stock Exchange
NSFR	Net Stable Fund Ratio
NYSE	New York Stock Exchange
OECD	Organisation for Economic Corporation and Development
OLS	Ordinary Least Squares
P-P	Phillip-Peron
PWC	Price Waterhouse Coopers
RC	Replacement Cost
RSF	Required Stable Funding
RWA	Risk Weighted Assets
SA-CCR	Standardised Approach for Counter Party Credit Risk
SARB	South Africa Reserve Bank
SEC-ERB	SEC-External Rating Approach
SEC-IRB	SEC-Internal Ratings Based Approached
SI	Shares Issued
SIT	Seller Initiate Trades
SVAR	Stressed Value at Risk
TC	Transaction Cost
TORQ	Trade, Orders, Reports and Quotes
TV	Trading volume
US	United States
VNET	Net Volume to Price Volatility
VAR	Vector autoregression
VECM	Vector error correctional model

CHAPTER 1

INTRODUCTION AND BACKGROUND

1.1 Introduction

In banking and financial management, risk, which represents exposures to losses, is mitigated through diversification (Roncoroni, Battiston, D'Errico, Hałaj & Kok, 2014:3). The concept of diversification in financial systems makes it possible to obtain a relatively safe return from any investment (Benartzi & Thaler, 2001:81). Liquid equity securities provide safe returns by ensuring that the asset realises at least its face value when traded (Romanyuk, 2010:5). These liquid assets are tradable financial instruments and can be bought and sold in the open market to meet the needs of a firm (Elliot, 2015:3). To this end, liquid securities are ideal investments due to their robustness in providing fast and secure trading with ready access to cash and low probability of sale rollbacks. Sturdy liquid security benefits market participants by fostering transparency, market efficiency and investor confidence (Yartey, 2008:17). This means that the price of liquid securities is aligned to their fundamental values with no expectation of arbitrage opportunities (Ajello, Benzoni & Chyruk, 2012:56). Any arbitrage opportunity is automatically transmitted to the valuation of the asset hence improved market efficiency (Herschberg, 2012:9). The abovementioned advantages of liquid assets are possible because they have the following characteristics (Sarr & Lybek, 2002:4);

- Liquid securities can be traded in deep financial markets, which is characterised by large volumes and high-frequency trading.
- Low-interest rate risk due to lower risk and return trade-offs.
- Lower levels of withdrawal run risk.
- Easy access to liquidity pools.
- Easy access to cash without exposures to price risk.
- Symbiotic relationship between stable price, large volume and trading cost.

The idea of mitigating risk was the premise that the Basel Committee for Banking Supervision (BCBS) (2010) based the introduction of the concept of high quality liquid assets (HQLA) in the liquidity standards for liquidity management in the BASEL III framework. This liquidity standard comprised of two ratios; namely, the liquidity coverage ratio (LCR) and net stable fund ratio (NSFR), where banks are expected to hold a certain level of HQLA and stable funding to mitigate the effect of market shocks on liquidity risk predominant in banks (BCBS, 2010). The LCR and NSFR aimed to provide short-term and long-term resilience to potential adverse conditions in the market by ensuring that banks hold enough HQLA and stable funds,

thereby improving liquidity positions (Neijs & Wycisk, 2015:3). As outlined in the BCBS (2010:28) report, the purpose of these ratios is to;

- Provide a simple, non-risk based and credible ratio to act as a backstop and supplement risk capital requirement.
- Reduce the build-up of excess leverage in the banking sector to avoid destabilising the operational efficiencies.
- Re-enforce the capital base requirements.

During the 2008 financial crisis, distressed banks were still portraying substantial risk-based capital ratios although they were experiencing severe liquidity shortages (BCBS, 2013, p.1). Before the 2007/2008 financial crisis, financial institutions had taken too much debt with inadequate liquidity measures, which was later amplified by ineffective risk measures leading to a mismatch of their liquidity and credit risk (Acharya & Richardson, 2009:196). The financial crisis caused a reduction in the banking sector leverage which resulted in the amplification of downward pressure on asset prices (Koh, Kose, Nagle, Ohnsorge & Sugawara, 2020:10). The introduction of the LCR was to absorb additional losses that may arise from risky assets, which is common in banks that are less resilient to shocks in the market and are highly levered (Al-Darwish, Hafeman, Impavido, Kemp & O'Malley, 2011: 59). This is partly achieved by ensuring that banks have enough supply of cash for a 30-day period in cases of financial distress. The 30-days period refers to the minimum time frame for the bank's management or risk management committee to take necessary actions to address the distress (Adrian & Brunnermeier, 2016:904).

On the other hand, the NSFR is to restrain balance sheet maturity transformation risk, which was evident in the banking sector (BCBS, 2010:31). Again, before the financial crisis, many financial institutions did not see the need to continuously monitor their funding structures as they believed liquidity was boundlessly available in the market (Marco, 2016:66). Therefore, the NSFR prudential measure of liquidity management can restrain intemperate reliance on unstable funding sources (Hlatshwayo, Petersen, Petersen & Gideon, 2013:8). Rectifying this transformation risk will be achieved by matching the long term assets such as long term loans with less reliable funding sources. According to Adrian and Brunnermeier (2016:906), the LCR and NSFR ratios should provide banks with the necessary cushion needed to remain solvent and not force banks to sell their assets at a price that is not justified.

The components of the LCR and NSFR designed for liquidity management in BASEL III are cash, and cash equivalents, sovereign, corporate and covered debt securities, common equity securities, residential mortgage-backed securities, available stable funding (ASF) and required

stable funding (RSF) which relies on a sophisticated, well-functioning financial systems and fair trading (BCBS, 2013:14; Elliot, 2015:8). However, this might not be the case for most emerging markets, particularly in the case of South Africa, where the market has continuously deteriorated (Erasmus, 2015; SARB,2019). Coupled with other macro factors, the South African market is experiencing an increase in inactive traders and adverse regulations which do not support the market (Kapingura & Ikhide, 2011; Mabuza, 2017). As a result, in addition to the systematic risk in the economy mentioned above, the level of market makers has significantly decreased, and liquidity has become very thin (Erasmus, 2015:97; Mabuza, 2017:107). This is attributed to the complex environment in South Africa, which has proven to be challenging where banks and investors face numerous risks, ranging from global contagion, national uncertainty and increasing level of government debt. Also, the LCR and NSFR may not provide a good coverage of macro-prudential risk without empirically assessing the market liquidity, considering that it revolves around trading (Hlatshwayo, Petersen, Petersen & Gideon, 2018:8)

Furthermore, considering that the BIS (2014) stressed the need for a solid liquidity base and capital adequacy and also considering the recent trends in the market as stated above, there is still uncertainty as to whether South African banks can confidently rely on the LCR and NSFR to curb liquidity risk and provide a good liquidity cushion. The International Monetary Fund (IMF) (2011), as cited in the study of Marozva (2017:127), contends that the LCR and NSFR in Basel III are not adequately structured to address any additional liquidity shortfall that may arise from market stress. This concern stems from implementing a static measure for different geographical market conditions without continuously estimating and reporting the liquidity state of the assets, although banks are required to disclose the following (Bank for international settlement (BIS), 2014, P.3);

- The consolidated basis of LCR and NSFR in a single currency
- Simple averages of daily data
- The number of data points.
- Weighted and unweighted figures of the ratios
- The adjusted values of HQLA and net outflows
- Qualitative discussion on these ratios.

This prompted the IMF to request for a more robust macro prudential liquidity standard (IMF, 2011:30). In the banking sector, funding and central bank liquidity have to do with raising capital and deposits to the central bank, respectively, which are not as important as market liquidity (Czelleng, 2018:514). This is particularly true because banks operating in South Africa

have consistently met the South African Reserve Bank requirements in terms of funding and central bank liquidity but are unable estimate and report on the market liquidity positions of their level 2B HQLA (Scott, 2019). Therefore, considering the relevance of financial market liquidity and the role of the banking sector in the South African economy, it becomes necessary to investigate the state of financial market liquidity with specific emphasis on level 2B HQLA in South Africa to improve the LCR and NSFR.

1.2 Research problem

Prior literature (Berger & Bouwman,2009; Achary & Schnabl, 2010; Ivanshina & Scharfstein, 2010) indicates that the 2008 financial crisis was amplified partly because of liquidity shortfalls. Therefore, adequate measures need to be put in place to abrogate any adverse circumstance regarding liquidity management. As already alluded, the BASEL III framework aimed to improve on previous policies on liquidity risk management. However, it is perceived that the LCR and NSFR still significantly underscored liquidity risk management as recommended in the Basel III framework (Schmitz & Hesse, 2014; IMF, 2013). This concurs with the report of (Schmitz & Hesse, 2014), which contends that some of the asset classes in the definition of HQLA, mainly equity securities are still too volatile in terms of price changes and trading.

The Level 1 and Level 2A assets are cash, central bank reserves, corporate and covered debt securities rated AA- which are liquid and do not generally need liquidity assessment (Boneva, Islami & Schlepper, 2021:9). According to Gabrielsen, Marzo and Zagaglia (2011:21), evaluating an asset's market depth, tightness, and resilience is the crux of financial market liquidity. However, this intuitive consideration is not part of the characteristics for determining the liquidity state of level 2B common equities in the BASEL III framework.

Thus far and in line with equity securities, the input units of market liquidity measures are unclear and difficult to estimate considering that market liquidity is time-related, which has been proven to be a significant challenge (Marozva, 2017:88). Considering the robust measures of assessing capital requirements in the upcoming Basel IV to be implemented in January 2023 (Klynveld, Peat, Marwick & Goerdeler (KPMG) (2020:4), the qualifying equity securities in the LCR and the components of NSFR may be a misrepresentation of the current market nature of level 2B HQLA.

Considering the abovementioned lapses in the BASEL III framework and limitations in academic literature in investigating the financial market liquidity of the specific type of equity securities in the Basel III framework, this study seeks to improve on this niche area and bank liquidity management which has thus far proven to be a challenge particularly in the South African context (Marozva, 2017). Furthermore, following other financial models, this study will introduce a more suitable estimate for LCR and NSFR should the current LCR and NSFR

needs improvement. So far, to the author's knowledge, no comprehensive study has empirically measured and validated the financial market liquidity state of the level 2B HQLA for South African banks.

1.3 Rationale of Study

Market liquidity in stock markets has been investigated (Pennings et al., 2003; Frank & Garcia, 2008; Boonvorachote & Lakmas, 2016; Pham et al., 2020; George and Longstaff, 1993; Kim and Ogden, 1996; Bhattacharya and Bhattacharya, 2018). However, there is a need to empirically investigate the financial market liquidity state of the level 2B common equities for South African banks to validate or improve the LCR and NSFR. Analysing financial market liquidity of the qualifying common equity in the Basel III framework and its implication is not a punitive-based approach but rather an incentive-based approach focusing on specific factors that constitute liquidity. Consequently, this study is significant in that it aims to examine the financial market liquidity state for the level 2B common equities for banks in South Africa and the fact that it is aligned with the renewed interest in the topic. Without this knowledge, it is tough to develop interventions that pinpoint specific aspects of liquidity management. As such, it is worthwhile investigating the market depth, market tightness and market resilience of common equities as there is very little information on this topic in South African.

According to Elliott (2015:4), relying on equity securities with insufficient financial market liquidity may result in economic turmoil or exacerbate an already existing crisis. This implies that banks will have to do fire sales to raise the necessary cash to meet their outflows, which are very common where banks rely on assets with low market liquidity or assets and liabilities mismatches (Marozva, 2017:7). Furthermore, investors are usually averse in markets where their financial market liquidity positions are not certain or very thin, like in the case of South Africa (Brunnermeier & Pederson, 2009:1). This is particularly true because the transaction costs are much higher for illiquid assets where there is a wide bid and ask spread for trading (Goyenko, Holden & Trzcinka, 2009:154). This may also result in a decrease in trading volumes and extending the time to execute a transaction. Market liquidity uncertainty is also a significant factor that affects the fundamental values of trading securities and the volatility of prices (Hameed, Kang & Visawanathan 2010:258). In some instances, there are casualties when securities trade in the opposite direction from their true values, which gives rise to price volatility. This further gives rise to greater risk premium expectations to compensate for additional risk due to the difficulty that may arise when they decide to trade their securities (Jorda, Schularick & Taylor, 2019:27). The aftermath of the abovementioned scenarios will be an increase in the cost of raising capital.

Therefore, it is imperative to empirically estimate the financial market liquidity for the designated common equities to have a robust risk management system for banks and to have informed policies. Banks may find it beneficial to appropriately measuring the state of their level 2B HQLA liquidity positions, considering that they rely on these assets for a 30-day period. Therefore, a paucity of research necessitates this study on liquidity management, specifically in the context of financial market liquidity of common equities.

1.4 Research questions, aims and objectives

The main research question is, what is the financial market liquidity state of level 2B common equity securities for banks in South Africa and its implication on LCR and NSFR?

1.4.1 Research questions

The study seeks to answer the following research questions

- What is the market depth position of level 2B common equity securities in the South African financial markets?
- Those the level 2B common equity securities in the South African financial markets have sufficient market tightness?
- Is there sufficient market resilience for 2B common equity securities in the South African financial markets?
- From the above questions, what will determine an adequate LCR?
- From the above question, what will determine an adequate NSFR?

1.4.2 Aims of the study

The broad aim of this study is to investigate the financial market liquidity of the level 2B common equity securities for commercial banks to propose a more suitable framework for LCR and NSFR.

1.4.3 Research objectives

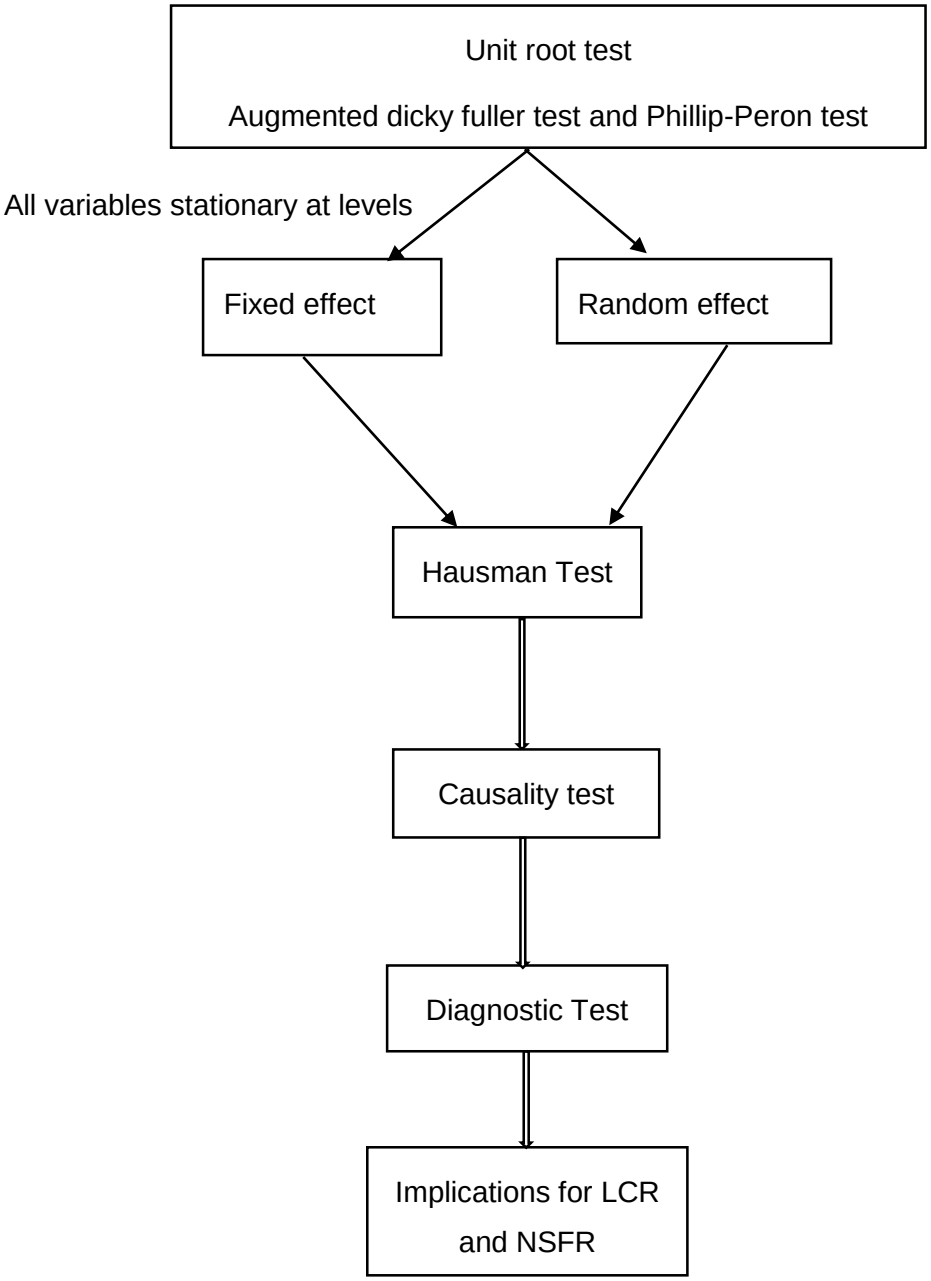
The study seeks to achieve the following objectives

- To assess the Market depth position of level 2B common equity securities.
- To investigate the market tightness position of level 2B common equity securities.
- To determine the market resilience position of level 2B common equity securities.
- To propose a general framework for estimating a more suitable LCR.
- To propose a general framework for estimating a more suitable NSFR.

1.5. Data and methodology

Panel data collected from Bloomberg and Yahoo finance was used to test the hypothesis highlighted in section 1.5 above. In order to meet the research objectives, this study adopted the framework in figure 1.1 highlighted below.

Figure 1.1. Summary of data analysis



Source: Adapted from Shrestha and Bhatta (2017)

1.6. Demarcation/delimitation of the study

This study was limited to level 2B common equity securities trading on the Johannesburg Stock Exchange (JSE). Other level 2B securities such as qualifying debt securities and qualifying Residential mortgage-backed securities were not included in this study because the leading South African banks confirmed with the researcher that these securities are not included in their LCR and NSFR. Also, this study was based on the South African market because South African banks are more compliant with the BASEL III regulation in Africa (BIS, 2015).

1.7. Ethical considerations

In academic studies, the systematic blueprint of data collection and analysis method is of central importance to guarantee ethics in research (Pope, Ziebland & Mays, 2000:2). This study used data that is free to the public, such as Bloomberg terminal, Ycharts and Yahoo finance. Therefore, anonymity, confidentiality, and informed consent were not relevant for this study. The required data did not need any coding nor posed any identification risk and did not involve any human participants. Data from the different secondary sources was carefully applied in order not to diminish the original value. Finally, the findings of this study were not used as a punitive incentive to impose fines or discredit the image or brand of commercial banks operating in South Africa. Therefore, this study did not pose any risk and was free from ethical issues.

1.8. Chapters Outline

Chapter 1: Introduction and background

This chapter will provide an overview of the proposed study. The background, problem statement, research questions, limitations and delineation, and the significance of the research will be covered in this chapter.

Chapter 2: Theoretical Framework

The second chapter provides a blueprint metaphor for the research questions, the research design, and the analysis used to achieve this study's aim. The constructs of financial market liquidity and the interrelationship between the variables was provided in this chapter. This study was built on the theoretical foundation highlighted in the chapter.

Chapter 3: The global Liquidity standard

This chapter provides an overview of the Basel accords: Basel I, Basel II and Basel III and Basel IV. In so doing, the critical issues surrounding the LCR and NSFR are highlighted and contextualised. The conclusion of the chapter set the scene for the literature review.

Chapter 4: literature overview

The literature on liquidity is vast, but this chapter will focus on the financial market liquidity of trading assets. Specifically, this chapter reviews prior literature on market depth, market tightness and market resilience. This review highlighted the current status of the market liquidity in common equities and identified gaps that were used as motivation for the study.

Chapter 5: Research Methodology

This chapter describes the research design and blueprints that were used to address the research question and sub-questions. This chapter also highlights the data analysis models and justifications for the models used and a brief description of why they are better than the other traditional measures.

Chapter 6: Findings and data analysis

This chapter presents the results obtained from the robust data analysis. These analyses were used to accept or rebuff the hypothesis stated in the first chapter to conclude. This chapter presented the analysis and interpretation of the results using the statistical models highlighted in the previous chapter.

Chapter 7: Conclusion and Recommendations

The final chapter provides a summary and conclusions of previous chapters before proceeding to draw conclusions and make recommendations of the study's findings. This chapter highlighted the study's contribution, limitations and areas for further research on financial market liquidity of qualifying common equity securities in the Basel III framework.

CHAPTER 2

THEORETICAL FRAMEWORK

2.1 Introduction

This chapter, the theoretical framework, sets out a contextualised comprehensive theoretical framework that will be used as a base to test the financial market liquidity models highlighted in chapter 5. The ideas that explain and predict the relationship between the constructs of market liquidity of common equities are presented in this section. Accordingly, this chapter highlights the theories that were used to develop the hypotheses.

Section 2.2 begins with the theoretical underpinning.

Section 2.3 highlights Black's price continuity theory of Liquidity preference.

Section 2.4 outlines the transaction cost theory.

Section 2.5 describes the hypothesis developed.

Section 2.6 describes the logical consistency of financial market liquidity theories.

Section 2.7 highlights the explanatory power of financial market liquidity theories.

Sections 2.8 outlines the concept of falsification of the financial market liquidity theories used.

Section 2.9 provides a summary and conclusion of the chapter.

2.2 Theoretical underpinnings

A theory is a tool, system, or proposition used to explain any construct of interest logically, systematically and coherently within some assumptions and boundaries (Kalinichinko, Kovalev & Kovaleva & Malkov, 2014:104). Theories are used to explain the relationship between constructs for an event or phenomenon (Glanz, Rimer & Viswanath, 2008: 96). A theory is bound by data analysis to either confirm, reject, or deconstruct the proposition that frames a study's conclusion (Kivunja, 2018:45). Therefore, theories can be seen as one of the foundations of research and help explain the context of the research and justify the research questions.

Selecting an appropriate theory for this study was of paramount importance because it required the researcher to establish a deep understanding of the research problem and purpose. To this end, the contributions of the current study were partly established from the theories applied. Considering those above, this study utilised the price continuity theory of liquidity preference and the transaction cost theory to provide the structure of the study and as a guide for the research questions and hypothesis.

2.3 Black's price continuity theory of Liquidity preference.

This study's financial market liquidity constructs were based on Black's price continuity theory of liquidity preference developed by Black (1971), which started with Keynes (1936) liquidity preference theory. The liquidity preference was postulated to expound on the determination of interest rate using supply and demand for money, where the demand for money was theorised as an asset (Keynes, 1936). According to Keynes (1936), interest is the compensation for forgoing liquidity, and cash is the most liquid asset. Accordingly, assets should be considered liquid if they can be quickly converted to cash to meet the demand for money (Keynes, 1936). This intuitive logic was based on three motives which are transactionary motive, precautionary motive and speculative motive. According to Keynes (1963), market participants will prefer liquid assets for trading purposes due to uncertainty that may arise in the expected income of risky assets. Also, holding liquid assets serves as a precautionary motive in order to meet unexpected contingencies. Finally, liquid assets may also be held for speculative motives to take advantage of opportunities that may arise in the future.

The theoretical background of the liquidity preference theory was later modified by Black (1971) to include the role of market makers in trading, quantity trading, the role of asymmetric information, and the structure of the market to describe the liquidity of an asset. Market participants mainly are individual investors and institutions. They can raise the same amount of cash if they both hold liquid assets. This is because liquid assets will display a reasonably constant price over the long and short-run irrespective of large market orders. Thus, a small

number of stocks in a well-diversified portfolio can be traded without affecting prices. Also, Black's (1971) price continuity theory proposes that transitionary price changes triggered by mainly market search costs tend to follow a uniform distribution despite the presence of noise traders and private information.

Furthermore, the trading cost of a liquid asset is not exacerbated, and the price recovery from an uninformative shock is expected to be more continuous, which signifies resilience. This proposition was later supported by another paper published by Black (1986), where he ascertains that the volatility of liquid assets tends to be relatively constant and will revert to equilibrium despite market shocks. According to Black (1986:533), if the current market price of a liquid asset is above the average price, market forces such as demand and supply will induce the market price to fall to its average level and vice versa. This means deviations from the mean is expected to revert quickly.

The modified version of the liquidity preference theory proposed by Black (1971) had the characteristics of a more scientific method of estimating market liquidity than other static measures because of the interplay between precise numerical values gleaned from historical data. The additional dimension of the liquidity preference theory demonstrated some form of symmetry due to the notion that long term return variance of the liquid asset should be equal to the sum of the variance of the respective shorter term of the same asset (Isaenko, 2010:2376). Also, Black's (1971) modified theory provided some form of indication of the actual behaviour of the security. This predefined behaviour, the normality of an asset return, is observed in the normal price distribution despite distortions in equilibrium prices by macroeconomic fact (Kim & Kim, 2019:243). In other words, price volatility should not affect order flow because prices will adjust quickly. In instances of bankruptcy or crisis, the assets are expected to trade at their fundamental values.

Black (1971) first added the concept of price continuity to the liquidity preference theory after he noticed the shortcomings in the study of liquidity management in the 1960s. During that period, there was limited knowledge of how some assets termed "liquid" will react to sudden market changes and business fluctuations as proposed by Keynes in the early 60s (Black, 1971). Also, supervisory authorities in most financial institutions ignored the concept of constant price movement portrayed by liquid assets when setting standards for liquidity management (Black, 1971:31). This limitation became a source of concern, which prompted Black (1971) to investigate the price behaviour of liquid assets empirically. According to Black (1971:33), liquid assets guarantee that a market participant will always be willing to execute a buy or sell order when the asset is in the market. In addition to this, the liquid asset will also display a normal distribution shape because of continuous trading. Black (1971) also

contended that the market liquidity of an asset is a function of the number of sell-side and buy-side traders actively trading the asset, and a liquid asset can be sold without distorting its fundamental values. From the modified liquidity preference theory proposed by Black (1971), there should be sufficient evidence of little or no distortion of price movements in the long, intermediate and short term in order to provide a meaningful understanding of market liquidity, including periods of adverse markets wide shocks and idiosyncratic events. Also, static measures in estimating market liquidity, such as the ratio of unpledged securities to total deposit, which was used as a benchmark for evaluating liquidity, need to be refuted (Blacks, 1971). These undeviating and arbitrary measures of liquidity did not meet the requirements for liquidity adequacy (Black, 1971:33).

Black (1971:31) proposed an amalgamation of three factors that constitute market liquidity, as shown in the diagram below.

Figure 2.1. Determinants of financial market liquidity

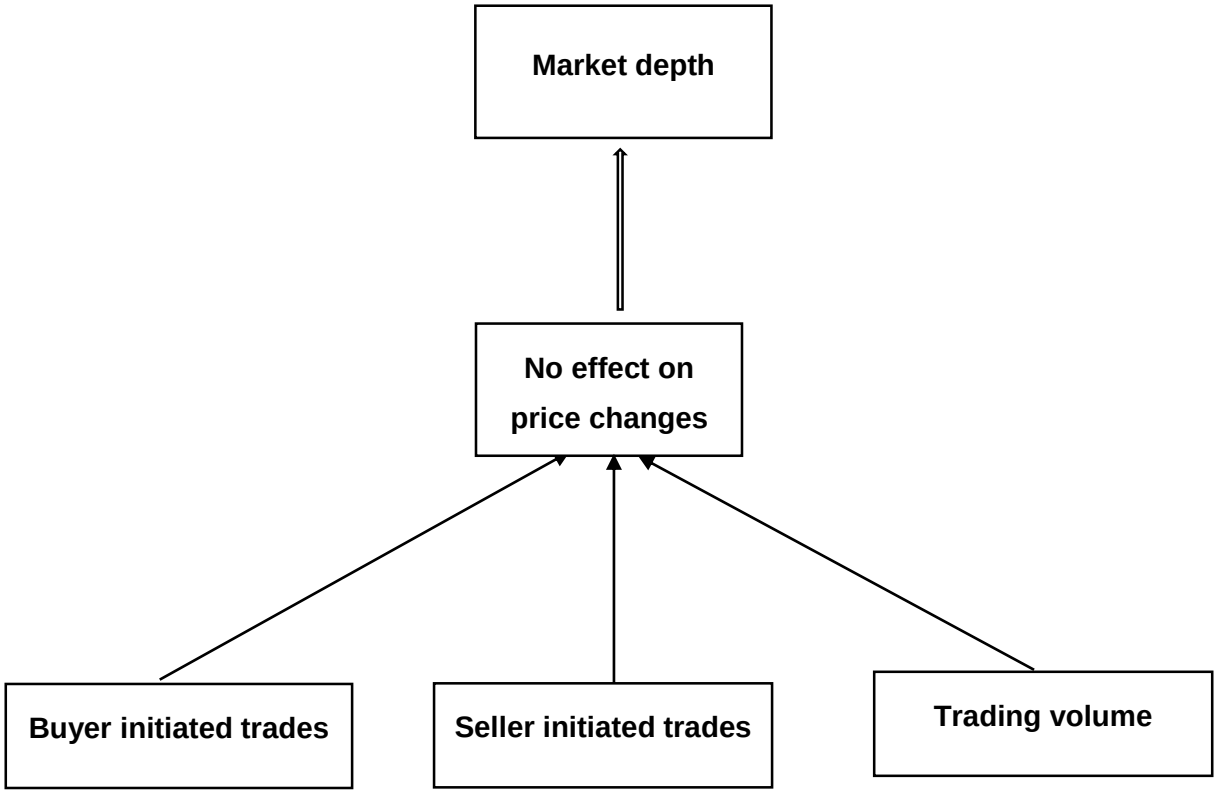
Source: Black (1971:31)

2.3.1 Market depth framework

Black (1971:31) identified four variables that constituted market depth: price changes, buyer-side trades, sell-side trades, and trading volumes. An understanding of market depth is a *sine qua non* in financial market liquidity, especially in trading financial assets (Black, 1971). Market depth was defined by Black (1971:31) as the ability to trade a large number of stocks in the

short and long periods without significant change in price. An understanding of market depth provides good knowledge of the prevailing orders and how these affect the price of a liquid asset. This is seen in the general trend of the market, where increased stocks are seen. An asset is considered to have sufficient depth if more than 80% of the stock is trading above its 200 days moving average (Caginalp & Laurent, 1998:181). Therefore, market depth recognises the long term and short term price stability trends of a liquid asset. This interplay is depicted in the diagram below.

Figure 2.2. Constructs of market depth



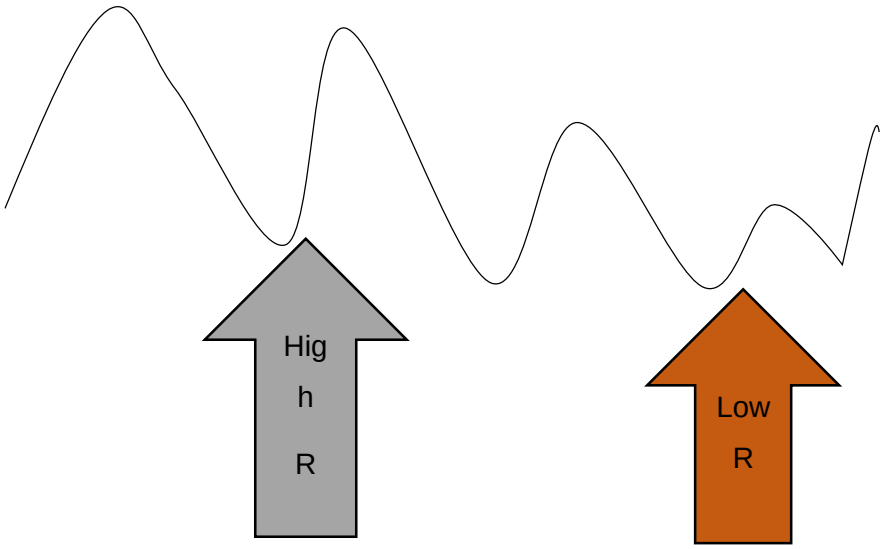
Source: author

2.3.2 Market resilience framework

Black (1971:31) also defined the financial liquidity of an asset in terms of its ability to return to equilibrium after changes in market conditions. This provides the market participant or market the leverage to trade over a long period at the equilibrium price. In essence, liquid financial assets should be able to withstand exogenous market shocks on a regular and ongoing basis. According to Black (1971:31), resilience supports equilibrium by driving the prices upwards quickly from uninformative shocks. The market resilience of an asset can only be ascertained when the asset's market price is tested over time because changes in resilience are rhythmic

(Wanzala, Muturi & Olweny, 2017:2). Also, the market resilience of an asset reveals the views and enthusiasm in the market where market participants will favour liquid assets. Market resilience is an essential aspect of market liquidity because the pace at which an asset returns to the equilibrium level can place capital requirements at risk (BIS, 2019:19). This is because the decrease in the value of the asset signifies a loss in investments (Black, 1971:35). Therefore, the variability of market prices which is a function of price volatility, should be the same in the short and long run (Bhattacharya & Bhattacharya, 2018:1).

Figure: 2.3. Market resilience of an asset



*High R→ High resilience

*Low R→ Low Resilience

Source: Author.

2.3.3 Market immediacy

According to Black (1971), the fourth aspect of financial market liquidity of an asset is market immediacy, a self-perpetuating time-related concept. Market immediacy is the speed at which large orders are executed or the rate at which orders in limit order books are filled (Black, 1971). An asset is considered liquid if the demand for immediacy is high and the cost of continuous market marking is low (Black, 1971). These factors are mainly due to the benefits of closing out a position quickly. The price at which a seller is willing to trade an asset is usually a function of volatility and the risk involved in holding the asset (Black, 1971). To get a price that will justify the sale, the seller expects the market participant to provide a reasonable bid

price. Due to price risk transfer from seller to buyer, the market maker will create immediacy if they are compensated for taking this risk. In the case of a liquid asset, this compensation will be minimal because of low price risk. Therefore, market makers and participants always stand ready to provide immediacy for liquid assets because of low price risk and low volatility.

Dutta and Madhavan (1993) applied Black's price continuity theory of liquidity in their study to analyse the price dynamics that inhibit price changes in the presence of asymmetric information. Dutta and Madhavan (1993) modelled the autocorrelation return induced by price continuity rules to provide a rationale for technical trading. Their analysis of price dynamics showed that the rate of convergence of prices is not dependent on price continuity requirements regardless of the number of market participants (Dutta & Madhavan, 1993). More importantly, the findings of Dutta and Madhavan (1993) showed that price continuity in liquid assets improves market efficiency and induces more trading activities. This is because market participants will be informed about the cost of the asset. Conversely, restrictions on price continuity may cause asset prices to swing in either direction in response to order flow or trading volume (Dutta & Madhavan, 1993:201). In summary, financial market liquidity should be a function of price continuity (Dutta & Madhavan, 1993:221)

From the above propositions, the price continuity theory proposed by Black (1971) holds that there should be sufficient evidence of market depth, market resilience and immediacy for an asset to be considered liquid. When applied to this study, common equity securities that qualify to be included level 2B HQLA in the South African markets will portray a lack of market depth and market resilience. Specifically,

- The independent variables, which are buyer and seller initiated trades and trading volume, will significantly influence the dependent variables, which are price changes (lack of market depth).
- The long term variance will not be equal to the sum of short term variance (lack of market resilience).

This perceived significant relationship is due to adverse selection in the South African market (Brownbridge, 1998; Hansi, 2004; Mkhabela, 2018). Adverse selection exists when sellers have more information about the quality of an asset than buyers (Klein, Lambertz & Stahl 2013:4). In this case, there is information disparity between market participants (De Donder & Hindriks, 2009:1). This will cause the price of the asset to fluctuate, and trading activities will move the prices. In the case of the designated level 2B common securities, it is perceived that the sellers may be unwilling to trade, leaving low-quality assets circulating in the market. As a result, most of the level 2B equity securities that provide liquidity in the form of collateral will

lose their trading abilities, increasing liquidity risk (Kirabaeva, 2010:11). This theory will investigate the following research questions,

- What is the market depth position of level 2B common stock equities in the South African financial markets?
- What is the market resilience of level 2B common stock equities in the South African financial markets?

2.4 Transaction cost theory.

This study also made use of the transaction cost theory proposed by Williamson (1979). According to Williamson (1979), institutions and markets differ in their ability to manage economic transactions. Accordingly, firms should choose a structure that will optimise the cost of exchanging their assets. Transactions that can be performed at a lower cost will be managed within the firm, and transactions that cannot be managed effectively within the firm will be executed by another market participant (Williamson,1979). The transaction cost theory focuses on minimising the trading cost based on the assumptions of bounded rationality and opportunism. Bounded rationality refers to the availability of information to make informed decisions and is limited by search cost in seeking all available information and, in some instances, the complexity of the asset (Williamson,1979). Financial institutions will always make the correct investment decisions If rationality is not bounded, implying that these institutions will always accurately anticipate every future contingency need (Williamson,1979). Opportunism refers to the propensity of a market participant to seek his own interest and take advantage of any opportunities that may arise (Williamson,1979). Considering the bounded rationality and opportunism assumptions, Williamson (1979) identified three observable characteristics of any transaction that will affect the relative efficiency of trading. These characteristics were asset specificity, uncertainty and trading frequency.

2.4.1 Asset specificity

Asset specificity refers to the degree to which an asset can be used to fulfil several purposes (De Vita, Tekaya & Wang, 2011:329). In other words, the degree to which the asset is valuable in a specific use and with a specific trading partner. Investments in highly specific assets will increase the transaction cost due to the increase in search time to get a suitable partner, coupled with the fact that the asset cannot be used for a limited purpose which might lead to hold-ups (Foss & Weber, 2016:63). On the other hand, the transaction cost for trading an asset will be negligible in cases where there are many potential trading partners and less customised assets because the value will not depend on a single or few trading partners.

2.4.2 Uncertainty

Uncertainty exacerbates the issue of asset specificity. In the context of trading, little uncertainty about the nature of an asset may prompt market participants to increase their trading activities even with relative specified assets (Williamson, 1979). However, in the presence of high uncertainty, it is usually difficult to anticipate the set of events that might unfold regarding the price and nature of the asset. Hence high uncertainty in the presence of asset specificity increases transaction cost (Foss & Weber, 2016:64).

2.4.3 Frequency

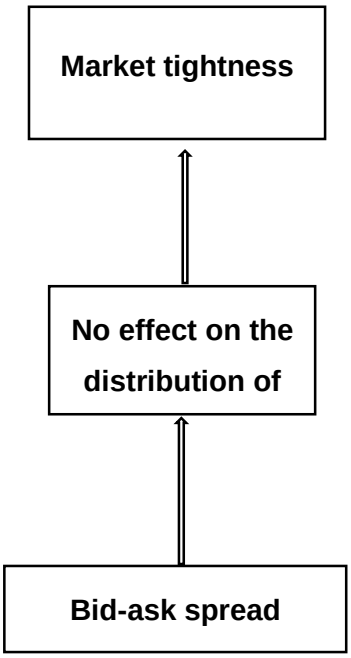
Assets characterised by high-frequency trading will result in lower transaction costs due to the shorter time to execute a trade. This shows the amount of participation in a particular asset. According to Williamson (1979), high-frequency trading reduces price volatility where market participants will not experience price swings. Also, the frequency of trading determines the liquidity risk, where assets with high-frequency trading usually have low liquidity risk because they can easily trade in the market and vice versa (Foss & Weber, 2016:68).

The basic predictions of the transaction cost theory are that the market will provide optimal governance transactions for assets characterised by low asset specificity and low uncertainty (Williamson, 1979). At the limit, liquid assets will have low transactions because of the shorter time and efforts to look or wait for a trading partner or market maker (Williamson, 1979). As a result, the sell-side trades and buy-side trades are not vulnerable to hold-ups, and the market facilitates trading as it is almost costless to transact. Conversely, asset specificity and uncertainty will increase the transaction cost due to the search time needed to find a suitable trading partner (Williamson, 1979). Also, a relative higher transaction cost may be in the context of asset specificity, and uncertainty may overshadow the potential benefits of engaging in a transaction, increasing the hazards of governing a transaction. An increase in trading frequency is predicted to make uncertainty less likely by providing some form of assurance that reduces trading risk. Therefore, assets characterised by low specificity, low uncertainty and high frequency will have low transaction costs.

Market tightness is the theoretical application of the transaction cost theory. Market tightness constitutes the knowledge of how bid-ask spreads will affect the price changes (Kociński, 2014; Mckane, 2017; Pan & Misra, 2021). An understanding of an asset's liquidity can also be gleaned through the interaction between the transaction cost, which is the bid-ask spread and price changes (Kociński, 2014; Mckane, 2017; Pan & Misra, 2021). Market participants will prefer securities that offer a high degree of trading confidence where the asset can be easily bought or sold at a low cost. In addition to this ease of trading, the market maker would like to be compensated for the trade and benefit from buying at a price known as the bid price and

selling at a price known as the ask price (Pan & Misra, 2021:3). Considering that the market participant does not want to spend much time searching for counterparties, the bid and ask price difference will have to be small to enhance trading (Lin, Sanger & Booth, 1995:1154). Also, the market maker will not want the price to be affected to quickly trade off the position and profit from the spread (Wang & Yau, 2000:950). This lateral integration of smaller spreads and stable prices connotes market tightness in a liquid asset. Illiquid stocks usually have spreads that tilt the market direction, resulting in an order imbalance between trades that affects the price of the asset (Pereira, Silver & Barbedo, 2019:2). The diagram below portrays the framework for market tightness.

Figure 2.4. Market tightness framework



Source: Author

The transaction cost theory was applied in Yuping (2015) to empirically investigate the stock market liquidity in the US market. Yuping (2015) modelled the effect of transaction on price impact. The author believed that understanding the impact of transaction cost on price impact is an essential aspect of asset pricing, which is highlighted through the cross-sectional returns. Yuping's (2015) study revealed that systematic volatility liquidity risk is embedded in asset returns. This connotes that liquid assets will have lower systematic risk and lower transaction costs. The study of Jang, Koo, Lui and Loewenstein (2007) also used the transaction cost theory to explain the liquidity premia effect. The authors found that transaction costs are crucial in determining the first-order effect of an asset's liquidity.

When applied in this study, the independent variable, the TC, should significantly influence the dependent variable, the price effect (lack of market tightness). This perceived significant relationship might also be due to wider spreads resulting from increasing TC and a continuous decrease in market participants in the South African markets (Shaw, 2018:1). The increase in TC and low market participants indicate inactive markets with a low probability of executing trades quickly (Shaw, 2018:5). Conversely, narrow TC securities can provide quick liquidity access because the assets are bought and sold quickly. In this case, banks can quickly shift their liquid assets at their fundamental prices without incurring losses. Accordingly, banks will be able to raise the necessary capital needed to meet their liquidity needs as indicated in the LCR and NSFR. Day's (2018) study showed a distorting market in terms of larger price volatility and an economic growth retarding effect, which might affect the market liquidity in the South African market. This is in addition to per capital gains in the sell-side of an asset exceeding the per capital loss on the buy-side (Olivier, 2007). Therefore, this theory will investigate the following research questions,

- What is the market tightness position of level 2B common stock equities in the South African financial markets?

The price continuity theory of liquidity preference and transaction cost theory highlighted above in sections 2.3 and 2.4, respectively, suggest that the LCR and NSFR may need to be improved due to illiquidity in the level 2B common stock equities. This market illiquidity in the securities may result from asymmetrical information, decreased market makers, and broader spreads (Black, 1971:36: Reilly & Brown, 2003:75). Efficient market liquidity impediment may also result from the information gap between market participants (Ebert, 2001: Bandama, 2011, Makina & Wale, 2016). Considering that banks and other market participants raise capital from the market through trading securities, there may be incentives to engage or produce information about a security that might not reflect the fundamental value. Also, asymmetric information destabilises the market liquidity of a security through a disproportionate information spiral between market participants, which is used to explain the pricing behaviour in financial markets (Shor, 2017). The fluctuation in trading volumes can be partly explained by the availability of information used as a risk factor (Shor, 2017). In the South African context, the presence of asymmetric information has been documented (Ebert, 2001: Bandama, 2011, Makina & Wale, 2016).

2.5 Development of hypothesis

A research hypothesis is a tentative hunch used to anticipate the outcome informed by statistics based on the underpinning theory (Wolverton, 2009:371). Silva-Ayçaguer, Gill & Somoano (2010:2) define a research hypothesis as a prediction of an outcome based on the

relationship between variables. A hypothesis can also be referred to as a tentative statement indicating the outcome of research based on predictions on existing knowledge.

From the hypothesis, the research design and analysis should be evident. This study developed and implemented a hypothesis in order to predict a suitable outcome. Based on the theories, the hypothesis provides a framework between prior literature and methodology. This study developed the relevant hypothesis from the research problem and is supported by the theoretical underpinnings, which are the price continuity and transaction cost theory, as highlighted below.

- **According to the price continuity theory of liquidity preference, level 2B common stock equities lack market depth due to asymmetry information. Therefore, the trading volume, buyer and seller initiate trades will significantly impact the logarithmic price scale.**

The price continuity theory of liquidity preference proposes that although banks may have met or exceeded the LCR and NSFR, future contingency needs may cause these institutions to desire more liquidity than expected because of a lack in market depth in the level 2B common stock equities as a result of asymmetry information. Trading liquid assets should be executed quickly without significant price change (Huberman & Stanzl, 2005:166). Inferring that, liquid assets are characterised by timely and easy settlement with large trade volumes having no impact on the prices. In order words, liquid assets should demonstrate market depth. This theory is critical in periods of distress where there is a significant change in fundamental values of assets, and prompt adjustment to equilibrium prices are essential. Assets with sufficient market depth have large trade volumes with no significant impact on prices. This is because large orders are broken into smaller trading volumes which minimises price impact known as shiftability (Teall, 2018:23). The shiftability is particularly important in the equity market, where large trade volumes are an important source of information about the level of liquidity. Trade volumes, the number of issues, and the number of buyers and sellers initiated trades provide valuable information on the accuracy of prices in order flow and imbalances. Significant price impact resulting from trade volumes, the ratio of issued shares to trading volumes and the number of buyers and sellers initiated trades creates imbalances in order flow which diverts the prices away from their fundamental values that are not warranted (Jiang, Mclnish & Upson, 2012:4). This process creates the lack of continuous price information sources, which causes uncertainty about the equilibrium prices and increases transaction costs (Wanzala *et al*., 2017:3). Market depth is considered one of the main determinants of market liquidity because it is usually exogenous (Wuyts, 2007:284). Market makers usually want to unwind their positions at the least possible price risk, without which they will not be willing to trade. In South

Africa, these exogenous factors are prevalent and prevailing because of the fragile and contagion economy (Havemann, 2019:8). Global factors and macroeconomic variables pose a severe risk to the economy. The rand has lost more than 15% of its value since 2015, and the market currently has a lower compared to 2015 (Kanto, 2019). These contiguous risks cause prices to fall significantly, affecting the trading volume, the amount in issue, the number of buyer and seller initiated trades for liquid securities, and may not return to equilibrium.

Although the South African financial market has been tipped to be liquid, the relationship between price distribution and trading volume, number of buyer and seller initiated trades still has a paucity of research to be done. Financial market liquidity in current literature is mainly determined from the volume of trades and market capitalisation, which may not reliably approach in determining liquidity (Chordia, Roll & Subrahmanyam, 2001: Benić & Franić, 2008: Bodgan, Bareša & Ivanovic, 2012: Muktiyanto, 2015: Motepe, 2017). Moreover, market depth research is an untouched area in the South African market.

- **According to the Transaction cost theory, level 2B common stock equities lack market tightness due to asymmetry information. Therefore, the transaction cost will be greater than 0.1% and have a significant impact on price effect.**

In the case of South Africa, prior research has indicated that liquidity has become very thin, and the cost of turning around a position within a short period will significantly affect the price, which refers to low market tightness (Erasmus, 2015; Mabuza, 2017). According to Brigden and Thomas (2003:11), market tightness affects the demand for securities and contributes significantly to the number of active traders. According to Ernst (2019:11), fragmented assets are instead a result of thin tightness where the cost of trading is not justified by fundamentals other than disequilibrium prices. Illiquid assets are often associated with high transaction costs, which might result in unsymmetrical information, decreasing the number of market participants as in the case of South Africa (Ebert, 2001:93). This is attributed to the complex environment in South Africa, which has proven to be challenging. According to Coetzee, Bezuidenhout, Claassen & Kleynhans (2015:155), South African investors face an innumerable list of risks, ranging from global contagion, national, political uncertainty and increasing level of government debt. There has been an increase in credit spreads in South Africa, and the reserve bank has continually shrunken its assets (Visser, & Van Vuuren, 2018:7; Fedderke, 2021:1).

The bond market yield curve has flattened with increased volatility in the currency and stock market (Bond Exchange of South Africa (BESA), 2019). The JSE top 40 in South Africa has seen a significant drop in share value by 15% to the US indexes from 2018 and more than

10% drop in the rand compared to the US dollar since 2010 (SARB, 2021). All these factors may have contributed to the decrease in the number of market makers and participants in the system. Furthermore, South Africa faces an ailing economy, with the Gross Domestic Product (GDP) decreasing by 0.8% and 1.4% in the third and fourth quarters in 2019, respectively (Statistics South Africa, 2020). The economy grew at a decreasing rate of 0.8% and 0.2% in 2018 and 2019, respectively, with seven out of 10 sectors contracting the fourth quarter of 2019 (Statistics South Africa, 2020). According to BESA (2019), the expected government spending on infrastructure, welfare, education and new health system will cause an upward pressure in bond yield due to higher borrowing relative to the GDP. These negative sentiments in the South African market may have also increased the risk and the cost of trading. The abovementioned unfolding events may have served as inhibiting factors for the lack of liquidity, which will have significant adverse implications for financial institutions, particularly for banks. These factors will have significant implications, especially during economic uncertainty. Due to the limited ability in trading, it becomes challenging to raise the necessary funding, which may cause market failure and disturbance in the financial system (Lumpkin, 2009:8). In addition, prior research (Ebert, 2001; Smith, 2019) has consistently shown asymmetric information in the South African market. Asymmetric information causes delays in executing a trade because buyers are sceptical that sellers are more knowledgeable about the quality of the security than they do (Bergh, Ketchen, Heugens & Boyd, 2018:122). This can be used to explain why loans cannot trade in liquid markets. Therefore, banks may need more liquidity and find it difficult to trade their assets, especially during economic uncertainty, and the cost of trading will have a significant positive impact on price distribution in the long and short run.

- **According to the price continuity theory of liquidity preference, level 2B common stock equities lack market resilience due to asymmetry information. Consequently, the ratio of the long-term variance to the sum of short term variance for the same period will not be equal to or close to 1.**

According to the price continuity theory of liquidity preference, the price of liquid assets in a market should follow a continuous random process portraying resilience. This notion of the resilience of asset pricing has gained significant attention in the financial systems (Caruana, 2012; Cunliffe, 2020; Ishrakieh, Dagher & El Hariri, 2020), primarily because resilience has become an integral paradigm in macro-prudential management. According to Wanzala *et al*. (2017:3), resiliency refers to the degree to which the price of an asset can adjust quickly from market shocks. As Kim and Kim (2019:244) postulate, asset resilience is the extent to which prices can return to efficient prices after an uninformative market stupor. It has been widely

accepted that price reversal is a measure of resilience (Pastor & Stambaugh, 2003; Vayanos and Wang, 2012; Hua, Peng, Schwartz & Alan, 2019; Butt, Högholm & Sadaqat, 2021). In the absence of market resilience, liquidity becomes thin and vulnerable to market shocks (Heston, Korajczyk & Sadka, 2010:2). Lack of resilience can also cause asset prices to be less informative and cause overreaction with systematic consequences (Harvey, Lui, & Zhu, 2016:7). For a resilient asset, price changes are conventional and resonate in stable future cash flows (Bessembinder, Carrion, Tuttle, & Venkataraman, 2016:143). As pointed out by Nowak & Olbryś (2016), price disequilibrium from market shocks due to a lack of resilience impairs the process of linking investors and firms that need funds. According to the SARB (2018), there has been a significant transformation in the South African market over the years. Some of these changes are;

- The introduction of new regulations
- New business models of new regulations
- Improved electronic trading platforms
- Development of mutual funds

The abovementioned factors may have impacted the liquidity position of banks in different ways ranging from a reduction in market makers to a reduction in supply for certain assets (SARB, 2019). This is because the unconventional monetary policies introduced have led the SARB to become the primary buyers of certain assets, which have led to investments in low liquidity assets (SARB, 2019).

Prior research (Gupta & Reid, 2012; Ferreira, Van Vuuren & Dickason, 2019) has shown that stock prices in the South African market do not adjust quickly to new information in the market. In some cases, it took over 30 days for the price to adjust to new information, which signifies a dearth of resilience. In this case, the long-term variance is not equal to the sum of short term variance for the same number of periods. Furthermore, the variance deviation was supported by the study of Ferreira *et al*. (2019), which also showed a significant difference in the variance of certain stocks for the period in the study. Therefore, considering the above mentioned, it is perceived that the ratio will not be equal to or close to 1.

- **From the above proposition, LCR ratio needs to be improved**

Already alluded, the LCR and NSFR are based on well-functioning markets (BCBS, 2012; Elliot, 2015). Therefore, it becomes lacklustre to provide a suitable LCR and NSFR without effectively assessing the financial market liquidity of the assets involved. This implies that markets need to demonstrate depths, tightness and resilience. As also pointed, this might not

be the case for the South African financial market where prior research has proven otherwise. Considering that banks operating in South African may rely on LCR, adjustments need to be made in the LCR and NFRS if the qualifying level 2B common stock equities exhibit low levels of liquidity. This adjustment will factor in systematic risk, which is also a risk factor to capture the illiquidity. It can also be suggested that the LCR will not be able to capture the financial nuisance of meeting their short term obligations for the 30-day period as stipulated by BCBS (2010). Therefore, from hypotheses H_0, H_2 and H_4, the LCR ratio needs to be improved.

- **From the above propositions, the NSFR needs to be improved.**

The purpose of NSFR is to limit the over-reliance on short term sources of funding and reduce funding risk over the longer term. The NSFR requires banks to fund their activities with stable funding to mitigate future stress scenarios (Hlatshwayo *et al*., 2013:13). However, the NSFR depends on the characteristics of liquidity and residual maturities of the HQLA (BCBS, 2010:21). That is to say, the extent to which the NSFR will provide stability and effectiveness depends on the market liquidity and the extent to which the risk for each asset class can be estimated. Considering the hypotheses H_0, H_2 and H_4, the NSFR is inadequate and needs to be improved.

The effectiveness of these theories highlighted in sections 2.3 and 2.4 will have an integral role in shaping a proposed framework for LCR and NSFR. Also, the data analysis and interpretation will determine the potency of the abovementioned theories. The effectiveness and potency refer to the empirical evidence to support or refute a proposition. This refers to testing the theory through 3 main stages. The purpose of testing is to provide sufficient evidence to support a proposition rather than superficially agreeing or disagreeing on a phenomenon. The following three aspects will be tested;

- Logical consistency of the theories.
- Explanatory power of the theories.
- Falsifiability of the theories.

2.6 Logical consistency of financial market liquidity theories.

The logical consistency of the price continuity theory of liquidity preference and transaction cost theory will be tested in the South Africa context to determine the adequacy of LCR and NSFR. Logical consistency refers to the extent to which the theoretical proposition and constructs reliably fit each other (Wacker, 1998:363). This involves consistency and no contradictory results. In semantic terms, consistency and no contradictory results mean enough evidence exists in the data analysis to accept a hypothesis based on theoretical

underpinnings (Newman & Covrig, 2013:71). This study will test the logical consistency of the theories highlighted in sections 2.3 and 2.4 in the South African context. In particular, the market tightness, market depth, and market resilience position of the level 2B designated common equity securities in the South African context will be investigated.

2.7 Explanatory power of financial market liquidity theories.

According to Schupbach and Sprenger (2011:106), the explanatory power of a research theory is the ability of a theory to explain and provide evidence of the subject under study. Ylikoski and Kuorikoski (2010:202) describe the explanatory power of a theory as the extent to which a theory is able to explain or predict phenomena or reality. According to Pearl (2009:697), the explanatory power of a theory is best explained;

- When the results from data analysis confirm what is expected as indicated in the hypothesis.
- When the data analyses provide causal relationships leading to high accuracy and precision as indicated in the hypothesis.
- When more facts and observations from the data analysis are attributed to the theory.
- When the theory does not rely on assumptions and is testable.

In this study, the explanatory power of the price continuity theory of liquidity preference and transaction cost theory will be determined by the level of significance between the dependent and independent variables. This level of significance will be based on the p-values and the causality test which is, the extent to which the independent variables provide statistically significant information on the dependent variables. Furthermore, as indicated in the hypothesis, the explanatory power of these theories will be determined based on the extent to which the independent variables, TV, BIT, SIT, and TC, statistically influence the dependent variables, which are log of price scale price effect.

2.8 Falsification of financial market liquidity theories

The third aspect of the theory that will be tested is falsification. Falsification refers to the extent to which a particular theory can be disapproved based on empirical evidence (Persson, 2015:461). This refers to how the interactions between the constructs can disprove the theory (Cohen, 2016:1080). Falsification generally meets deductive reasoning in which the theory-driven hypothesis guides the data collection and analysis, which is the case of this study (Briggs, 2012:140). Based on the assumptions of the price continuity theory and transaction cost theory, the outcome of the data analysis will either falsify the propositions made or provide

evidence to accept the hypothesis, which will shape the framework of LCR and NSFR. For example, the following propositions were made:

- According to the price continuity theory of liquidity preference, level 2B common equities lack market depth. Therefore, TV, BIT and SIT will have a significant impact on log price scale.
- According to the Transaction cost theory, level 2B common equities lack market tightness. Therefore, the TC will be greater than 1% and have a significant impact on price effect
- According to the price continuity theory of liquidity preference, level 2B common equities lack market resilience. Consequently, the ratio of the long term variance to the

2.9 Summary and conclusion

This chapter aimed to review the theoretical philosophies and assumptions underpinning financial market liquidity. Accordingly, market depth, market tightness, market resilience and market immediacy was identified. This chapter also highlighted the three stages in establishing the effectiveness of the theory highlighted in sections 2.3 and 2.4, respectively. With this theoretical background, the next chapter, which is the global liquidity standards, provides an overview of the liquidity regulatory framework instituted by the BCBS to create a financially stable banking environment.

CHAPTER 3

THE GLOBAL LIQUIDITY STANDARDS

3.1 Introduction

This chapter provides an overview of the regulatory management of liquidity instituted by the BCBS to create a financially stable banking environment. The BCBS (2010) introduced liquidity measures to monitor liquidity risk, which were expected to provide sound supervisory practices and safety in the banking sector

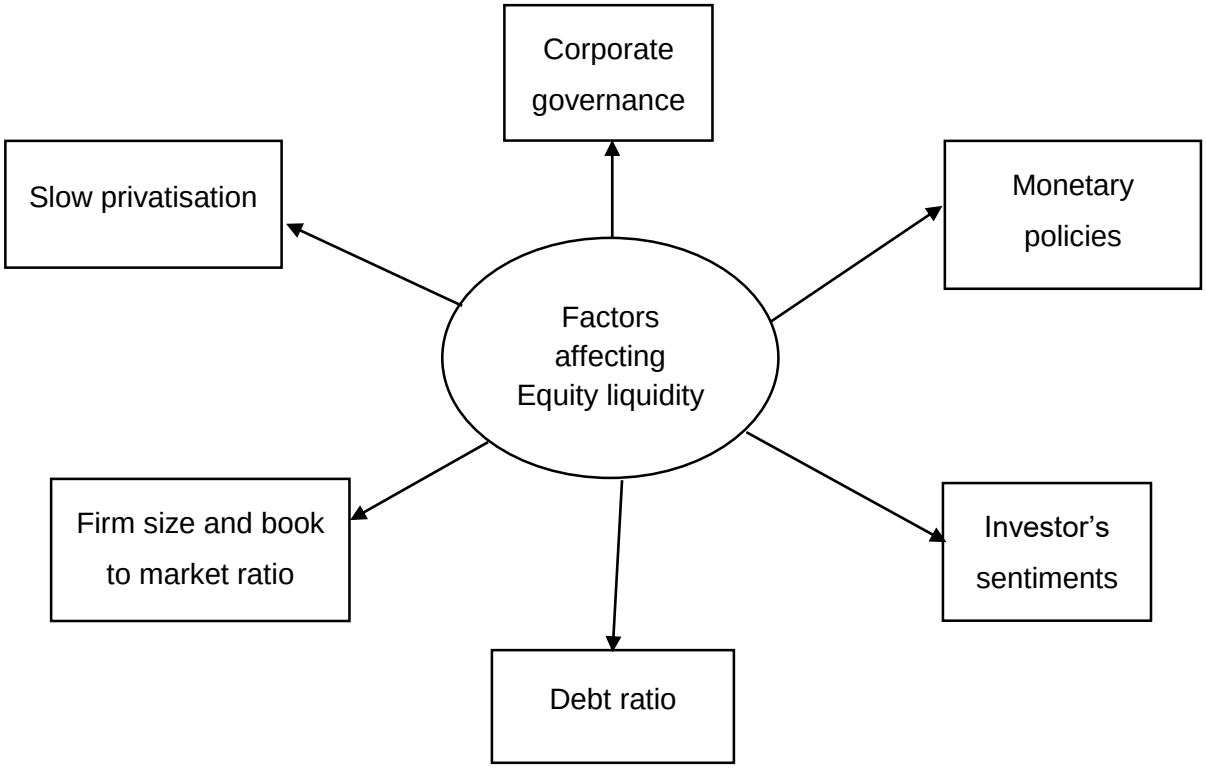
This chapter begins with liquidity management in banking in section 3.2. Section 3.3 highlights the Basel Accords, Section 3.4, 3.5, 3.6, 3.7, 3.8 and 3.9 highlights Basel I, Basel II, Basel II.5 Basel III, Global Liquidity standards, Basel IV and conclusion and summary respectively.

3.2 Liquidity management in banking

Liquidity management in banking involves the conscious effort to manage liquidity risks while ensuring that the business can continuously meet its obligations (BCBS, 2008:1). Liquidity risks in banking operations are customarily borne from different sources (Casu, Girardone & Molyneux, 2006:605). The market liquidity in equity securities is an essential component of gauging market opportunities in the market (Naik, Poornima & Reddy, 2020:1). At its core, market liquidity represents the collective expression of market participants in the market (BIS, 2004:2). These opinions are quantified and represented as either existing positions held by traders, also known as open interest, or buy and orders communicated to the rest of the market. The size and price of these orders may vary considerably, but the critical element to consider is that the more opinions are expressed, the more liquid the equity security. However, the liquidity positions in equity securities may be affected by several factors, some of which are;

- Corporate governance (Matonela & Karodia, 2015:32; Tang & Wang, 2011:2; Farooq, Derrabi & Naciri (2013:1).
- Slow privatisation (Matonela & Karodia, 2015:32).
- Monetary policies (Fernández-Amador, Gächter, Larch & Peter, 2013).
- Investor's sentiment (Debata, Dash & Mahakud, 2018; Cheng,2007:453).
- Firm size and book to market ratio (Nasser, 2016:76).
- Debt ratio (Nasser, 2016:76).

Figure 3.1. Factors affecting liquidity in equity securities.



Source: Author

Assets of high quality that can return the principal quickly and frequently trades with large volumes on a security exchange can be an essential supplier of liquidity (BCBS, 2013). These assets usually have a greater probability of being sold with convenience and no misfortunes. Accordingly, the transaction cost of these liquid assets is usually minimal, which enhances trading (Amihud & Mendelson, 2006:235). However, these factors that determine an asset's liquidity are affected by the level of information asymmetry prevailing in the market (Ajina, Sougne & Lakhal, 2015:1223). The Information gap about the nature of an asset between market participants creates an additional risk premium with respect to pricing the asset (Tripathi, Dixit & Vipul, 2019:201). This risk premium raises uncertainty and widens the transaction price between the buyer and the seller (Amihud, Mendelson & Pedersen, 2005:273). This gap is generally represented in the bid and spread, affecting trading volumes. In promoting liquidity management regarding holding assets, regulatory authorities had often neglected the abovementioned aspects of liquidity, resulting in complexities of managing the real-time visibility of inflows (Ritz & Walther, 2015:391). To enhance market liquidity in HQLA, supervisory authorities in the banking sector are opted to centralise their liquidity management practices and policies (Wignall & Atkinson, 2010:3). In so doing, these supervisory authorities seek greater visibility and control over their liquidity usage in the short term and long term, which are well incorporated in their funding sources (Pather, 2017). This led to the introduction

of the Basel accords and the 2010 global liquidity standard. An overview of the journey of the Basel accords is highlighted below.

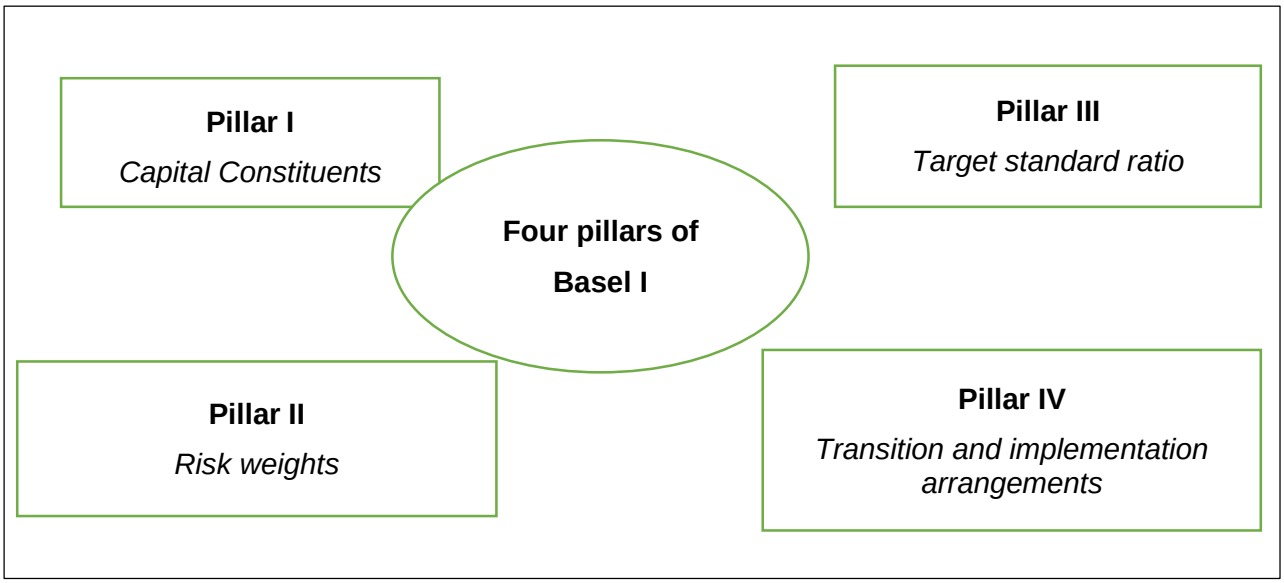
3.3 Basel accords

The BCBS has its roots in the Hersatt financial crisis in 1974, where banks incurred significant losses amounting to about three times its capital (Druol, 2015:311). This also led to the bankruptcy of the Franklin National bank in the USA. In response to these market disruptions, a group of central bank governors in the eleven most industrialised countries named the G10 established the Basel Committee on Banking Supervision in an attempt to enhance financial stability in the banking sector (Fratianni & Pattison, 2010:2). Also, the Basel committee wanted to provide a uniform reporting system across the banking sector to provide supervisory coverage adequately and consistently across banking establishments (Beltratti & Stulz, 2012:3). To achieve this aim, the BCBS instituted a series of regulations to provide good governance and resilience, which subjected banks to a specific capital requirement due to the nature of their operations (BCBS, 2009:4). Risk analysis was also an essential factor in these regulations because their assets and liabilities made regulations indispensable (Bologna, 2013:82). Considering the banking sector's relevance and the importance of risk sharing, the BCBS introduced the Basel accords. The Basel accords are banking and supervisory norms, which constitute a series of recommendations on prudential banking and financial regulations set by the Basel committee and supervisory (BCBS, 2008:1). The primary purpose of regulations was to develop a discreet rule for banks focusing on minimum capital requirements. To this end, the Basel committee focused on exchanging information, improving supervisory processes, and establishing minimum prudential standards to achieve their aim (BCBS, 2009:2). This subsequently led to the creation of Basel I in 1988. Considering the research topic, it is imperative to give an overview of the Basel accords.

3.3.1 Basel I

The Basel I framework was introduced in 1988, which imposed the minimum capital requirements in the banking sector (Jablecki, 2009:18). This norm implemented by 1992 was triggered by the heightened debt crisis in major international banks in the early '80s (BCBS, 1988:13). Coupled with deteriorating capital ratios, the BCBS resolved to introduce a capital standard in the banking sector to prevent capital erosion (Barth, Caprio & Levine, 2004:244). The scope of Basel I included the harmonisation of regulatory capital in the banking sector among the G10 countries (BCBS, 1988:15). According to Balin (2008:2), Basel I was built on four pillars, as shown below.

Figure 3.2. Four pillars of Basel I.



Source: Author

- Capital constituents: This refers to the different types of capital sources, and the relative weighting for each source comprised the minimum capital in the framework (Naceur & Kandil, 2009:74). Capital constituents were initiated to regulate the quantity of bank reserves and their disclosures. In the Basel I framework, capital reserves were divided into Tier 1, Tier 2 and Tier 3. Tier 1 capital was the bank's core capital that can be exhausted without placing the banks under insolvency or liquidation consisting of common stock, preferred stock and disclosed reserves such as retained earnings (Smith, 2007:200). Tier 2 or secondary bank capital, also known as supplementary capital, comprises revaluation reserves, undisclosed reserves, hybrid instruments, and subordinate term debts (BCBS, 2005:15). Finally, Tier 3 designated capital known as supportive capital aimed at supporting certain risk classes such as market risk, commodity risk, foreign currency risk and other exposures not included in Tier 1 and Tier 2 (BCBS, 2005:16). The table below summarises the capital constituents of Basel I

Table 3.1. Summary of Capital constituents under Basel I.

Tier 1	Tier 2	Tier 3
• Common stock • Preferred stock • Retained earnings	• Revaluation reserves • Undisclosed reserves • Hybrid instruments • Subordinate debt	Capital to support • Market risk • Currency risk • Commodity risk

Source: BCBS (1988:28)

- Risk-weighted assets (RWA): RWA refers to assets weighted according to their risk used in determining capital adequacy (Gambacorta & Karmakar, 2018:157). RWA was deemed appropriate because it included off-balance sheet exposures in capital adequacy requirements across banks in different countries. Reporting risk weights also provided transparency on whether banks had adopted the standardised approach in reporting their RWAs (Leslé & Avramova, 2012:15). Low-risk assets such as marketable securities were assigned low weightings than riskier assets. Consequently, five risk categories were developed and the first risk category was assigned a 0% weighting characterised by risk-free assets such as cash, sovereign debt and Organisation for Economic Corporation and Development (OECD) government claims (BCBS, 2004:13). The second risk classification was weighted 10%, which is the central banks' debt for countries with low inflation rates. The third category was the 20% RWA which comprised low-risk securities such as multilateral development bank debts. The fourth risk group was the 50% risk category characterised by assets with moderate risk, such as residential mortgages. The fourth category was the 100% risk assets such as private sector debt. Finally, discretion was provided for banks to classify their risky asset either as 0%,10%,20% or 50% depending on the central banks' judgements. The table below summarises the RWA categories.

Table 3.2. RWA categories according to Basel I.

0% risk category	10% risk category	20% risk category	50% risk category	100% risk category
Cash, government debt, central bank debt	Central bank debt for countries with low inflation	Development bank debts, OECD bank debt	Residential mortgages	Private sector debt, non-OECD bank debt

Source: Carvalho, Hohl, Raskopf & Ruhnau (2017:14)

- Target standard ratio: The target standard ratio aimed to set minimum agreed capital standards, expected to achieve a sound capital base (BCBS, 1988:14). The BCBS, therefore, set a target capital to RWA ratio of 8%. In addition, a minimum of at least 4% of the target ratio must be core capital (BCBS, 1988:15). The 4% minimum core capital was perceived to provide adequate insurance against credit risk.

- Transitional and Implementation arrangements: This pillar set the stage for gradual phasing in adjusting the new regulation. Banks were required to fully adhere to the new

framework by the end of 1992 with a target compliance of 7.25% set by 1990 (Carvalho *et al*., 2017:16)

However, the Basel I norm mainly focused on credit risk and risk weighting, the leading risk prevailing in the banking sector (Demirgüç- Kunt & Detragiache, 2010:180). As the banking industry evolved with new products and institutions, financial risk became complex, and these new products circumvented the Basel I norms (Fadun, 2013:57). Also, Basel I ignored the need for a robust risk management process and excluded important market disciplines (Enrique & Sergio, 2006:9). According to Lind (2005:13), some of the other shortcomings of Basel I included;

- Incomplete coverage of risk resources.
- An arbitrary risk measure.
- A lack of risk sensitivity.

To this end, the BCBS recognised the need to develop a more comprehensive risk management framework, which led to the development of Basel II.

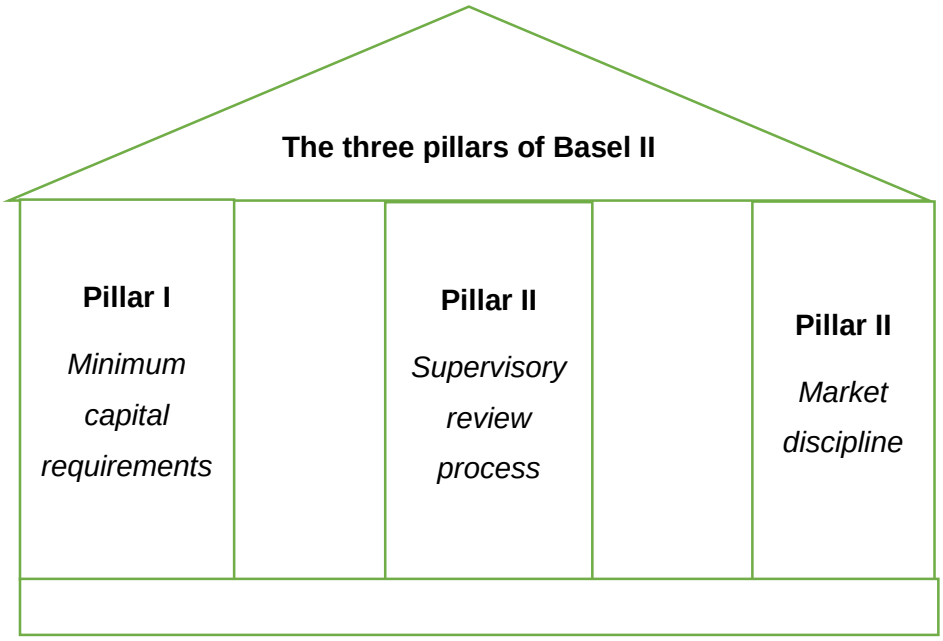
3.3.2 Basel II

Basel II was published in 2004 and was a modified version of Basel I. Basel II was a reaction to the loopholes found in Basel I norm and capital arbitrage opportunities introduced by new products in the banking sector (Fadun, 2013:56). Advocates of Basel II believed that the framework could protect banks against operational and credit risk in the event of default (BCBS, 2005: Barth, Caprio & Levine, 2008; Ong, 2006; Valova, 2007). Also, the framework was designed to protect banks against lending and investment risk by providing adequate capital. Another aim of this norm was to determine the level of capital required to provide resilience against the different risks that could potentially have an adverse impact on banks internationally (Mynhardt & Marx, 2019:4). According to the BCBS (2006:206), the three broad objectives of this accord were;

- To implement a more risk-sensitive regulatory capital.
- To enhance risk management practices among international banks.
- To maintain consistency of capital requirements internationally.

Basel II was built on a three-pillar approach to achieve this aim, as shown in the diagram below.

Figure 3.3. The three-pillar approach of Basel II.



Source: BCBS (2006:2)

Pillar I: The first pillar established the minimum capital requirement, which was the same as in Basel I but recognised only two forms of capital: Tier 1 and Tier 2 capital (Brei & Gambacorta, 2016:360). Also, the minimum capital requirement should reflect the credit risk and include market risk and operational risk (BCBS, 2006:5). In other words, the minimum capital requirements should be weighted according to credit risk, market risk and operational risk (Vallascas & Hagendorff, 2013:1956). The estimation of credit risk was similar to that in Basel I but placed greater emphasis on risk sensitivity and credit rating of counterparty risk (Prakash, 2008:98). Therefore, the calculation of RWA in Basel I was replaced by a more complex process and recognised internal models. As a result, there were two methods of estimating a banks RWA: the standard approach and the internal rating-based approach (Måssebäck, 2014:3). The standard approach, also known as the external approach, refers to using external credit assessment methods to assess the riskiness of a bank's assets (BCBS, 2017:22). Banks were required to use an external credit rating framework to quantify the capital required for credit risk, which was the only approach approved by regulatory authorities. A summary of the standard approach is highlighted below.

Table 3.3 Standardised approach of RWA.

External Credit Assessment	AAA to AA-	A+ to A-	BBB+ to BBB-	BB+ to B-	Below B-	Unrated
Risk weights	0%	20%	50%	100%	150%	100%

Source: BCBS (2006:19)

The Internal rating approach refers to using a bank's internal models to estimate risk parameters and counterparty risk exposures to calculate the capital requirements (BCBS, 2006:19). Banks were required to perform risk sensitivity and incentive compatibility of the risk exposures regarding their assets (Thomas & Wang, 2005:16). Before the risk analysis, banks were first required to categorise their assets according to the exposures on various asset classes and estimate each asset's risk parameters (Gerali, Neri, Sessa, & Signoretti, 2010:116). This was computed by calculating the probability of default, the loss of a given default and the exposures at default determined by the supervisor (BCBS, 2017:12).

Market risk, the second component of pillar I, refers to exposures arising from trading financial instruments such as interest rate risk and currency risk, including off-balance sheet items (Jayadev, 2013:117). This involves the risk of timing mismatch between assets and decline in earnings due to interest rate changes, loss in earnings and a decline in portfolio value. These exposures may arise due to speculative trading from banking transactions or may surface because of market activities.

Operational risk was the final component of pillar I. The BCBS (2004) defined operational risk as the probability of loss resulting from failed internal processes, systems or external events, including information technology failures and security breaches. Regulators were mainly concerned with minimising adverse consequences on value protection aspects of operational risk and excluding value creation (Francisco, 2005:1160). The primary sources of this risk were internal fraud, process failures, cybercrime, system disruptions, and a lack of processes. Therefore, the total capital under Basel II was given by the formula below:

Total Capital = 8% × (Credit RWA + Market RWA + Operational RWA) (The BCBS, 2004)

Pillar 2: The introduction of pillar 2, the supervisory review process, added monitoring and assessment control and minimum capital requirements (Pelizzon & Schaefer, 2007:3). This pillar allowed banks to continuously monitor and improve their risk management techniques in managing risk. To achieve the purpose of this pillar, supervisors are expected to evaluate a bank's capital requirements in relation to the risk of the asset and take appropriate measures where needed (Al-Eideh, 2011:7). This may also involve active cooperation between the bank and the regulatory authority to act promptly when there is insufficient capital or excess risk

(Torell, 2013:7). Pillar 2 was also recognised as an important aspect of Basel II because it emphasised the need of using other methods of curbing risk other than capital (Emmer & Tasche, 2005:85). These methods involved the use of internal control and risk management monitoring tools based on four fundamental principles, which were

- Internal performance assessment procedures: This principle required banks to have internal processes for assessing the capital adequacy relative to risk and implementing a strategy to maintain these ratios.
- Regulatory responsibility for assessment mode: The Supervisory authority is responsible for reviewing, evaluating and assessing the bank's internal modes for capital adequacy compliance. If necessary, the regulatory authority must take adequate actions.
- Capital requirements can exceed minimum standards: The bank's supervisory authority should expect banks to fulfil capital requirements above the minimum standard and require banks to have excess capital.
- Intervention by regulatory authority: rapid intervention of the supervisory authority is required to prevent the decline in capital below the minimum level that cannot support risk.

Pillar 3: The third pillar, market discipline, represented a logical complement to pillars 1 and 2. Under market discipline, banks were required to disclose their risk assessment procedure and capital adequacy levels fully. This pillar aimed to promote a safe and sound financial system by sharing information with other market players (Fadun, 2013:57). It was also to facilitate the assessment of the bank by other stakeholders, including assessment agencies. According to Deli and Hasan (2017:220), market discipline also required banks to disclose and comply with more detailed banking regulatory requirements with regards to:

- The amount of Tier 1 and Tier 2 capital
- Constituents of Tier 1 capital
- Capital requirements for credit risk, market risk and operational risk.
- Risk management design
- Disclose ownership structures.

These disclosures implied that market participants sufficiently understood the bank's activities and identified negative trends early. Also, the market can penalise the bank without the interference of regulatory authority (Dickinson, Humphry & Siciliani, 2015:335). These three pillars were expected to provide resilience in the banking sector and foster financial stability. However, there were subsequent changes in the global environment after the implementation of Basel II due to the 2007-2008 financial crises (Diamond & Rajan, 2019). The crisis started

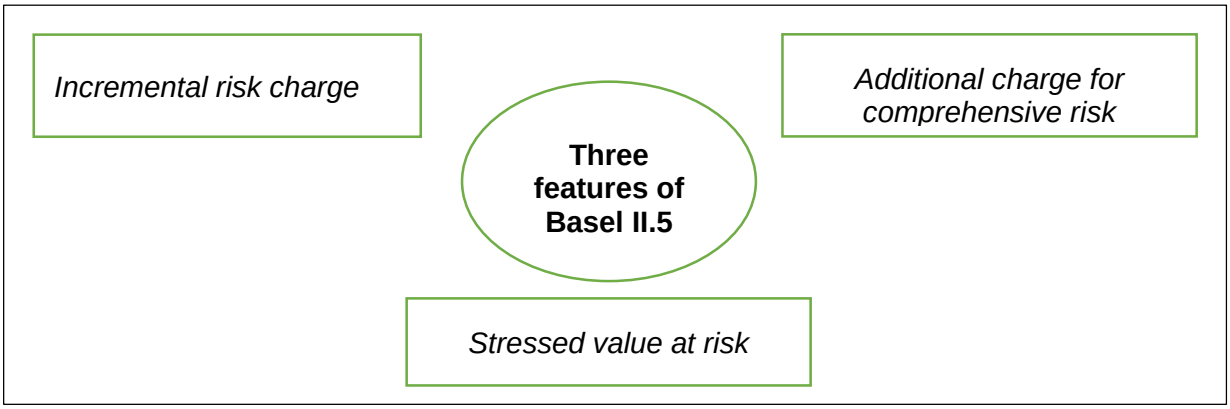
with the subprime mortgage market in the USA and became a banking crisis with the collapse of the Lehman brothers in 2008 (Wiggins, Piontek & Metrick, 2014). Also, other contributing factors which led to the subprime mortgage crisis were low interest rates which encouraged mortgage lending, relaxed regulations which allowed predatory lending in the private sector (Mishkin, 2011). In addition, banks in the US also took advantage of the ambiguity in the Community Reinvestment Act, which was designed to assist low and moderate income earners to secure loans resulting in the proliferation of high-risk loans (Zuluaga, 2019). These high approval mortgage rates led to a large pool of homebuyers, increasing the mortgage delinquency rate and securitisation (Chima, 2010). As a result, the market for these securities plummeted, and banks had heavily invested in these assets resulting in a consequential liquidity crisis.

The 2007 -2008 financial crisis revealed the susceptibility of the banking sector and the flaws in Basel II, such as underestimating credit risk when using internal models. This led to the introduction of Basel II.5 in 2009.

3.3.3 Basel II.5

The BCBS introduced Basel II.5 in 2009 to address the shortcomings of Basel II (Moosa, 2015:33). Basel II.5 was particularly aimed at addressing the process of securitisation. During the 2007-2008 financial crises, banks bundled their junked bonds portfolios using securitisation, thus outsourcing their risk (Chen, 2013:191). The recipients of these portfolios repeated this process resulting in the concealment of AAA prime mortgages. As a solution to this problem, Basel II.5 introduced new modifications to the three-pillar approach in Basel II. The three features of the modification are shown below;

Figure 3.4. Three features of Basel II.5.



Source: Author

- Incremental risk charge (IRC). IRC estimates credit migration and default risk, including recovery risk of unsecuritised products over one year (Xiao, 2019:3). Credit migration

risk refers to the risk of moving loans from one bank to another (Ferretti, Gabbi, Ganugi, Sist & Vozzella, 2019:2). The IRC framework aimed to complement the VAR differences between a bank's trading books and the banking books in which the trading books had lower VAR computation compared to the latter (Wilken, Brunac & Chorniy 2013:810). Considering that the capital requirements in the trading books were much lower than that of the banking books, banks were exploiting this arbitrage by converting their banking books to trading books, consequently converting securitised loans (Smit, Van Vuuren & Styger, 2011:140). Therefore, the IRC required banks to compute a 99% confidence VAR for all instruments in the trading books, especially if the instrument is sensitive to default risk (Wilken *et al*., 2013:813). In so doing, the capital charge in the trading book will increase to the approximate required amount in the banking books.

- Additionally, banks were required to estimate the sensitivity of an asset to downgrading risk and rebalance their portfolios at regular intervals (BCBS, 2009). Finally, the computation of liquidity horizon for all the securities in the trading books that were sensitive to liquidity risk and downgrading risk was also required (BCBS, 2009). In addition, it was mandatory to replace assets that were prone to these risks.

- Comprehensive risk measures (CRM). CRM is a single capital charge for correlation dependent instruments such as asset-backed securities and collateralised debt securities (Finger, 2011:54). This instrument was introduced to estimate how one risk relates to the other, implying CRM captured the correlation risk in the books (Prorokowski & Prorokowski, 2014). Under the CRM approach, a standard charge was applicable for securitised and re-securitised products. However, higher capital requirements were required for re-securitised products, as shown in the table below

Table 3.4. Standard capital charge under the CRM approach

External Credit Assessment	AAA to AA-	A+ to A-	BBB+ to BBB-	BB+ to BB-	Below BB- or unrated
Securitised products	1.6%	4%	8%	28%	Deduction
Re-securitised products	3.2%	8%	18%	52%	Deduction

Source: Finger (2011:56)

Banks had the flexibility of using their internal models in computing the CRM for unrated tranches. These internal models had to meet some basic criteria such as the model had to be rigorous and sophisticated, it had to conduct numerous stress tests and be able to capture

credit spread risk (Martin, Lutz & When, 2011:46). Also, the model should capture multiple default risks and determine the implied volatility and recovery rates (Wisse, 2018). Accordingly, the following stress testing should be performed.

- Stressed Value at Risk (SVAR): Post the 2007-2008 crisis, SVAR was developed as an added regulation for Basel II.5. The losses that banks experienced during the crisis significantly exceeded the capital requirements that regulatory authorities had required banks to hold against trading market risk (Katarzyna, 2016). Up till 2007, regulatory capital associated with trading exposures was primarily based on the banks' simple VAR measures or historical simulation. This historical simulation was based on the percentage change for a random 250 days from a sample period of four years with an additional one per cent VAR (Čorkalo, 2015). However, volatilities were much lower before the financial crisis, implying lesser VAR values and lower capital requirements (BCBS, 2010). Basel II.5 addressed this shortcoming by introducing a SVAR computation in addition to the historical simple VAR. The concept of SVAR was based on the notion that under stressed financial conditions, banks may require more capital that is not covered by normal VAR computation (Drehmann & Tarashev, 2013). Compliance with SVAR required banks to conduct a VAR for the worst-performing 250 days' period when the market was experiencing challenging conditions. Therefore, the total capital charge for market risk was given by;

$$\text{Total capital} = \text{Max}\,[VAR_{t-1} + \text{Mc}VAR_{avg}] + [SVAR_{t-1} + \text{Ms}SVAR_{avg}]$$

(Drehmann & Tarashev, 2013:594)

Basel II.5 was a quick response to the market turmoil that happened in the financial sector during the crisis. It was evident that the new measures proposed by the framework were still insufficient to prevent the system from falling into another financial crisis. According to Moosa (2015:30), Some of the structural limitations of Basel II.5 were;

- The framework did not address the cognitive factor upon which credit risk and market risk are based. This lapse created difficulty in consistently enforcing the Basel II.5 across banks.
- Several weaknesses were found in the internal models used by the different banks where it ignored losses that had a probability of less than 1%.
- Basel II.5 ignored the market liquidity of the securities in the trading books assuming that banks could quickly trade their securities without affecting the market price.

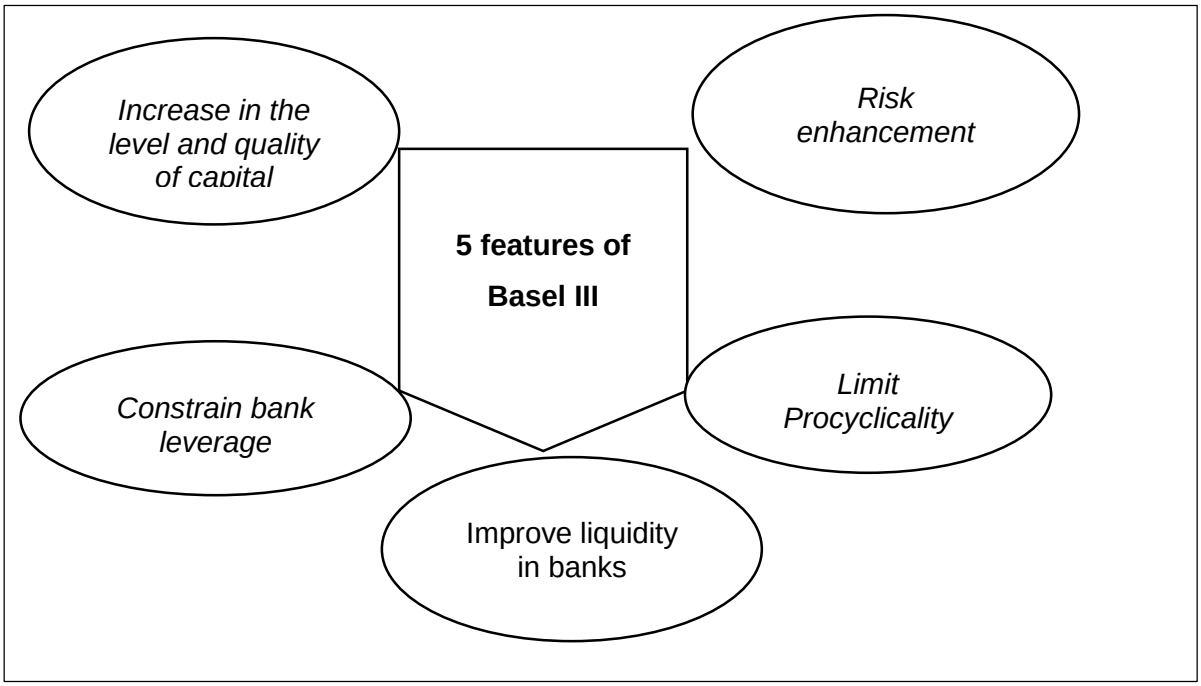
- The SVAR and VAR computations did not take into consideration the credit risk inherent in the trading books.

In addition, the 2007-2008 financial crisis revealed the contagion of systemic risk in the banking sector (Keregero & Fan, 2019:152). This means the failure of one bank could lead to the failure of more counterparties, triggering a chain reaction (Acharya & Mora, 2015). Therefore, the BCBS decided to implement a new framework called Basel III.

3.3.4 Basel III

Basel III was released in 2010 and is also a global regulatory framework set by the BCBS to enhance resilience in the banking system by absorbing market shocks arising from financial and economic factors (Lyngen, 2012:530). In so doing, the framework aimed at substantially strengthening regulatory capital, diversifying market liquidity risk and providing stability in stress testing (Dietrich, Wanzenried & Hess, 2014:13). Specifically, the framework was instituted to address the credibility of the RWA, where discrepancies in the capital ratios were reported due to wide variations in RWA (Stattin, 2018:4). First, these discrepancies made it extremely difficult to evaluate capital ratios. Secondly, several limitations of internal models were also reported where some models could not reliably quantify SVARs while others had the incentives to minimise risk weights to achieve lower capital requirements (Begley, Purnanandam & Zheng 2017:337). To address these limitations, the following components were the main features of Basel III.

Figure 3.5 Basel III features



Source: Author

3.4 Increase in the level and quality of capital

Adjusting the level and quality of capital provided a unified definition of capital across the board and its disclosure. This was due to the lack of consistency in the definition and disclosure from the previous norms (Lyngen, 2012:533). In addition, the BCBS realised the need to further provide more shock absorbers for risk exposures by increasing the quality of capital (BCBS, 2013:4). Consequently, Tier 1 capital was adjusted to predominantly common stock and retained earnings due to credit losses and write-downs against retained earnings (BCBS, 2013:5). Tier 2 capital was comprised of specific securities as shown in the table below;

Table 3.5. Composition of capital base under Basel III.

Tier 1 capital	Tier 2 capital
• Common stock issued by a bank as per regulatory requirements. • Share premiums • Retained earnings • Other comprehensive income and disclosure reserves • Common stock issued by banks subsidiary.	• Instruments issued by a bank that qualifies for Tier 2 capital • Certain loan provisions

Source: BCBS (2013)

Additionally, the ratio of standard equity Tier 1 (CET1) to RWA must be at least 4.5% at all times, while the minimum rate of Tier 1 capital to RWA and total capital to RWA should be at least 6% and 8%, respectively.

3.4.1 Risk enhancement

The BCBS introduced a new capital requirement for exposures in the trading and banking books to enhance risk coverage further. This resulted from the oversight in the major on and off-balance sheet risk (Fratianni & Pattison, 2015:11). This enhanced treatment required the computation of a continuous 12-months SVAR and additional capital requirements for re-securitised assets and counterparty risk.

3.4.2 Leverage ratio

In addition to the modifications in capital requirements, Basel III introduced a non-risk weighted ratio called the leverage ratio to prevent banks from having excessive on and off-balance sheet leverage (Stattin, 2018:6). In so doing, banks were required to maintain a minimum leverage ratio of 3% calculated by dividing Tier 1 capital by the bank's total exposures. Thus, the total exposure was given by the total consolidated assets (BCBS, 2013:12). In addition, the US

federal reserve bank later mandated a 6% and 5% minimum leverage ratio for all systematic financial institutions and banks, respectively (Acharya & Naqvi, 2012).

3.4.3 Limiting Procyclicality

The financial crisis also revealed the adverse effects of procyclical shocks in the banking sector, where banks experienced severe losses due to market amplifiers such as systemic risk and volatility (Miele & Sales, 2011:270). To provide resilience against procyclical dynamics, the BCBS introduced countercyclical buffers to serve as an absorber of risk transmitted in the banking sector (BCBS, 2013). Another goal of this buffer was to establish a mechanism to act as a shock absorber before any risk could materialise so that in periods of financial stress, the bank will continue operating normally (Acharya & Mora, 2015). The countercyclical buffers allowed regulatory authorities to require additional capital of 2.5% to the RWA during periods of high credit growth (Burra *et al*., 2015). Restrictions in dividend payments, share buybacks and bonuses were also imposed on banks in cases of non-compliance or when the ratio was less than 2.5%. The BCBS also introduced a capital conservation buffer of 2.5% to absorb losses during economic or financial stress (BCBS, 2013). The addition of this buffer increased the total equity requirement to 7%, of which 4.5% was common equity and 2.5% capital buffer (Van Vuuren, 2012). The implementation schedule for this buffer is shown below

- January 1, 2016, → 0.625%
- January 1, 2017, → 1.25%
- January 1, 2018, → 1.875%
- January 1, 2019, → 2.5%.

3.5 Global Liquidity standards

The financial crisis highlighted that most banks did not manage their liquidity prudently despite portraying adequate capital requirements (Claassen & Van Rooyen, 2012:33). The crisis also revealed how quickly liquidity could evaporate in the system despite buoyant financial conditions. Poor liquidity risk management amplified the reversal of bullish market conditions and most banks' difficulties during the crisis (Bonner & Eijffinger, 2016:1947). In response, the BCBS (2010) also introduced a new global liquidity standard constituting short term LCR and long term NSFR. These standards were introduced to ensure that banks have sufficient liquid assets to survive acute and long term stress scenarios. To do so, banks have to hold HQLA and more stable sources of funding, ensuring that they are congruent with the principle of sound liquidity risk management (Giordana & Schumacher, 2013:634). These standards aim to provide sound short-term liquidity risk management practices within 30 days and enhance long term resilience with stable funding. To this end, the LCR and NSFR were introduced.

3.5.1 Liquidity Coverage Ratio

The definition of LCR was based on the combination of market and idiosyncratic factors evolving from the immediate availability of external funding and the contractual outflow of a bank's obligation (BCBS, 2013). LCR is referred to as a 30 days' flow ratio where the incumbent should allow banks to survive a 30 days' stress scenario without raising additional funds (BCBS, 2013). This ratio is an essential component of managing liquidity risk and a key reform in strengthening bank capital requirements (Fuhrer, Müller & Steiner, 2017:293), introducing the LCR aimed to promote a more resilient banking sector while decreasing the risk profile. To achieve this objective, banks have to hold adequate HQLA that can be easily and immediately converted to cash in the private market to meet their obligations within the 30 days' horizon in a liquidity stress scenario (Giordana & Schumacher, 2017:4). The BCBS' (2010) introduction of this liquidity standard was perceived as a potential shock absorber to reduce the banking sector's spillover risk to the global economy. The formula for the LCR is shown below.

$$\text{LCR} = \frac{HQLA}{Total\ net\ cash\ outflows}$$

Source: BSBS (2010)

It was later revised in 2013 to incorporate the new amendments in defining HQLA and net cash outflow. The new definition included a broader scope of liquid assets eligible for inclusion in HQLA and refinements to the net outflow to reflect actual experiences in stress scenarios (Sadien, 2017:34). In addition, to ensure smooth implementation, a minimum phase-in schedule was established at different time intervals, as shown in the figure below:

Table 3.6 LCR implementation schedule

	2015, January 1	2016, January 1	2017 January 1	2018, January 1	2019, January 1
LCR	60%	70%	80%	90%	100%

Source: BCBS (2013)

The gradual phase-in approach was designed to prevent disruptions in implementing the LCR as prescribed by a standard guideline recommended by the BCBS (2013). According to the BCBS (2013), the following guidelines were prescribed as characteristics of HQLA in the ratio;

- Low-risk securities: These securities are assets that can be quickly converted to cash with low volatility in market prices. These low-risk assets should possess the following features: low duration, low inflation risk, low foreign exchange rate risk and high credit standing.

- Ease and certainty of valuation: there should be readily available information that will ease the process of determining the market value of the asset. This will enable market participants to quickly agree on a price. In addition, the pricing of the asset should be based on standardised and straightforward structures or approaches, ruling out subjective views and assumptions.
- Low correlation with risky assets: HQLAs should have a low correlation with other assets. Low correlation is usually associated with lower risk, where the effect of significant market losses due to high volatility is dampened. Furthermore, the correlation of HQLA with other investment securities should not change significantly during idiosyncratic stress periods.
- Listed on recognised exchange: the HQLA should be listed on a developed exchange in order to increase the level of transparency for valuation and pricing purposes.
- Market size and trading frequency: there should be enough evidence of market breadth, tightness, and depth. This evidence should reveal low spreads, high numbers of market participants, frequent trading, and high trading volumes. These diverse market characteristics should have minimal impact on price distribution.
- Low volatility: another vital characteristic of HQLA is the stable price distribution over a specific period. This is to mitigate the risk of a fire sale to meet the liquidity needs. In this case, the ratio of long term to short term variance over the period should be constant.

HQLA were further categorised into Level 1 and Level 2 assets. Level 1 assets are the most liquid, comprising cash, central bank reserves, central bank debt for 0% risk-weighted sovereigns and other marketable securities backed by the central bank (Pattanaik *et al*., 2018). Level 2 assets comprised of securities issued by sovereign banks and central banks with a 20% risk weighting, corporate debt securities rated AA- or higher, covered bonds rated AA- or higher, qualifying corporate debt securities rated between A+ and BBB- and common equity securities (BCBS, 2013). A summary of Level 1 and Level 2 assets are shown in the table below.

Table 3.7. Components of HQLA

Constituents of HQLA	Factor
Level 1 assets (unlimited holding) Cash Marketable securities from sovereigns, central banks and multilateral development banks Central Bank reserves Central bank debt for a 0% risk-weighted sovereigns	**100%**
Level 2 assets with a maximum of 40% of HQLA	
Level 2A assets Securities issued by sovereign banks and central banks qualifying for 20% risk weighting Corporate debt securities rated AA- or higher Covered bonds rated AA- or higher	**85%**
Level 2B assets maximum of 15% of HQLA	
Qualifying corporate debt securities rated between A+ and BBB-	**50%**
Common equity securities	**50%**
Qualifying residential mortgage-backed securities	**75%**

Source: BCBS (2013:73)

Conversely, the total net cash outflow was the difference between the total outflows and 75% of the total inflow (BCBS, 2013:75). This is because the outflows are based on the outstanding balances of various categories of liabilities and off-balance sheet commitments, as summarised in the table below.

Table 3.8. Summary of cash inflows and outflows for LCR ratio

Cash Inflows	
Level 1 assets	**0%**
Level 2A assets	**15%**
Level 2B assets - Eligible Residential Mortgage-backed securities - other assets	 **25%** **50%**
Margin Lending backed by all other collateral	**50%**
All other assets	**100%**
Other inflows by counterparty -Amounts to be received from retail counterparties - Amounts to be received from non-financial wholesale counterparties - Amounts to be received from financial institutions and central banks	 **50%** **50%** **100%**
Net derivative cash inflows	**100%**
Other contractual cash inflows	**National discretion**

Source: BCBS (2013:73)

Cash Outflows	
Retail deposits	
- Deposit insurance schemes that meet the criteria for stable deposit	**3%**
- Stable deposits	**5%**
- Less stable retail deposits	**10%**
Term deposits greater than 30 days	**0%**
Unsecured wholesale funding	
- Stable deposits	**5%**
- Less stable deposits	**10%**
Operational deposits derived from cash management	**25%**
- Portion covered by deposits	**5%**
Deposits from centralised institutions	**25%**
Non-financial corporatives, central banks, multilateral banks deposits	**40%**
Other legal entity customers	**100%**
Secure funding	
- Secure funding transactions with central banks counterparties	**0%**
- Secure funding transactions backed by Level 2A assets	**15%**
- Secure funding backed by non-level 1 or non-level 2A assets	**25%**
- Backed by residential mortgage-backed securities eligible for Level 2B assets	**25%**
- Backed by other level 2B assets	**50%**
- All other secure funding transactions	**100%**

Source: BCBS (2013)

3.5.2 Net Stable Funding Ratio

Before the financial crisis, markets were buoyant, and funding was readily available at a low cost (Grant & Wilson, 2012:2). As conditions reversed during the crisis, liquidity became thin and evaporated. During the crisis, a combination of excessive exposures to subprime mortgages, excessive balance sheet leverage led to overreliance on short term lending, which contributed to the bankruptcy of some banks (Gobat, Yanase & Maloney 2014:5). The financial crisis also revealed that relying disproportionately on the issuance of asset-backed securities and other securitisation programs to maintain funding is unsustainable (Wei, Gong & Wu, 2017:230). Also, borrowing from short term sources and investing in high credit risk securities carried a significant amount of liquidity risk. Accordingly, the BCBS (2010) introduced the NSFR as a key reform to promote stability in the banking sector. The NSFR was aimed at promoting resilience by ensuring a symmetrical response to market-wide shocks. According to the BCBS (2014:1), the calibration of NFSR requires banks to maintain a stable funding profile relative to their assets, including their off-balance-sheet assets. A sustainable funding structure such as the NSFR can reduce the plausibility of disruption in traditional sources of funding and,

in so doing, limit the risk of eroding liquidity positions and limiting systematic risk (BCBS, 2014:3). The NSFR can also be used as a funding risk assessment tool across all on and off-balance sheet items, promoting liquidity. According to the BCBS (2014), the NSFR is the ratio of available stable funding to required stable funding, which should be at least 100%, as shown below.

$$\text{NSFR} = \frac{Available\ amount\ of\ stable\ funding}{Required\ amount\ of\ stable\ funding} \geq 100\%$$

Source: BCBS (2014)

According to Setiyono and Naufa (2020:546), the amount of Available Stable Funding (ASF) is the tranche of capital and liability expected to be readily available over a one-year horizon. Conversely, the required stable funding is a portion of a bank's asset-weighted according to their maturity, credit quality and liquidity together with an amount relative to the off-balance-sheet commitments. Therefore, the definition of the required amount of stable funding (RSF) mirrors those used in the LCR. A summary of ASF and RSF is summarised below.

Table 3.9. Summary of liability and asset categories associated with ASF and RSF, respectively.

ASF factor	Components of ASF category
100%	• Total regulatory capital (excluding Tier 2 instruments with residual maturity of less than one year) • Other capital instruments and liabilities with effective residual maturity of one year or more
95%	• Stable non-maturity (demand) deposits and term deposits with residual maturity of less than one year provided by retail and small business customers
90%	• Less stable non-maturity deposits and term deposits with residual maturity of less than one year provided by retail and small business customers
50%	• Funding with residual maturity of less than one year provided by non-financial corporate customers • Operational deposits • Funding with residual maturity of less than one year from sovereigns, PSEs, and multilateral and national development banks • Other funding with residual maturity between six months and less than one year not included in the above categories, including funding provided by central banks and financial institutions
0%	• All other liabilities and equity not included in the above categories, including liabilities without a stated maturity (with a specific treatment for deferred tax liabilities and minority interests) • NSFR derivative liabilities net of NSFR derivative assets if NSFR derivative liabilities are greater than NSFR derivative assets • “Trade date” payables arising from purchases of financial instruments, foreign currencies and

Source: BCBS (2014:4)

RSF Factor	Components of RSF Category
0%	Coins and banknotes • All central bank reserves • All claims on central banks with residual maturities of less than six months • "Trade date" receivables arising from sales of financial instruments, foreign currencies and commodities.
5%	• Unencumbered Level 1 assets, excluding coins, banknotes and central bank reserves
10%	• Unencumbered loans to financial institutions with residual maturities of less than six months, where the loan is secured against Level 1 assets as defined in LCR paragraph 50, and where the bank can freely rehypothecate the received collateral for the life of the loan
15%	• All other unencumbered loans to financial institutions with residual maturities of less than six months not included in the above categories • Unencumbered Level 2A assets
50%	• Unencumbered Level 2B assets • HQLA encumbered for six months or more and less than one year • Loans to financial institutions and central banks with residual maturities between six months and less than one year • Deposits held at other financial institutions for operational purposes • All other assets not included in the above categories with residual maturity of less than one year, including loans to non-financial corporate clients, loans to retail and small business customers, and loans to sovereigns and PSEs
65%	• Unencumbered residential mortgages with a residual maturity of one year or more and with a risk weight of less than or equal to 35% under the Standardised Approach • Other unencumbered loans not included in the above categories, excluding loans to financial institutions, with a residual maturity of one year or more and with a risk weight of less than or equal to 35% under the standardised approach
85%	• Cash, securities or other assets posted as initial margin for derivative contracts and cash, or other assets provided to contribute to the default fund of a CCP • Other unencumbered performing loans with risk weights greater than 35% under the standardised approach and residual maturities of one year or more, excluding loans to financial institutions • Unencumbered securities that are not in default and do not qualify as HQLA with a remaining maturity of one year or more and exchange-traded equities • Physical traded commodities, including gold
100	• All assets that are encumbered for one year or more • NSFR derivative assets net of NSFR derivative liabilities if NSFR derivative assets are greater than NSFR derivative liabilities • 20% of derivative liabilities as calculated according to paragraph 19 • All other assets not included in the above categories, including non-performing loans, loans to financial institutions with a residual maturity of one year or more, non-exchange-traded equities, fixed assets, items deducted from regulatory capital, retained interest, insurance assets, subsidiary interests, and defaulted securities

Source: BCBS (2014:4)

3.6 Basel IV

Basel IV is one of the most discussed topics among banking regulators and professionals due to several postponements resulting from the COVID-19 global pandemic (KPMG, 2020:5). This new regulation will come into effect on January 1, 2023, allowing banks to set up structures and different mechanisms for smooth implementation. According to a report by Price Waterhouse and Cooper (PWC) (2017:3), there will be significant changes in BASEL IV, ranging from RWA to business models. Specifically, the calculations of RWA for credit risk, market risk and operational risk will be significantly different under the new framework (PWC, 2017:2). Also, the standardised approach and internal models for calculating these risk weights will change. Consequently, Basel IV proposes a new framework for calculating capital requirements for credit risk, capital risk and operational risk (KPMG, 2020:6). According to a report by KPMG (2018:3), the BCBS has provided the following reasons for revising the capital requirements;

- Insufficient risk sensitivity.
- Dependence on external ratings.
- Outdated calibration.
- Too many national discretions.

To this end, Basel IV is proposing a more balanced risk sensitivity approach that captures most risk drivers and qualifies the framework to be called “a more risk-sensitive framework” (PWC, 2017). In addition to this, Basel IV will be replacing the current exposure and standardised methods of calculating derivative exposures with a standardised approach for counterparty credit risk (SA-CCR) which should be applied to all banks (PWC, 2017). This SA-CCR approach will be implemented for the following reasons:

- To increase the comparability of RWA across banks
- Avoid variations in RWA across banks
- To have a consistent modelling process among banks.

These new SA-CCR approaches, together with the new capital requirements, will be used to estimate the new exposure at difficult (EAD), which will be given by:

$$EAD = alpha \times (RC + Multiplier \times add\ on)$$ (PWC, 2017)

Where alpha is equal to 1.4, RC is the replacement cost, including the margin period risk. Multiplier will constitute over collateralisation, and any negative mark to market ratio and add-ons will be any future potential increase in the current exposure (PWC, 2017).

Basel IV will introduce three approaches for securitising positions (PWC, 2017:4). Firstly, Basel IV will introduce the SEC-internal ratings-based approach (SEC-IRB:5). This is a straightforward approach for accounting for securitised portfolios based on internal models. The second method will be the SEC-external rating approach (SEC-ERB:5) which is similar to the SEC-IRB but with the use of external ratings. The final approach to account for securitised portfolios will be the SEC-standard approach used in the absence of internal and external ratings. The SEC-standard approach will be based on supervisory formulas without any subjective inputs. According to PWC (2017), the following reasons were also given for the new securitisation approaches:

- Strengthening risk sensitivity models.
- Flexible mechanism for accounting for securitisation.
- Minimising the cliff effect.

Although Basel IV may improve the quality of reporting, the framework does not consider modifications in the liquidity standards, namely, the LCR and NSFR. Hence, this study may help improve Basel IV regarding estimating and managing the level of liquidity.

3.7 Unwinding the LCR and NSFR

In banking, liquidity regulation is an integral part of risk management, particularly from the lessons learnt during the financial crisis (Dietrich *et al*., 2014:15). Without these regulations, banks may engage in unrestrained liquidity transformation. However, there is still substantial uncertainty about whether the LCR and NSFR adequately deal with liquidity risk (Golubeva, Duljic & Keminen: 2019; König & Pothier, 2016: Goodhart, 2011). One of the critiques of LCR and NSFR was intuitively presented by Goodhart (2011). In his article, Goodhart (2011) likened the LCR and NSFR to a traveller arriving at a station late during the day and found a taxi. The traveller later found out that the taxi cannot assist after requesting the service when it is most needed. The taxi could not assist the traveller because local authorities required at least one taxi to be at the station at all times, and unfortunately, this was the only taxi on duty. Goodhart (2011) compared the liquidity ratios (LCR & NSFR) and banks to the traveller and the taxi in which he inferred that banks might be involved in hoarding the HQLA when liquidity needs are binding.

According to Elliot (2015), the LCR and NSFR are still a vague representation of theory because they do not preclude the risk of negative liquidity positions or provide adequate buffers to fend off negative net liquidity positions. In congruent with (Schmitz & Hesse, 2014; IMF, 2013) the implementation the LCR and NSFR may result

- Decrease in high yielding investment securities
- An increase in the number of active unfilled orders in the limit order books.
- An increase in the time it takes to execute a trade and a decrease in trading volume
- Decreased in active traders.

From the viewpoint mentioned above, it can be suggested that the financial market liquidity of equity securities will be affected because measures such as ease of trading, the volume of trading and the time it takes to execute a transaction will cause uninformative price movements. This might suggest an improved LCR and NSFR. Also, the standard models in the Basel III framework concentrated mainly on capital requirements and ignored liquidity assessments (BCBS, 2021).

However, Basel III has also seen considerable success in implementing new models for estimating capital requirements (BCBS, 2021). Also, scenario simulations of the Basel II reform have successfully captured the transmission mechanism of several policies (BCBS, 2021). Also, the introduction and implementation of Basel III have positively affected the GDP in most European countries and US (BCBS, 2021).

The next chapter, the literature review, provides an overview of the financial market liquidity concept to better understand the effectiveness of the LCR and NSFR and identify the gaps in the current knowledge.

3.8 Summary and conclusion

The global liquidity standards articulate liquidity risk tolerance for effective risk management in banking, hence promoting good practice for liquidity risk. The aim of the global liquidity standards is to ensure a robust banking system during periods of financial stress. In so doing, the global liquidity standard established liquidity requirements aimed at mitigating risk in the short and long term. These liquidity requirements were grafted in the Basel III Accords, namely, the LCR and NSFR. The LCR and NSFR highlights certain types of assets that can be used to promote short and long term resilience, quantifying projected liquidity needs in times of stressed. These ratios were introduced as a measure to mitigate liquidity risk by holding sufficient HQLA to settle any obligations under a 30-days stress market conditions.

However, despite the relevance, the level 2B HQLA are perceived to lack market depth, tightness and resilience and may exhibit liquidity black hole when traded. Considering that there is still uncertainty surrounding the validity of the LCR and NSFR, a vivid understanding of financial market liquidity is required before embarking on an empirical analysis. Therefore, the next chapter, which is the literature review, contextualises the LCR and NSFR in the financial market liquidity setting.

CHAPTER 4

LITERATURE REVIEW

4.1 Introduction

This chapter provides a literature review on the concept of financial market liquidity. In so doing, the chapter first presents the different definitions of the concept. It then proceeds with contextualising the different components of financial market liquidity and a review of prior research that has been done so far.

Section 4.2 begins with the concept of financial market liquidity. Section 4.3 provides some evidence of deteriorating financial market liquidity in the global economy and proceeds to section 4.4, highlighting recent market liquidity trends. Section 4.5, 4.6 and 4.7 highlight the different themes of financial market liquidity, namely market depth, market resilience and market tightness, and a prior literature review for each theme. This is followed by the summary and conclusion of the chapter in section 4.8.

4.2 The Concept of Financial Market Liquidity

Market liquidity has gained significant attention from regulatory bodies and financial institutions due to the rapidly changing and unpredictable economic environment surrounding many institutions such as banks and other financial organisations (BCBS, 2019). However, financial market liquidity is a complicated, multifaceted concept that presents numerous challenges in its definitions because there has not been a standardised matrix used to capture the different dimensions of market liquidity (Wuyts, 2007:280). Also, some of these matrices capturing this concept have shown deterioration over the years (Narayan & Zheng, 2011:261). More so, measures that may capture liquidity in one market may not necessarily apply in another market (Hodrea, 2015:1438). Therefore, there have also been several definitions of financial market liquidity in an attempt to factor in these uncertainties. One such definition was put forward by Shen and Starr (2002:53), who defined the financial market liquidity of an asset as the ability to absorb inflows and outflows orders smoothly. More substantiated definitions of financial market liquidity are given below:

- "Financial market liquidity of an asset is the ability to trade quickly, in large volumes without distorting its fundamental price and with minimal cost" (Stange & Kaserer, 2008:12).
- "The market liquidity of an asset refers to the ease of trading with lower transaction cost in a timely manner" (Lee & Chou, 2018:125).
- "market liquidity in any asset is the ease of liquidating a position at a reasonable price timeously" (Singh, Gupta & Sharma 2015:30)
- "A liquid asset is the extent to which funds can be quickly accessed when committed to long term investments" (Fang, Noe & Tice, 2013:152)
- "A financial liquid asset refers to the extent in which an asset can be liquidated at a price close to the consensus value" (Foucault, Pagano & Roell, 2013:2).

According to Muktiyanto (2015:39), "a financial liquid asset is when trades are executed quickly and at low cost on demand".

Finally, Wuyts (2007:280) defines the financial market liquidity of an asset as "the ease at which market participants can take the opposite side of a transaction without significantly affecting the price".

From the above definitions, houses and cars are relatively illiquid as they take months or even years to be sold. On the other hand, the South African Treasury bill is an example of a liquid asset as it takes a very short time to be sold with minimal transactional cost (Nyawata, 2012:4). Market liquidity is a multifaceted concept involving an interplay between variables over time.

Therefore, quantifying liquidity at any given point in time and drawing conclusions may be insufficient because liquidity should be a continuous process, and there should be enough evidence over time before conclusions can be drawn (Nikolaou, 2009:6). Also, there appear to be some underlying factors that capture the concept of financial market liquidity vividly. These are bid-ask spreads or transaction cost, price impact, trading volume and the log of price changes (Sarr & Lybek, 2002:9). It is also evident from the definition of financial market liquidity that the fundamental price of a liquid asset should reflect the fair market price (Dudycz & Praźników, 2020:10). In this case, the price distribution of the asset should not be significantly affected by market shocks or overreact to changes in trading volumes (Rehse, Riordan, Rottke & Zietz, 2019:321). Therefore, the variance, which is a measure of price volatility, should be constant in the long and short run.

In addition to the above mentioned, the level of market participants becomes an integral aspect in determining the factor of financial liquidity (Poon, 2013:87). Increasing the number of market participants initiating trades is often associated with an increase in trading and high levels of liquidity (Saad & Samet, 2017:21). An increase in trading activities signals quick trading, greater chances of initiating and settling a position. Failing to unwind a position easily or on short notice without significantly affecting the price may result in market liquidity risk (Malik & Lon, 2014:50). Liquidity risk causes financial markets to be fragile and prone to market shocks. According to Nikolaou (2009:10), other implications of liquidity risk or insufficient financial market liquidity may include

- Disruption in raising sufficient funds.
- Erosion of capital because cash is locked down in the asset.
- Increase in vulnerability of financial markets.
- Severe consequences in economic growth as experienced in the 2008-2009 financial crisis.
- A lack of market liquidity which results in higher transaction costs.
- An increase in price volatility of security prices.
- A fall in bond prices followed by an increase in premiums for holding these bonds and an increase in the cost of raising capital.

The Basel III framework highlighted the different constituents of HQLA but assessing the financial market liquidity in specific markets is still lagging and should be considered. During financial distress, the liquidity of an asset may decrease depending on the nature of the asset and the market (Loudon, 2017:10). Banks rely partly on trading their liquid assets in a well-functioning exchange to raise sufficient cash to fund different activities. Banks and many

financial institutions typically have an incentive to have sufficient liquidity, but there might be many shortfalls to these incentives. Some of these shortfalls include loss of confidence in the market, decrease in active market markets and the presence of asymmetric information between buyers and sellers (Shen & Zhao, 2017:18). Contrary to the notion that an illiquid market does not exist, the recent market turbulence has demonstrated that financial market liquidity cannot be overlooked (Kim & Shamsuddin, 2008:521). Therefore, the concept of financial market liquidity of an asset needs to meet two criteria: Logical consistency in terms of the relationship between variables and measurability regarding quantifying financial market liquidity (BCBS,2013).

Financial market liquidity is defined in this study as the extent to which trading activities which are trading volume, buyer and seller trades and transaction cost affects the market prices according to the BCBS (2013) definition of liquid assets and the price continuity theory of liquidity preference as described by Black (1971). These two measure were synthesised to provide a logical framework in accessing liquidity due to the depth and relevance in their definitions as highlighted in chapters 2 and 3 respectively. Therefore, a liquid asset will be determined when there is no significant relationship between trading volume, buyer and seller trades and transaction cost on price changes and log distribution per this definition. This definition is not time-bound and does not consider the time to execute a trade as indicated in the characteristics of liquid assets highlighted in the BCBS (2013) framework. Also, in this study, the time to execute a trade was not considered because of the concept's ambiguity. Ambiguity stems from the lack of consensus or universally acceptable trading time to quantify market liquidity. It is also very difficult to measure the average time to place an order up to when the transaction is executed. Prior studies (Loebnitz, 2006: Wanzala *et al*., 2017) on financial market liquidity have also acknowledged the shortcomings of using time-related proxies in estimating financial market liquidity and accessing the frequency of transactions orders and the number of orders per unit time. Therefore, estimating market liquidity based on the speed of executing a transaction presents a dimensional distortion limitation. As already alluded, financial market liquidity should be continuous, evident where trading activities and market participants should not affect the market price (BCBS, 2013). There are several benefits of market liquidity; these benefits are highlighted below.

4.2.1 Relevance of financial market liquidity

- Financial market liquidity of an asset is important for financial stability: Market liquidity is an integral aspect of market stability in the context of asset volatility and efficient allocation of capital (Busse & Green, 2002:420). Banks will continuously access funds when needed and can quickly close a position with little risk regarding asset volatility. This can also be applied to the supply of credit. A financial liquid asset market can

minimise major disruptions in asset prices and limit significant changes in transaction costs (Brutti, 2011:70). Minimising disruptions in asset liquidity will enable market participants to move the market and provide sufficient funding when needed.

- Conversely, low liquidity in financial assets signals fewer market participants trading and fewer counter orders (Fung, 2007:701). A small catalyst can cause exacerbated and fast moves in asset prices, increasing market volatility (Prasanna & Bansal, 2014:103). A financial liquid asset can also prevent market failure by limiting excessive trading risk (Amihud & Mendelson, 2006:21). This trading risk arises from trading at prices not supported by fundamental values.
- In the context of efficient allocation of capital, liquid assets can facilitate information flow between borrowers and lenders to overcome the inherent asymmetric information prevalent in emerging economies (De Wet, 2004:623). The information flow is in the form of easily identifying lenders in the form of bond investments. Moreover, borrowers may have constructive ideas but do not have the required fund to materialise these ideas. Finally, the financial market liquidity of an asset plays an important role in macroeconomic stability by providing resilience to market shocks during economic distress (Arabsalehi, Beedel & Moradi, 2014: 498). It prevents market turbulence, as seen in most developed markets such as the US and Germany.
- Liquid assets have lower transaction costs: Transaction cost refers to the difference between an asset's bid and offer price, also known as the spread (Werner, 2003:310). When a market marker trades on either side of the spread, they take a position in the market which is a risk because of uncertainty in trading the asset. This risk is minimised when several other market participants are willing to trade. In order to compensate for this risk, market makers pay a premium known as the spread. In financial liquid assets, the spread is very thin as market participants can easily execute a trade which limits uncertainty (Hussain, 2011:26). Also, these thin spreads are due to competition between market markers to undercut rivalry and have the best prices. Thus, the lower risk and lower transaction cost attract market participants.
- Conversely, high transaction cost reduces the number of market participants, resulting in fragmented markets (Zhang, Russell & Tsay 2008:659). The principle of fragmented markets is due to having multiple trades at a price not supported by the fundamental value. Worse still, low liquidity assets may result from trading at a price far from the equilibrium price, hence the relevance of financial market liquidity (Ostry, Gosh & Chamon, 2012:410).
- Financial market liquidity is an integral aspect of assets and liabilities management (ALM): ALM is a comprehensive and dynamic framework for managing a firm's balance sheet structures in other to mitigate interest rate and liquidity risks (Marozva, 2017:2).

These balance sheet structures involve ALM to mitigate liquidity and interest rate risks by matching inflows from assets and outflows from liabilities cash projections. Normally, these risks arise from the firm's inability to meet its liabilities when they are due. Liquidity risk can also be from either a bank's inability to trade its assets or borrowing restrictions (Bacchetta & Benhima, 2015:1103). For a financial liquid asset, banks can trade large volumes quickly to meet their liabilities when due. This facilitates planning and improves performance due to minimal uncertainties. Furthermore, liquid assets are an essential mechanism in stabilising spreads by minimising the exposures to cyclical rates and earnings, hence balancing the gap between sensitive assets and liabilities (Brunnermeier Gorton & Krishnamurthy 2013:101)

- Prior research (Caballero & Krishnamurthy, 2008; Calem, Covas & Wu, 2013; Carlin, Lobo & Viswanathan, 2007) has shown that significant disruptions in financial markets are amplified where financial market liquidity is inadequate or low. In this case, the level of systematic risk in an asset with low liquidity will cause back runs which acts as an inhibiting factor in effective transmission of central interventions (Curdia & Woodford, 2011:64). In this case, the ability of central banks to provide the required funding through open market operations becomes severely impeded. Therefore, market liquidity facilitates the functioning of financial markets, which tends to provide resilience.
- Financial market liquidity provides a true reflection of inflation expectation from asset prices and term structure yields. Therefore, these measures are deemed essential for implementing and monitoring efficient monetary and fiscal policies (BCBS, 2006).
- Financial liquid assets generally have a lower funding cost due to low liquidity premiums demanded by market participants. In equilibrium markets where liquidity is maximised, market participants demand low margin requirements. These low margins facilitate trading activities that amplify liquidity (BCBS, 2006).

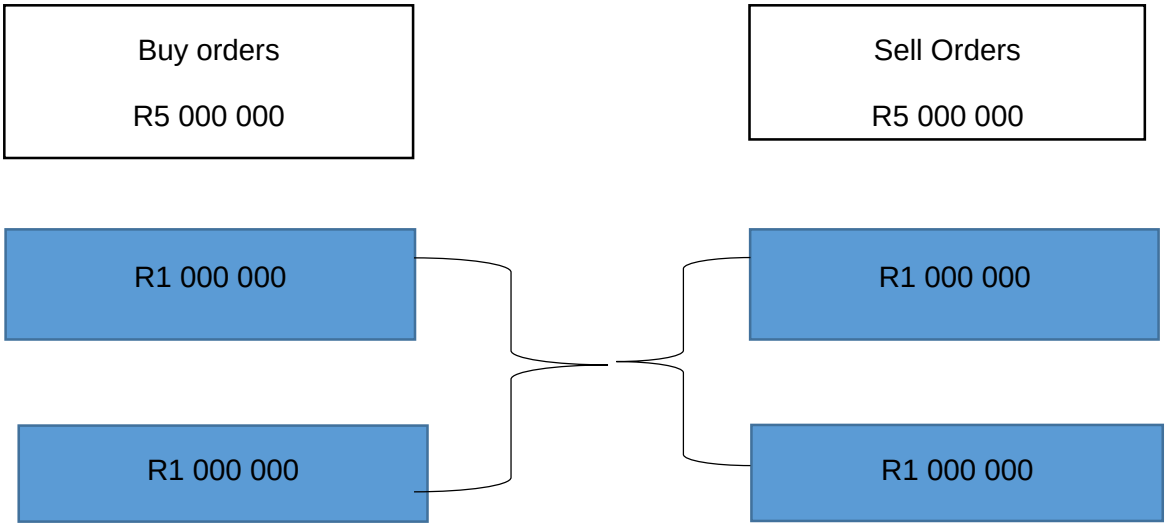
4.2.2 Mechanism of Market liquidity

A liquid asset has many market participants and market makers known as the main players (Panayides, 2007:1). Market makers provide services to buyers and sellers who are the market participants, including hedge funds, retail traders, insurance companies, mutual funds, pension funds, and commercial businesses, including banks. The interaction between these market players is the crux of financial market liquidity. For an asset to be liquid, market participants must be willing to take the opposite side of the trade. This is to say, when a market participant initiates a trade, another trader should offset the order (Perotti & Rindi, 2010:2). In this case, the price will not move in any direction. Alternatively, if there are more buyers than sellers, the price will not move as proposed by the liquidity concept because the waiting time to execute a

trade will be very short (Hendershott & Seasholes, 2014:141). In financial markets, market makers do not have an opinion on whether the prices should go up or down. They only profit from the spread, which is the bid-ask price.

In a liquid asset, large order sizes cramp together often with multiple market participants overlapping each other as opposed to illiquid assets where there are small volumes that are spread apart (Foucault, Kadan & Kandel, 2005:1172). The diagram below depicts an illustration of a liquid market.

Figure 4.1: Diagram illustrating the distribution of order size in a liquid asset



Source: Author

Multiple market participants at different levels quickly fill market orders. These market orders are primarily in small quantities, which makes the prices unchanged. It will take a substantial market order to move the price significantly (Allen & Gale, 2004:1016). Due to the profit that market makers gain from each transaction, they tend to quote equal amounts of the bid and ask prices to balance their inventory levels (Ausubel, 2004:1460). Although the bid-ask prices differ among market participants, liquidity is usually balanced from the buyer and seller side in the asset. As a result, prices tend not to move in a liquid asset when market participants initiate a trade (Bacchetta & Benhima, 2015:1108).

Conversely, illiquidity in financial assets is not easily balanced, caused by trades that outweigh one another resulting in an unbalanced price movement, either up or down (Chacko, Jurek & Stafford, 2008:4). In effect, liquidity acts like a resistant to absorb market orders. Thus, the higher the liquidity, the harder it is to move prices significantly and vice versa.

Due to uncertainty arising in trading, such as the low probability of executing a trade, liquidity management in the banking sector is important because of the risks involved in having too

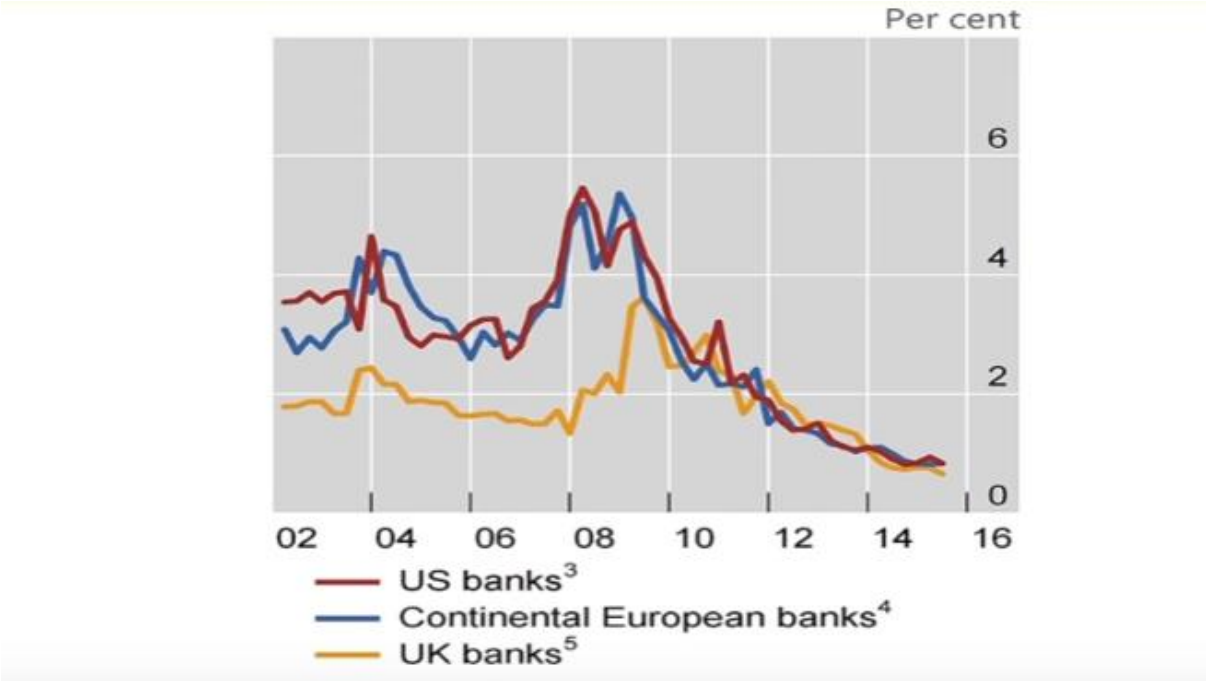
much or too little liquidity. Liquidity can be split into either market liquidity or funding liquidity (Marozva, 2017). In recent years, there has been an irregular supply and demand for liquidity due to a reduction in the number of market makers, which has affected the different categories of investors (Bekaert, Harvey & Lundblad, 2007:1785). According to Engle and Ferstenberg (2007:40), several changes need to be made in the market structure to help the market function appropriately to create market liquidity. These aspects include trading venues and electronic transactions, access to trading platforms, trading protocols that need to evolve specifically to block size transactions, and the behaviour shift of traders. Considering that there has been a significant injection of capital in the market since the financial crisis, appropriate mechanisms need to be put in place to ensure that capital moves from holder to holder or banks to banks in a more seamless, cost-effective mechanism. Also, electrification can assist in matching buyers and sellers and also assisting in matching trading volumes. Jorion (2007:54) believes that the crux of market liquidity is market depth; in other words, how large can a trade be to affect prices. Due to the quest for quantitative easing, monetary policies and regulations shock absorbers will be required to unwind the different positions in case of turmoil. According to Lei and Lai (2007:6), dealers are no longer able to provide the risk transfer as in the past due to the market growth. Also, the capital that dealers commit to secondary markets making activities in risk transfer has decreased significantly hence a significant driver in prohibiting financial market liquidity. According to Gómez, Prado & Galacho (2019:3), the top 10 dealers have contemporaneously agreed that their capital commitment has momentously decreased from 2007 by approximately 20%, affecting financial market liquidity. From a macro perspective, a lack of liquidity can amplify the transmission of shocks and further affect economic activities.

It is essential to distinguish the liquidity for different securities in the financial market. Therefore, for this study, only the financial market liquidity of equity and bonds will be analysed.

4.3 Deterioration in Financial market liquidity

There have been concerns of deteriorating liquidity in financial assets (De Renzis, Guagliano & loiacono, 2018; Blanqué & Mortier, 2019). Although spreads have been relatively stable in most European markets, the ability to trade at prices close to bid-ask spreads have been compromised considerably (Vayanos & Wang, 2012:227). Consequently, the liquidity adjustment occurs through trading volume instead of prices (Gerhold, Guasoni, Karbe & Schachermayer, 2012:11). Also, due to regulatory changes, some commercial banks have opted to exit their market marking positions (BCBS, 2019). In addition, higher capital requirements have caused a shift in trading patterns partly due to capital requirements (BCBS, 2019). The graph below shows that commercial banks limit their trading activities to abide by the stringent regulatory requirements around capital and funding.

Figure 4.2: Value at risk leverage for Bank of America, Citigroup, Goldman Sachs, JP Morgan Chase, Lehman Brothers, Morgan Stanley, BNP Paribas, Deutsche Bank, Societe Generale, UBS, Barclays, Royal Bank Scotland and HSBC.



Source: *Bloomberg LP, Bank of America & BIS* (2016:8)

The above graph illustrates the ratio of value at risk as a percentage of trading assets of major international banks. The decline in trading value at risk is also reflected in fixed income inventory which coincides with a significant increase in global bond markets (Fender & Lewrick, 2015:99). The divergence in trading value at risk, which measures the financial risk in banks and total assets, is a compromise position by banks to provide market marking services suitable for financial market liquidity (BIS, 2016). This raises serious liquidity concerns about systemic risk (Gwizdala, 2018:4). These regulatory changes also limit the number of liquidity providers willing to step in when prices move in a particular direction by modest demands, which causes prices to swing more widely (BCBS, 2019).

Monetary policies have also contributed to the deteriorating financial market liquidity (BCBS, 2020). Low-interest rates have caused a strong similarity in the exposure profile of various market participants. These similarities in risk profiles further cause market participants to follow the same investment strategy limiting the ability to take the opposite of a trade that limits financial market liquidity (BCBS, 2020). As already mentioned, financial market liquidity involves a heterogeneity of positioning.

In addition to those mentioned above, experienced market traders and financial institutions have also voiced concerns about deteriorating market liquidity. Some of these concerns are:

- According to Berner (2015), liquidity has increasingly become brittle, especially during episodes of adverse conditions.
- According to Furse (2015), there is sufficient evidence to justify the existence of increasingly fragile liquidity in most assets and markets.
- According to De Renzis *et al*. (2018), there have been several episodes of increasing volatility across most financial markets, which has caused liquidity to worsen. This backdrop has also led commercial banks to decrease their market marking roles. Worse still, market participants from the buy and sell sides are experiencing difficulties in trading large positions within a reasonable time (Cici, Shane & Yang, 2019:3).

As also indicated by Merkley, Michaely & Pacelli (2017:1290), the market marking positions of buy-side and sell-side traders have decreased due to lower risk-taking appetite caused by stringent regulatory requirements. In addition, these regulatory requirements have also affected banks' trading activities by reducing the risk appetite, leading to the growth of trading activities in the secondary market to stall, causing evaporations of market liquidity.

4.4 Trends in financial market liquidity in the bonds and equity market

There have been perceptible trends in the bond and equity markets over the years post-2007 crises. To date, there has been a doubling in corporate debts outstanding against a backdrop of a decrease in inventories on the bank balance sheets (Brunnermeier & Krishnamurthy, 2020). This is due to regulators taking a risk-averse position, indicating that these regulators are actively trying to de-risk the global banking system. These decrease in inventory levels and increase in corporate debt is also accompanied by a significant decrease in the daily transactions in some market like the credit default swap market (Anton & Nucu, 2020:10). Financial markets are also experiencing historically low-interest rates and high corporate bond levels, while central banks are assiduously promoting economic growth through quantitative easing (Brunnermeier & Krishnamurthy, 2020). The decrease in inventory levels has also led to an increase in volatility risk, increasing the cost of liquidity. Therefore, the cost of providing liquidity increases as volatility increases. This increase in volatility was partly triggered by three factors (Marco, Kermani & Palmer, 2020), namely:

- The US flash crash
- The US taper tantrum
- The European sovereign bond volatility.

According to the IMF (2020:1), there has been an increase in bifurcation across financial markets globally, particularly in emerging markets. This bifurcation is caused by the increase

in liquidity in more liquid assets such as South African treasury bills classified under the tier 1 liquid assets. This is accompanied by a decrease in liquidity in tier 2 assets. The IMF (2015) reported that globally, banks had reduced their market marking activities partly through bifurcations. These market-making activities are also caused by constraints in the balance sheets, regulatory reforms, and increased trading charges (Behn Daminato & Salleo, 2019:9). These trends have led to an increase in market liquidity spillover, triggering demand and supply mismatches in trading activities and limited capital provision (Behn *et al*., 2019:10). Prior research (Elliot, 2015; Tayeh, 2016; Guijarro *et al.*, 2019) has suggested several factors that improve liquidity in financial assets. Some of these factors are:

4.4.1 Market Microstructure.

Market microstructure is part of a broader analysis of financial market liquidity relating to how trading occurs under specific sets of rules (Madhavan, 2000:210). Market microstructure examines how trading mechanisms affect the determinants of transaction cost, price formation and trading volumes. In essence, market microstructure encapsulates trading transparency and market participants' access to private and public information.

Apart from trading rules and mechanisms, market microstructure also encapsulates price discovery and formation (Aigbovo & Isibor, 2017:121). Price discovery and formation refer to the extent to which future market prices expectation reflects current prices (Sehgal, Rajput & Deisting, 2013:58). Price discovery also refers to the act of determining a standard price of an asset (Dey & Maitra, 2011:24). It occurs instantaneously as prices are quoted in the market or every time a buyer or seller agrees to trade. In this type of market, buy-side and sell-side traders can be fair and efficient. In this case, market participants from different parts of the world can trade on the same bid-ask prices (Dey & Maitra, 2011:26). As a result, market participants expect new information to adjust, and market prices adjust accordingly quickly. The possibility that privately informed traders have pre-trade information becomes irrelevant. Accordingly, the price-setting mechanism in the market structure is almost immediate. Security prices in a good market structure can reflect fundamental values as prices adjust quickly to new information (Ayadi, 1994:35). The expected transaction cost is minimal in a well-organised market despite the proliferation of trading volumes, which affects liquidity (Carlson & Bitsch, 2019:6). Therefore, the current spot prices can be used as a valuation base for future markets, which increases financial market liquidity (Lee, Stevenson & Lee, 2012:305)

4.4.2 Market fragmentation.

Market fragmentation refers to the extent to which financial markets are concentrated and how trades are executed (Claessens, 2019:10). Trading occurs at numerous trading centres in fragmented markets, which reduces an asset's liquidity. This is due to differences in

transparency and transaction costs in some instances and particular markets. These different trading centres are also accompanied by different infrastructures or inadequate trading infrastructures, as in some emerging markets such as Brazil (Gaal & Alfrah, 2017:52). These differences in structures may result in transaction risk and cost, which influence trading decisions (Kociński, 2014:31). However, these risks are minimised or eliminated in segmented markets (Wilhelmsson & Zhoa, 2018:10). Market fragmentation also causes imperfect financial markets due to varying asset prices, which causes arbitrage opportunities (Gomber, Pujol & Wranik, 2012:150). Therefore, fostering the financial market liquidity of an asset connotes reducing market fragmentation.

4.4.3 Asymmetric information.

Asymmetric information exists when the buyers or sellers possess significant material information about the nature of an asset that the other party does not have, which leads to imperfect information (Trifunović, 2008:10). This refers to imperfect information flow about the quality of an asset. Usually, market participants are unwilling to reveal this information, which affects the asset's trading activities unless this is overcome. Asymmetric information also causes market failures resulting from an asset selling at different prices (Izquierdo & Izquierdo, 2007:860). This usually results in too many low-quality assets and little high-quality assets being sold. Market signalling is another consequence of asymmetric information, which impedes market liquidity. Market signalling refers to the degree to which sellers convey signals to buyers regarding the quality of an asset (Lőfgren, Persson & Weibull, 2002:199).

In most cases, sellers usually have more information about the quality of an asset than buyers. Therefore, buyer side traders may assume low quality and become bearish when sellers Initiate sell orders (Bergh, Connelly, Ketchen & Shannon, 2014:5). Although the sell orders might not necessarily be due to low quality, prices tend to fall, which causes fragmentation in financial market liquidity. This is one of the reasons why small business loans do not trade in liquid markets (Bergh *et al*., 2014:6). For this study, financial market liquidity will be simplified into three broad areas which are:

- Market depth
- Market Tightness
- Market resilience

4.5 Market Depth.

Market depth refers to the order size required to change the price of a security (Boonvorachote & Lakmas, 2016:56). For liquid security, large orders are not required to move the price significantly (Chueh, Yang, Yang & Fang 2010:157). In most markets, order quantity changes are usually accompanied by a subsequent change in price, which is not the case for liquid assets (Engle & Lange, 2001:120). Prices do not move significantly with new market orders in a deep financial asset due to a perfect fit between the order volumes and market price (Chueh, Yang, Yang & Fang 2010:157). This is because the trading of liquid assets matches the best offer prices and bid prices swiftly, which causes market orders to be filled quickly with no movement in prices (Mu, Zhou, Chen & Kertesz, 2010:10).

Conversely, there is a significant difference between market order prices and trading volumes in illiquid security characterised by a lack of market depth. Prices in these illiquid assets tend to move based on aggressions by market participants, which is in line with the notion that when there are more buyers than sellers, prices tend to increase and vice versa. This is to say that the aptness of limit order books to suck up trading orders depends on the aggression of market participants. A market reaction curve tends to be steeper, indicating significant price changes and a lack of liquidity. Therefore, it is evident that market depth is directly linked to market price and trading activities, especially trading volumes. These trading activities and market prices are displayed in well-organised exchanges and trading systems where market participants enter their orders at different times and prices. The price entered by the market participant determines which orders get priority over the others and how the orders are matched, and the most aggressive prices receive priority (Mattos Garcia & Pennings, 2007:12). If the aggressive prices are the same, non-hidden orders are prioritised, followed by the chronology of orders. Price priority, non-hidden orders, and chronology priority allow participants to trade aggressively, displaying their entire orders and encouraging early trades, increasing market depth. Therefore, market depth is based on trading activities were Frank and Garcia (2008:5) believes that there are several benefits of adequate market depth in an asset. Some of these are;

- Market depth reduces hedging costs. Market participants are constantly faced with price fluctuations partly due to order imbalances. This risk is mitigated where there is depth, and the asset prices are relatively constant
- Market depth also reduces trading costs.
- Market depth provides the necessary information regarding the liquidity of an asset and its trading activities. Notably, deep financial assets have their buy and sell orders displayed, which is necessary for decision marking.

- Market depth is relevant in order optimisation. Optimised orders enable market participants to place their order in the right direction where there are large orders.

The concept of market depth in the context of market price and trading volume in financial markets has been extensively investigated but not so much in South African, where there exists a gap in the literature. Much literature was found on this topic globally but not so much in South Africa. These studies are highlighted below.

4.5.1 A Review of prior studies on market depth.

It is worth noting that the studies below were reviewed based on the context of market depth, that is to say, market price and trading activities. The relationship between market depth or stock market liquidity and other variables were not reviewed as it is out of the scope of this study. However, the current status indicates mixed findings with regards market depth in equity securities (Harris, 1996; Kempf & Korn, 1998; Pennings *et al*., 2003; Frank & Garcia, 2008; Chueh et al., 2010; Boonvorachote & Lakmas, 2016; Pham *et al*., 2020). Harris (1996) tested the effect of tick size trading on quoted prices for stocks listed in the Paris Bourse and Toronto exchange. This study aimed to investigate the relationship between price volatility and tick size, which is trading volume using a sample of 300 stocks. Using regression analysis, the findings of this study revealed a significant positive effect between trading volume and price volatility, inferring low levels of market depth.

The study of Kempf and Korn (1999) investigated the market depth level in the German futures index markets. Kempf and Korn (1999) used price logarithm and net order flow as indicators of market depth. The price logarithm was the dependent variable, while net order flow was the independent variable. The authors used 15 minutes trading volume data of trading volume as measures of net order flow. Using 18729 observations of the samples from 1993 to 1994 and a linearity test model, Kempf and Korn (1999) found a significant movement in prices from trading volumes. This indicated a lack of market depth in the German index market. However, despite the study's relevance, it was conducted in 1998, and its findings are outdated and not relevant at present. Moreover, the study was conducted in Germany, a more developed market and its findings may not apply to the South African Equity Market.

In a similar type of study, Engle and Lange (2001) measured the level of market depth using a net volume to price volatility (VNET) model and a 1-year data from the trade, orders, reports and quotes (TORQ) in the New York stock exchange. Engel and Lange (2001) believe that a lack of market depth is a function of order imbalance between the buyers and sellers initiated trade which causes price movement. This might result from new information in the market that is not reflected in the prices. Engle and Lange (2001) used a sample of 144 stocks over three

months from 1st of November 1990 to 31st of January 1991. The authors used an auto regression conditional model to analyse the data and found that market depth changes with trading volume and transaction sizes. Their study revealed that there were periods when prices stayed constant regardless of the trading volumes. However, there were periods where prices moved with trading volumes. Despite the relevance of this study, its findings and implications are outdated and cannot be generalised to the South African markets.

In Asia, Brockman and Chung (2002) invested the impact of informed trading in the Hong Kong stock exchange from May 1996 to August 1997. This study aimed to investigate how traders and hence trading activities affected the liquidity position in the Hong Kong stock market. Brockman and Chung (2002) used 645 stocks to analyse this relationship and found that market depth was significantly affected by the trading level where price fluctuates randomly.

Still in the US, Choridia, Roll & Subrahmanyam (2003) also explored the effect of trading volumes on market depth, where the effect of trading volume on price fluctuations was determined. The purpose of their study was to analyse the time series fluctuations of liquidity in the NYSE. Choridia, Roll & Subrahmanyam (2003) used a panel regression for a sample of 2694 firms in the exchange from 1989 to 1998. The findings revealed a significant positive price imbalance due to trading activities. This led to the conclusion of lower levels of market depth in the NYSE for that period.

Elsewhere, Pennings, Garcia & Marsh (2003) evaluated the market depth of Agricultural futures exchange in the Amsterdam market. The authors hypothesised market depth into four phases: sustainable, lag adjusted, restoring, and recovery. Pennings et al. (2003) used linear regressions and Dicky Fuller test to analyse a data set from August to September 1995. The authors found that prices fell significantly due to limit order imbalance, indicating a lack of market depth revealed in the lag adjusted and restoring phases. However, Pennings *et al*., (2003) study used a very small sampling frame (2 months) and was conducted in Europe; therefore, its findings may not be generalisable to the South African markets.

In the US, Rahman, Krishnamurti and Lee (2005) simultaneously examined the level of market depth in the NYSE and NASDAQ using a sample of 30 stocks from January to March 2000. Their study aimed to determine the direction trading volume has on price changes. Using a vector autoregression model, Rahman, Krishnamurti and Lee (2005) found high levels of market depth in the NYSE and lower levels in the NASDAQ because trading activities in the NYSE were non-informational and did not affect the market price.

In a later study, Frank and Garcia (2008) also investigated the market depth of the cattle market in the Chicago mercantile exchange. The authors estimated the impact coefficient between the trading volume at different time intervals and the logarithm of prices as proxies of market depth.

Frank and Garcia (2008) believe that deep financial markets should absorb the different trading activities characterised by incoming market orders. This implies that the market reaction curve, which shows the effect of trading volumes on prices, should be reasonably constant. Using a Bayesian model and an average of 32 transaction sizes, the authors found the Chicago mercantile exchange to have high levels of market depth because price movements were not directly observable. However, Frank and Garcia's (2008) study used only one independent variable (trading volume) to investigate this relationship and was conducted in 2008, which is outdated.

In an Asian study, Chueh *et al*. (2010) investigated the price duration market depth on the Taiwan stock exchange futures market. Their study aimed to investigate specific factors that affect market depth. Chueh et al. (2010) used data spanning two years from 2001 to 2002 for five different contracts and VNET methodology to analyse the price duration market depth. Unlike Frank and Garcia's (2008) study, Chueh *et al*. (2010) found that trading volume and size are essential factors determining market depth. The authors also found that the market reaction tends to be non-linear from the price duration depth. The authors concluded that investors tend to increase their trading behaviours when price volatility increases hence lower levels of market depth.

In another Asian study, Boonvorachote and Lakmas (2016) investigated the impact of trading volume and open interest volumes on price changes in the Asian market comprising Japanese, Chinese, Thai and Singaporean futures exchanges. Their study aimed to analyse market depth by exploring the information influence of trading volume on price volatility. The authors also used the logarithm of price changes as the dependent variable and trading volume and open interest as the independent variables. Boonvorachote and Lakmas (2016) used a sample of 4 rubber futures contracts and four gold futures contracts from 2006 to 2012 as the sample size. Using a generalised auto regression conditional Heteroscedasticity, their findings revealed a significant positive relationship between trading volume and price changes. However, the findings also revealed a significant negative relationship between open interest and price changes. The implications of this study revealed a low level of market depth in the Asian commodity futures markets.

Bhattachary and Bhattachary (2018) also explored the properties of market depth in the Indian stock market. The authors believe that illiquidity presents uncertainty and risk to investors and potential investors relating to their investment. Bhattachary and Bhattachary (2018) used spectral regression, Hurst Mandelbrot statistics and rescaled range statistics to investigate market depth from 2002 to 2016. The study made use of trading volume, turnover rate and individual asset prices. The authors found high levels of market depth in the Indian stock

exchange. This was evident in the persistent ability of the index to absorb large market orders without significant price changes.

Similarly, Olbrys and Mursztyn (2019) empirically analysed the market depth of the Warsaw exchange as a dimension of market liquidity. The authors used a sample of 53 firms listed on the index from 2005 to 2015. The findings of the study indicate a high level of market depth. This was seen in the empirical regression results as the buyers and sellers initiated trades of the largest companies did not affect the asset prices.

Despite the relevance of the above studies, a common remark that can be made from the studies mentioned above reviewed thus far is that they were conducted in other continents.

In an Australian study, Pham et al. (2020) exploit the information content of market depth in the ASX200 index. The purpose of the study was to investigate the effect of trading volume on price volatility. The authors believe that the dynamics of price changes explain the information process of deep financial markets. Pham et al. (2020) used financial data of 60 stocks from 2007 to 2013 and a heterogeneous autoregression model to examine the level of market depth. 89 802 580 trades were examined, comprising 46 290 024 buyer initiated trades and 45 512 556 seller initiated trades. The study's findings revealed that market depth tends to be high when market orders are less than limit orders. This is because the prevailing market orders are absorbed without altering the prices. Conversely, when the market orders are greater than the prevailing quoted order, market depth tends to be very low in the Australian market.

Table 4.1. Summary of key findings on market depth

Study (Author & year of study)	Model	Period	Country	Key variables	Findings
Harris (1996)	Regression analysis	November 8,9,14,15, 16,17,18: 1994	Paris and Canada	Price volatility and Trading volume	Significant positive effect between trading volume and price volatility inferring low levels of market depth
Kempf and Korn (1998)	Linearity test model	1993-1994	Germany	price logarithm and net order flow	• Significant movement in prices from sellers initiated trade than buyers initiated trades

					• lack of market depth in the German index market
Engle and Lange (2001)	Autoregression conditional model	1990 - 1991	USA	Price changes, trading volume and transaction sizes	• There were periods when prices stayed constant regardless of the trading volumes. However, there were periods where prices moved with trading volumes.
Brockman and Chung (2002)	Pooled cross-sectional and time-series regressions	May 1996 to August 1997	China	Price changes, trading volume	Market depth was significantly affected by the level of trading where prices fluctuated randomly
Choridia, Roll & Subrahmanyam (2003)	Panel regression	1989-1998	US	Price changes, trading volume	Significant positive price imbalance due to trading activities. This led to the conclusion of lower levels of market depth in the NYSE for that period
Pennings, Garcia & Marsh (2003)	Linear regressions and Dicky Fuller test	August to September 1995	Holland	Limit order volumes and price volatility	Lack of market depth revealed in the lag adjusted phase and restoring phase
Rahman, Krishnamurti and Lee (2005)	Vector autoregression	January to March 2000	US	Price changes and trading volume	High levels of market depth in the NYSE and lower levels in the NASDAQ because trading activities in the NYSE where non-informational
Frank and Garcia (2008)	Bayesian model	January to July 2005	USA	Trading volume at different time intervals and logarithm of prices	The Chicago mercantile exchange has levels of market depth because price movements were not directly observable

Pennings and Kuper (2009)	Linear regressions and Dicky Fuller test	August to September 1995	Holland	Limit order books, price volatility	Prices fell significantly due to limit order imbalance indicating lack of market depth revealed in the lag adjusted phase and restoring phase
Chueh et al. (2010)	VNET methodology	2001 to 2002	Taiwan	bid and ask spread, trading volume and trading size	• Bid and ask spread, trading volume and trading size are essential factors in determining market depth • Market reaction tends to be non-linear from the price duration depth
Boonvora chote and Lakmas (2016)	Generalised auto regression conditional Heteroscedasticity	2006 to 2012	Japan, China, Thailand and Singapore	Trading volume, open interest volumes and price changes	• Significant positive relationship between trading volume and price changes • Significant negative relationship between open interest and price changes
Bhattacha ry and Bhattacha ry (2018)	Spectral regression, Hurst Mandelbrot statistics and rescaled range statistics	2002 to 2016	India	trading volume, turnover rate and individual asset prices	• high levels of market depth in the Indian stock exchange • the index absorbed large market orders without significant price changes
Olbrys and Mursztyn (2019)	Regression analysis	2005 to 2015	Poland	Buyers and sellers initiated trades, asset prices.	• high level of market depth • buyers and sellers initiated trades of most large companies did not affect the asset prices
Pham et al. (2020)	Heterogeneous autoregression model	2007 to 2013		Trading volume	• Market depth tends to be high when market orders are less than limit orders • When the market orders are greater than the prevailing quoted order, market depth tends to be

					very low in the Australian market

Source: Author

4.5.2 Meta correlation analysis

A meta correlation analysis technique was employed to observe the extent to which trading volume affects price volatility. That is to say, the magnitude and effect size of trading volume on price. This was to investigate how the effect size of trading volume as described in the literature can adequately explain the movement in price fluctuation without considering other variables. In conducting this analysis, only studies with reported R square (R^2) values were used as some studies in the literature of market depth did not present their R^2 values. The table below presents a summary of the relevant studies.

Table 4.1.1. summary of R^2 analysis

Authors	Dependent variables	Independent variables	Sample size	R-square value
Harris (1996)	price volatility	Tick size	300	64.40%
Kempf and Korn (1999)	Price changes	Trading volume	18729	5%
Brockman and Chung (2002)	Price changes	Trading volume	645	41.5%
Choridia, Roll & Subrahmanyam (2003)	Price changes	Trading volume	2694	33.0%
Pennings, Garcia & Marsh (2003)	Price changes	Limit order imbalances	30000	9.9%
Chueh et al. (2010)	Price duration	Trading volume	5 contracts	64.3%
Boonvorachote and Lakmas (2016)	price volatility	Trading volume	4 contracts	1.7%
Pham et al. (2020)	price volatility	Trading volume	60	1.2%

Source: Author

A Kolmogorov-Smirnov Test was used to determine the R^2 normality distribution of the sample sizes under consideration. This test is used to evaluate the cumulative distribution of the actual data values to that of normal probabilities (Drezner, Turel & Zerom, 2008:2). In this study, the cumulative distribution of the R^2 values was compared to the theoretical normal distribution. This was done by comparing the difference between the actual and expected outcome to a critical value. The critical value was computed using the one-sample test in excel, and two hypotheses were analysed in order to determine whether the values R^2 from the selected sample are normally distributed. The hypothesis below was derived from the study of Arnastauskaite, Ruzgas & Braženas (2021:1).

H_o: The maximum value of the difference between the actual and expected value is less than the critical value; hence R^2 is normally distributed

H_1: The maximum value of the difference between the actual and expected value is greater than the critical value; hence R^2 is not normally distributed

The table below presents the output of the Kolmogorov-Smirnov Test.

Table 4.1.2 Kolmogorov-Smirnov Test results

R-square value	Cumulative	Expected	Rank	NORM.S.INV	Actual	Difference
64.40%	1	0.125	-0.125	-1.15034938	0.913159	1.038159
5%	2	0.25	0	-0.67448975	0.201234	0.201234
41.5%	3	0.375	0.125	-0.31863936	0.696097	0.571097
33.0%	4	0.5	0.25	0	0.578761	0.328761
9.9%	5	0.625	0.375	0.318639364	0.255934	0.119066
64.3%	6	0.75	0.5	0.67448975	0.912572	0.412572
1.7%	7	0.875	0.625	1.15034938	0.168982	0.456018
1.2%	8	1	0.75		0.164083	0.585917

Count	8
Mean	27.63%
Standard deviation	27.0%
Maximum	1.038159
Test statistics (5%, n=8)	0.45427

Although the sample size is small, the findings above indicates that R^2 is not normally distributed and trading volume accounts for minimal price variations. Therefore, the model

proposed by Black (1971) to investigate market depth may provide more insights into the market depth of equity securities.

4.6 Market tightness

The second indicator used in this study for exploring the market liquidity of the qualifying equity securities was market tightness. Market tightness in trading financial assets is the hidden cost of buying at the ask price and selling at the bid price, also known as the transaction cost (Wanzala *et al*., 2017:260). According to Salighehdar, Liu, Bozdog and Florescu (2017:2), market tightness refers to the ability to match trading demands at a low cost at the prevailing market price. Olbrys and Murstyn (2019:312) believe that market tightness is the transaction cost involved in trading an asset over a short period. For this study, market tightness is defined as the difference between the bid-ask spread known as the transaction and how it affects the security's market price (Sarr & Lybek, 2002:10). This definition of tightness seems to be more comprehensive and captures the relevant components of a tight market in relation to market liquidity (Sarr & Lybek, 2002:6). This is because the liquidity of equity securities is characterised by low transaction costs, which allows market participants to trade quickly with no significant effect on the market price (Ametefe, Devaney & Marcato, 2015:12). However, there is a considerable paucity of research in market tightness due to little empirical studies on this concept in South Africa, particularly how spreads are used to determine the liquidity of financial assets. To the best of the author's knowledge, two empirical studies have explored spreads concerning market liquidity in South Africa, mainly in the bond market.

A common observation made from the various definitions of market tightness was the low transaction cost. The question that arises is, what is a narrow spread that is characterised by low transaction costs? How do we quantify a narrow spread? What are the indicators of a liquid market with narrow spreads? According to Hayes (2019), investment practitioners and prior research has shown that ratio spreads to the lowest ask price in a tight market, indicating liquidity is generally less than 0.1% because of large market orders under the best bid and ask prices. These large orders create market pressures which cause the best bid price to move closer to the best offer prices causing a narrow spread and reducing the transaction cost (Ganti, 2020). Due to smaller spreads, the resulting effect will be insignificant on the price difference, creating more liquidity (Hayes, 2019). In an illiquid asset, large buy or sell trades signal some form of asymmetric information or private information from market participants, leading to the widening of spreads beyond the 0.1% margin (Vayanos & Wang, 2012:230). Also, spreads in illiquid securities are wider because the number of market orders under the buy and sell-side is significantly low, affecting the market price (Martins & Paulo, 2014:37). A large market order, in this case, drives prices away from their fundamental values and

increases transaction costs. When there is less interaction between market participants, competition between the best bid and ask prices is minimal.

Spreads are also good measures of financial market liquidity in financial assets because they indicate the market's ease of entry and exit (Angerer, Peter, Stoeckl, Wachter, Bank & Menichetti, 2018:212). Wide spreads indicated difficulty in exiting the market position because the best bid prices are further away from the best ask prices. The wider the spreads, the more difficult to exit without accumulating massive transaction costs. Most liquid stocks trade in thousands daily, while illiquid assets trade in hundreds. In addition to the abovementioned relevance of narrow spreads, the other benefits to market tightness as cited by Fox, Glosten & Rauterberg (2018:72) includes:

- There is a higher probability of executing a trade in an asset with high levels of market tightness and narrow spreads. This is because of numerous traders under the bid and asks prices which increases liquidity.
- Financial assets with narrow spreads attract most investors because of lower transaction costs.
- The risk of losses arising from vast price differences in securities is minimised in a financial tight asset.
- Market tightness enhances the option of opening simultaneous market positions, which increases trading activities and hence liquidity.
- Investors can follow a specific trading strategy when market tightness is evident in an asset due to lower volatility in price movements.
- Narrow spreads in financial securities offer transparency in future transaction costs. In this case, an investor can accurately predict and compare the cost involved in future trades.

From the abovementioned, it is clear that market liquidity in the context of transaction cost is a cost-based analysis. However, as already mentioned, very little research has been conducted on market tightness of securities and how it affects market liquidity. The current status below highlights a few studies that explored some of the concepts of market tightness.

4.6.1 A Review of prior studies on market tightness

In an outdated study, Mchinish and Wood (1992) analysed the dynamic behaviour of bid-ask spreads for six months in 1989 in the NYSE. The authors were interested in exploring the factors that account for the changes in spreads. Their study used four variables as perceived determinants: risk, activity of trading, and competition. The trading activity was characterised by the number of trades and shares per trade, while volatility measured risk. Using a linear regression model and time series minute by minute data, the authors found a significant

inverse relationship between bid-ask spreads and activity of trading, but a positive relationship was observed between the spreads and volatility. In addition, greater competition between market participants narrowed the spread. The authors concluded that market structures should be designed accordingly to incorporate the factors that will maximise spreads.

A year later and still in the USA, George and Longstaff (1993) examined the distribution of bid-ask spreads across the S&P 100 index options market. Their study aimed to investigate if narrow spreads, a characteristic of the S&P index, could predict the marginal cost of liquidity. Their study also examined the relationship between spreads and trading activities in the options markets. This was an attempt to compare spreads across different markets to ascertain which market had the highest transaction cost. The authors used bid-ask market data for all S&P 100 index options in 1989 and trading volumes of 10 contracts. The regression results indicated that 70% of variations in spread accounts for the marginal cost of liquidity while 50% of variations in spreads resulted from the level of trading activities, which was negatively correlated. Thus, the authors concluded that spreads affect the market marking activities of the options index.

In another study conducted in the 90s, Kim and Ogden (1997) invested the determinants of bid-ask spreads on the NYSE. Their study aimed to test the validity of the proposition by George et al. (1991) that adverse selection and order processing costs are the main determinants of spreads and are constant over time. However, Kim and Ogden (1997) felt that this theory is biased and unreliable because there are three types of market players: market makers, informed traders, and liquidity providers. To investigate this proposition, the authors used all quoted bid-ask spread data on the NYSE for 1993. In addition, they used a cross-sectional regression to model the spread behaviour and the correlation with trade frequency, order sizes, volatility and market value. The findings of their study revealed that adverse selection accounted for 50% in the movement of spreads and changes with different market conditions. Also, the firm's order size and market value were positively correlated to spreads, while a negative correlation was observed between the firm value and the spread.

In the same year, Huang and Stoll (1997) also investigated bid-ask spread components in the NYSE. In conducting this study, the objectives were to construct a basic model to reconcile spreads and determine the spreads' components. The authors believed that previous research on determinants of bid-ask spread was too simplistic and did not incorporate lag structures. Therefore, Huang and Stoll (1997) used a generalised method of moments (GMM) to analyse and sample data of 20 stocks for the 1992 calendar year. Using trade sizes and trading pressures, market prices, and bid-ask spread as the study variables, the findings of the study revealed that the primary determinant of spreads is the order processing cost which accounted

for more than 68%: adverse selection and inventory holding cost where evident but accounted for a small proportion of spreads.

In a later study, Saleemi (2014) empirically investigated the cost-based market liquidity measures in the US and Norwegian banks. This study aimed to estimate the spread in financial assets held by banks, especially during financial crises, to determine if wider spreads were among the issues many banks experienced during the financial crises. The author used a sample of 17 banks from the US and three banks from Norway with high low prices (proxies for spread) from 2003 to 2013. Using descriptive and regression analysis, the author found a substantial variation in bid-ask spread over time in both markets. The spreads widened during the financial crises. Saleemi (2014) concluded that the widening of spreads during the financial crises led to significant losses for banks.

Also, in the same year, Armitage, Brzeszczynski & Serdyuk (2014) studied the efficiency of market tightness in the Ukraine stock exchange. In particular, Armitage et al. (2014) believe that the cost of trading characterised by lower bid-ask spreads is crucial to institutional investors because it affects access to capital in any market. In so doing, the authors examined the liquidity and trading cost in the Ukraine market over two years (from 2005 to 2006) using 56 stocks. In addition, the authors estimated the impact of bid-ask trading quantities, market prices, time of trade and trading frequency on the best bid and ask prices. Using a time series, cross-sectional, ranking correlation, and ordinary least squares estimates, the findings revealed higher trading costs in the Ukraine market than in most developed markets. This was evident in the higher proportion of no-trading activities and a significant impact of price volatility and trading quantities on the spreads.

In a German study, Angerer et al. (2018) explored the predictable patterns of bid-ask spreads of high-frequency data for liquidity traders in the Xetra index in Germany. Angerer et al. (2018) was directed to discretionary traders whom they believe are the leading market and liquidity providers. These traders will increase the market activities hence liquidity where they perceived savings related to bid and ask spreads. The sample consisted of bid and ask prices of 1226 stocks listed on the exchange from 2002 to 2009. The authors used the mean, median and regression coefficients as the method of analysis. As a result, it was revealed that spreads in the Xetra index could be predicted, and there is some form of cost savings for discretionary traders. However, this was based on the assumption of sufficient market depth to allow traders to list their quotes and execute the trade without significant price changes.

Bhattacharya and Bhattacharya (2018) also investigated the predictability of liquidity in the Bombay stock exchange in India. The authors believe predicting market tightness is an essential aspect of active portfolio management for order execution with minimal price impact.

Bhattacharya and Bhattacharya (2018) used a sample of 500 stocks listed on the exchange and Augmented Dickey-Fuller test, Phillips Perron test and a spectral regression to achieve the aim of their study. Using bid-ask spreads, turnover rate and trading volume, the findings revealed a low transaction cost and predictability of liquidity in the exchange.

Similarly, Olbrys and Mursztyn (2019) empirically analysed relative spread calculated as the ratio of the difference between the best bids and ask prices to the sum of the best bid and ask prices as a measure of market tightness of the Warsaw exchange. The authors used a sample of 53 firms listed on the index from 2005 to 2015. The findings of the study indicated a low level of market tightness among the sample stocks. This was seen in the empirical regression results as the relative spread for most assets showed lower coefficients and lower estimators. A summary of the above studies is highlighted below.

Table 4.2. Summary of key findings on market tightness

Study (Author & year of study)	Model	Period	Country	Key variables	Findings
Mchinish and Wood (1992)	Linear regression model	1989	USA	number of trades, the number of shares per trade, volatility and bid-ask spread	• Significant inverse relationship between bid-ask spreads and activity of trading • Positive relationship was observed between the spreads and volatility. • Greater competition between market participants narrowed the spread.
George and Longstaff (1993)	Regression analysis	1989	USA	Bid-ask spread and trading volume	• 70% of variations in spread accounts for the marginal cost of liquidity. • 50% of variations in spreads resulted from the level of trading activities, which was negatively correlated. • The authors concluded that spreads affect the

					market marking activities of option index.
Kim and Ogden (1997)	Cross-sectional regression to model	January 2002 (22 trading days)	USA	Spread, trade frequency, order sizes, volatility and market value	• Adverse selection accounted for 50% in movement of spreads and changes with different market conditions. • Order size and market value of the firm was positively correlated to spreads while a negative correlation.
Huang and Stoll (1997)	Generalised method of moment	1992	USA	trade sizes, trading pressures, market prices and bid-ask spread	• The primary determinant of spreads is order processing cost which accounted for more than 68%. • Adverse selection and inventory holding cost were evident but accounted for a small proportion of spreads
Saleemi (2014)	Descriptive and regression analysis	2003 to 2013	USA and Norway	High-low prices of bid and ask spread	• Variation in bid-ask spread over time in both markets. • The spreads widened during the financial crises. • Widening of spreads during the financial crises led to significant losses for banks
Armitage et al. (2014)	Cross-sectional, ranking correlation and ordinary least squares	2005 to 2006	Ukraine	Bid-ask trading quantities, market prices, time of trade, trading frequency and the best bid-ask prices.	• Higher trading cost in the Ukraine market as compared to most developed markets. • Higher proportion of no-trading activities and a significant impact of price volatility and trading quantities on spreads

Angerer et al. (2018)	mean, median and regression coefficients	2002 to 2009	Germany	Bid-ask prices	• Spreads in the Xetra index can be predicted, and there is some form of cost savings for discretionary traders.
Bhattacharya and Bhattacharya (2018)	Augmented Dickey-Fuller test, Phillips Perron test and a spectral regression	N/A	India	Bid-ask spreads, turnover rate and trading volume	• low transaction cost • Predictability of liquidity in the exchange due to low market tightness.
Olbrys and Mursztyn (2019)	Regression analysis	2005 to 2015	Poland	The ratio of the difference between the best bids and ask prices to the sum of the best bid and ask prices	• The relative spread for most assets showed lower coefficients and lower estimators • Low levels of market tightness.

Source: Author

4.7 Market resilience

The third concept of financial market liquidity to be investigated in this study is market resilience. The market resilience of an asset refers to how the prices adjust quickly to significant order imbalance or uninformative shocks (Dániel & Kata, 2015:6). According to Wanzala *et al*. (2017:4), market resilience is the elasticity between marginal price changes and trading volumes. Thomas (2006:3457) ascertains that market resilience is the ability of the financial asset to revert quickly to its fundamental values despite market shocks. From, above definitions, it is evident that the concept of market resilience is closely related to market depth in the sense that large market orders can create order imbalances. Of essence, market resilience is the speed with which market prices return to their fundamental values or price recovery mechanism and equilibrium prices (Dániel & Kata, 2015:6). Prior literature (Wanzala *et al*., 2017; Bogdan *et al*., 2012; Thomas, 2006) has recorded several uninformative shocks that can trigger market prices to fall. Among these conditions, the most common market shocks are large market orders, political instability and unfavourable monetary policy changes. These market shocks can cause instability which swings the market prices and results in liquidity spillover across assets (Kirilenko, Kyle, Samadi & Tuzun, 2017:998). These spillovers are evident and well recorded in the South African bond and equity markets due to the presence

of asymmetry information (Kapingura & Ikhide, 2011:7). These spillovers can cause uncertainty about an asset's fundamental value, and market participants may find it challenging to observe signals from falling prices (Xu, Taylor & Lu, 2018:11). Also, these market anomalies in the South African markets was due to cash setbacks in certain investment assets because of unfavourable market conditions (Kapingura & Ikhide, 2011:10).

The concept of market resilience is an integral component of financial market liquidity because it partly addresses the issue of pricing errors and price changes. These pricing errors have been found to be drivers of price volatility and increase in trading cost, which causes substantial risk to market participants (Lee, 2015:35). However, despite the pricing errors from new information or market shocks which drive market prices, the principle of a resilient market relies on market efficiency for prices to adjust to equilibrium levels (Carrion, 2013:698). This means that market participants can rely on the quoted prices on the exchange and trade with the knowledge that they are getting the best prices as any other market participant (Degryse, De Jong & Kervel 2015:1589). Therefore, a standardised order from a single trader is treated the same as one hundred standardised orders from institutionalised traders as they will either pay or receive the same prices for their contracts (Gomber, Schweickert & Theissen, 2015:57). This open market mechanism means that all available information has been assimilated into the current asset price.

Market resilience also creates an efficiency pricing mechanism through competitive actions necessary for trading. According to Gray (2013:802), market resilience is a vital concept embedded in the macro-prudential paradigm of financial market liquidity. Regulators can build a system and institutional framework through a resilient financial system. According to Hendershott and Seasholes (2014:143), market resilience is an anecdotal concept that partly fosters liquidity access underpinned by a robust financial market. This predictable access to liquidity paves the way for desirable investing and risk transfer. Due to the vulnerability of financial markets, prices cannot be perfectly predictable, but resilience in financial markets can absorb excessive pressures from market shocks, causing prices to adjust quickly to their fundamental values. Therefore, the ratio of the long term variance and the short term variance sum should be equal to or close to one.

The concept of market resilience is partly rooted in the efficient capital market theory. An efficient market is defined as a capital market in which asset prices adjust quickly to new information (Hendershott & Seasholes, 2014:149). This implies that the asset prices reflect all information, whether private or public. In this case, rational investors will be willing to trade on the present value of future asset prices. Informational efficiency is based on three principles: competition for profits, low cost of transaction, and readily available information (Clapham,

Haferkom & Zimmermann, 2020:938). If investors perceive the value of an asset to be higher in the future, competitive traders with a low cost to access the market will purchase the asset today in anticipation of future profit when the value increases (Istianingsih & Manurung, 2020:8). Considering the efficient market theory, the idea of future increase in asset prices and the competition to purchase the asset will be quickly incorporated into the asset's price (Sinclair & Keller, 2014:289). According to Wanzala *et al*. (2017:5), market resilience of an asset is essential for several reasons, these include:

- A resilient asset mitigates liquidity shocks and reduces the probability of destabilising liquidity cycles.
- Market resilient assets improve market liquidity by stabilising the procyclical trend of financial systems.
- A resilient asset causes market liquidity to be less fragile, reducing the probability of disruptions in the financial system.
- Financial market resilience in assets promotes competitive capital markets and proper allocation of risk
- Market resilience in an asset also provides investors with predictable access to liquidity.
- Finally, resilient assets assist in effective monetary policy transmission through adjusting quickly to these new policy changes.

Market resilience index (MRI) was used by Rose and Krausmann (2013) to measure resilience in the US market stock market. The MRI measures the slope of the price changes from uninformative shocks. It is a function of market price movements and return changes in the index driven by price movements. However, empirical studies on market resilience used alternative methods to investigate resilience. The prior studies are highlighted below

4.7.1 A Review of prior studies on market resilience

The findings of the current literature indicate mixed findings on market resilience. This empirical research on market resilience was conducted in different parts of the world. Among those studies, Coppejans et al. (2004) analysed the stochastic dynamics of market resilience and its effect on volatility in the Swedish stock index futures market. Coppejans et al. (2004) believe that the presence of resilience in the market facilitates low cost and rapid trading. The authors used data from July 1995 to February 1996 (7 months) and a structural vector autoregression model to examine the relationship between price changes with the arrival of new information measured by volatility. Their findings indicated that price changes occur with the arrival of new

information, but these changes quickly dissipate, indicating the high levels of market resilience of securities listed on the Swedish market.

Thomas (2006) empirically investigated the market resilience of the Indian security market and the bond market. Thomas (2006) used monthly time series data from 1998 to 2005 for adjusted closing prices and turnover to investigate market resilience. The adjusted closing prices was the dependent variable, while turnover and interest rate were the independent variables. A Granger causality test with 12 lags was used as the unit of analysis. Thomas' (2006) study revealed a lack of resilience in the bond market compared to the equity markets. This was as a result of continuous positive price changes to turnover and interest rates. On the other hand, the findings also revealed strong resilience for the equity securities. However, the study was conducted in 2006, and its findings are outdated.

In a United Kingdom study, Large (2007) evaluated the market resilience by modelling Barclay equity security listed in the London stock exchange using a sample of more than 5000 shares of the asset in January 2002 (22 trading days). Large (2007) believes that market resilience in the context of smooth price recovery is difficult to observe directly, which has been noted by many other economists. The author also noted that resilience should be framed according to how fast uninformative market shocks impact the price of an asset and the frequency of occurrence. Large (2007) used a multivariate continuous point process to examine market resilience in the limit order books. In his study, the magnitude of trade, delay in replenishing the limit order books and the direction of trades were used as indicators of resilience and measured the effect on the bid-ask spread. The study's findings revealed that the market price of Barclay shares returned to the bid-ask price frequently but at a slower rate, concluding the presence of moderate levels of resilience.

In an American study, Dong *et al*. (2007) explored the NYSE's market resilience of stock price returns. Their study aimed to analyse the speed with which prices return to their fundamental values from uninformative shocks from large market orders. The authors believe that investors face greater risk when asset prices lack resilience emanating from pricing error resulting from competitive actions. To investigate this effect, Dong et al. (2007) used trading volume, standard deviations, daily price levels and relative spreads of 100 stocks listed on the NYSE from 2000 to 2001. As a method of analysis, the study made use of correlation analysis and a regression test. The study's findings revealed that resilience was not directly evident in the asset price returns and was found to be varying in the NYSE.

In a German study, Chlistalla (2012) investigated the market resilience of order-driven markets by exploring the time path of exogenous shocks in the French blue-chip index. Exogenous shocks were large market orders that originated from market participants. Chlistalla (2012)

believes that market fragmentation that limits resilience results from the absence of order interaction through a single mechanism. Chlistalla (2012) used the ten highest bid prices and ten lowest ask prices from the limit order book and extensive trading volumes. Using a Chi-X and a turquoise model and 15 stocks from 2009 to 2010, the author found severe adverse effects of large trades on market prices. However, despite the negative effect, the French blue-chip index showed a high level of resilience. This was revealed in the study when the sample asset prices of the securities returned to normal after a three-minute time frame. Thus, the author concluded that securities listed on the French blue-chip index possess high levels of resilience.

In a later study, Bhattacharya, Bhattacharya & Basu (2019) tested the dynamics of market resilience through price recovery from exogenous shocks in the Indian stock exchange. Bhattacharya & Basu (2019) believe that market liquidity relies on resilience because of its perceived ability to foster investment plans and trading activities. In their study, Bhattacharya, Bhattacharya & Basu (2019) used monthly time series data of price volatility, spreads, and trading days as independent and dependent variables. In addition, the authors used a sample period from 2002 to 2016, a robust artificial neural network and a random forest model to investigate resilience. The authors estimated the impact of execution cost on price volatility in the National and Bombay stock exchange in India using the market efficiency coefficient (MEC). Their findings revealed resilience variability in both exchanges shown in the continuous fluctuations of MEC above and below the sample period. The authors also found that prices adjust slowly and incrementally to new information in the market and concluded that the level of market resilience in both exchanges, especially in the Bombay stock exchange, was deficient.

In a similar study, Wanzala *et al*. (2017) empirically investigated the level of market resilience in the Kenyan market. Another aim of the study was to determine if market resilience was a predictor of economic growth and whether interest rate and risk premium were determinants of market resilience. The authors believe that market resilience is an integral aspect of financial stability and provides direct access to liquidity for investors. This study was motivated by a lack of sustainable economic growth in the Kenyan economy in which market resilience was perceived to be one of the inhibiting factors. Wanzala *et al.* (2017) used 10-year data from 2006 to 2015 and a sagacious moderating regression analysis to explore resilience in the Nairobi stock exchange (NSE). Using absolute price changes, trading volume, the total number of shares and a sample of 33 stocks, the authors found low levels of market resilience in the NSE. Their study also revealed that market resilience was low and is a predictor of economic growth. However, despite the relevance of this study, its findings did not explicitly indicate the price recovery levels and the variance ratio.

Similarly, Olbrys and Mursztyn (2019) empirically analysed the market resilience of the Warsaw exchange as a dimension of market liquidity. The authors used a sample of 53 firms listed on the index from 2005 to 2015. The findings of the study indicate a high level of market resilience among the sample stocks. This was seen in the empirical regression results as the real spread measure by the difference between bid-ask prices for most assets showed positive price reversals.

In the same year, Hua *et al*. (2019) also investigated market resilience and its relationship with the expected stock return. The authors evaluated market shocks on price reversal from 1993 to 2004 on the NYSE and the NASDAQ for all equity securities traded on the index. Hua *et al*. (2019) believe that persistent liquidity shocks without appropriate price recoveries dry up liquidity and cause transitionary price shifts. The authors used a covariance matrix, regression, univariate and bivariate analysis between daily returns, bid-ask spread, and large market orders. The authors found a significant degree of non-resilience among the securities traded. However, this study was conducted in the USA. Thus, its findings may not be relevant to the South African market.

Similarly, Kim and Kim (2019) evaluated the transitionary price frequency of all stocks listed on the NYSE, AMEX and the NASDAQ from 1964 to 2013. The purpose of the study was to determine recovery cycles from transitionary price movements in the market. Kim and Kim (2019) believe that deviations from the mean distribution correlate with the mean reversing speed of transitionary prices. The authors used a spectra analysis to investigate the components of transitionary prices that are affected by uninformative shocks caused. Using trading volumes, market capitalisation and the natural logarithm of prices, the authors found that assets with low resilience had high illiquidity premiums and financial market liquidity compliments resilience. However, Kim and Kim (2019) study did not investigate how the index reacts to new information or large trading orders and how the market prices of the assets react to these changes. Also, the study was conducted in the US, and its findings may not be generalisable to the South African markets.

In another German study, Clapham *et al*. (2020) investigated the market resilience of the DAX index using a sample of 30 stocks. This was achieved by exploring the effects of liquidity shocks on limit order books. The authors believe that limiting order book resilience is critical to market participants using different strategies to accomplish their goals. To mitigate the price impact effect, limited order books should absorb sudden market shocks quickly and in an efficient manner. To analyse this effect, the authors used data spanning ten trading days from August to September 2009. Using buyers, sellers and high-frequency trades, and descriptive and regression analyses, the study revealed strong resilience in high-frequency trading in

which market prices are restored within a very short period. The authors concluded that market resilience is an essential component of liquidity demands.

In an African study, Hmaied *et al*. (2006) analysed the dynamics of market liquidity resilience in the Tunisian stock exchange. In particular, Hmaied *et al*. (2006) explored the dynamic behaviour of market liquidity in the context of resilience. This interest originated from the continuous development of an automated trading system in the Tunisian stock exchange. The authors were interested in studying the effects of automated trades on market resilience, particularly how prices returned to their long-run equilibrium levels after market shocks. Their study used relative spread and trading volume to model market resilience and the changes in volatility (price changes) as a measure of market shock. Using a vector autoregressive model and a sample of 22 stocks from 2003 to 2004, the results of the study revealed a lack of market resilience among the sample stocks in the market index. This was evident in the time required to reach equilibrium. It took at least two hours to reach equilibrium compared to less than 5 minutes in developed indexes like NYSE and German blue-chip. The above studies cannot be generalised to South Africa. The table summarises the above studies.

Table 4.3. Summary of key findings on market resilience

Study (Author & year of study)	Model	Period	Country	Key variables	Findings
Coppejans *et al*. (2004)	Vector autoregression model	July 1995 to February 1996	Sweden	price changes and volatility as a measure of new information	• Price changes occur with the arrival of new information. • These changes quickly dissipate, indicating the high levels of market resilience the Swedish market
Hmaied *et al*. (2006)	Vector autoregressive model	2003 to 2004	Tunisia	Relative spread, trading volume and price changes (volatility)	• It took at least two hours to reach equilibrium compared to less than 5 minutes in developed indexes like NYSE and German blue-chip • Lack of market resilience among the

					sample stocks in the market index
Thomas (2006)	Granger causality test	1998 to 2005	India	adjusted closing prices, turnover volume and interest rates	• Continuous positive price changes to turnover and interest rates • lack of resilience in the bond market • Strong resilience in the equity market
Jeremy (2006)	Multivariate continuous point process	January 2002 (22 trading days)	United Kingdom	Bid-ask spread, magnitude of trade, delay in replenishing the limit order books and the direction of trades	• The market price of Barclay shares returned to the bid and ask price frequently but at a slower rate. • Concluding moderate levels of resilience.
Dong *et al*. (2007)	Correlation analysis and a regression test	2000-2001	USA	trading volume, standard deviations, daily price levels and relative spreads	Resilience was not directly evident in the asset price returns and was found to be varying in the NYSE
Chlistalla (2012)	Chi-X and a turquoise model	2009 to 2010	Germany	10 highest bid prices and 10 lowest ask prices from the limit order book as well as large trading volumes	• Prices of the securities returned to normal after a three minutes time frame. • Securities listed on the French blue-chip index possess high levels of resilience.

Bhattacharya *et al.* (2019)	Artificial neural network and random forest model	2002 to 2016	India	Price volatility, spreads, and trading days.	• Resilience variability in the exchange shown in the continuous fluctuations • prices adjust slowly and incrementally to new information in the market and concluded that the level of market resilience
Wanzala *et al*. (2017)	Sagacious moderating regression analysis	2006 to 2015	Kenya	Absolute price changes, trading volume, total number of shares	• Low levels of market resilience in the NSE. • market resilience was low and is a predictor of economic growth
Olbrys and Mursztyn (2019)	Regression analysis	2005 to 2015	Poland	Buyers and sellers initiated trades, asset prices.	• High level of market resilience • Bid-ask prices for most assets showed positive price reversals.
Hua *et al*. (2019)	Covariance matrix, regression, univariate and bivariate analysis	1993 to 2004	USA	Daily returns, bid-ask spread and large market orders	• large degree of non-resilience among the securities traded
Kim and Kim (2019)	Spectra analysis	1964 to 2013	USA	Trading volumes, market capitalisation and the natural logarithm of prices	• Assets with low resilience had high illiquidity premiums, and resilience compliments financial market liquidity
Clapham *et al*. (2020)	Descriptive and regression analyses	August to September 2009	Germany	buyers, sellers and high-frequency trades, price impact ratio	• Strong resilience in high-frequency trading in which market prices are restored within a very short period.

Source: Author

4.8 Gaps in literature

Despite the relevance of the abovementioned studies, they were conducted in other parts of the world (Europe, America and Asia) and therefore may not apply to South African. The South African study examined the bond market liquidity using price volatility but did not evaluate the bond or equity market's tightness. In addition, the context of the study was not related to LCR or NSFR. From the review of prior literature, the following gaps are identified;

- The concept of market depth was not well investigated as the R^2 could not correctly account for the variations in price movements, hence applying the price continuity theory using multiple variables may provide more insights.
- Almost all the studies were conducted in Europe, America and Asian financial markets. Therefore, their findings may not apply to the South African market.
- Out of the four African studies, two studies were conducted in less developed markets in Tunisia and Kenya, and thus their findings may not apply to South Africa.
- A number of the studies have been published for more than ten years and are outdated. Therefore, their findings may not be relevant.
- None of the studies examined the financial market liquidity of the level 2B common equity securities with respect to LCR and NSFR securities.
- None of the studies examined whether the LCR and NSFR needs to be improved in the respective markets
- The South African studies did not consider LCR and NSFR as highlighted in section 3.5; therefore, their findings are irrelevant to the current study.

Considering the abovementioned limitations and gaps in the current literature on financial market liquidity, there is a need for an empirical study such as this one. Therefore, this study seeks to unveil the market liquidity of the level 2B common equity securities in the South African context and determine whether the current LCR and NSFR need adjustment.

Therefore, the following research questions are still unanswered;

- What is the market depth position of level 2B common equity securities in the South African financial markets?
- What is the market tightness position of level 2B common equity securities in the South African financial markets?

- What is the South African financial markets' market resilience position of level 2B common equity securities?
- From the above questions, what will determine an adequate LCR?
- From the above question, what will determine an adequate NSFR?

4.9 SUMMARY AND CONCLUSION

This chapter described and summarised prior literature on financial market liquidity. Specifically, the chapter presented the definitions, trends, and relevance of market liquidity and the different themes of the concept. The chapter proceeded with a review of the three themes that constituted market liquidity, namely market depth, market tightness and market resilience. Market depth refers to the order size required to change the price of a security and there are several benefits for a security to exhibit market depth including a reduction in hedging and trading cost. A meta-analysis of market depth indicates that there may be potentially more variables that could explain price changes in equity securities. Market tightness is based on the transaction cost which is the hidden cost of buying at the ask price and selling at the bid price. Some of the benefits for an equity security to possess market tightness includes, higher probability of executing a trade and minimising the risk of losses arising from vast price differences. The review of prior literature on market tightness indicates a gap in the South African market in this area. The chapter the concluded with market resilience which is the extent to which prices adjust quickly to significant order imbalance or uninformative shocks. Gaps in literature where also identified where it is evident that market liquidity is an evolving concept and research on this area has been extensively covered, but very little research has been done in the context of the BASEL framework, especially in South Africa. Therefore, the next chapter, which is the methodology, highlights the blueprint used to achieve the objectives.

CHAPTER 5

RESEARCH METHODOLOGY

5.1 Introduction

This chapter aims to describe the blueprint of the research process, and the justification for the research methods used in this study. This chapter also highlights the data collection and analysis process that was implemented.

This chapter begins with section 5.2 with the justification of the research design and paradigm. The following section (5.3) provides the research approach used, followed by section 5.4,

highlighting the data collection method variables used to analyse financial market liquidity. Sections 5.5 highlights the data analysis method and proceeds to section 5.6 and Section 5.7, which highlights the justifications of methodology and the conclusion and summary of the chapter.

5.2 Paradigm

The research problem was viewed through the lens of the positivist paradigm. According to Kawulich (2012:1), a paradigm is a particular worldview characterised by assumptions regarding the nature of social reality (ontology) and the nature of knowledge (epistemology). The features of a positivist paradigm influence the researcher's objectivity in investigating the research problem (Kawulich, 2012:2). The aim of the positivist is mainly to objectively gain an understanding of the phenomenon under study, which is detached from the researcher's views (Thanh & Thanh, 2015: 24). The primary pursuit of this phenomenon is rooted in objective epistemology, which suggests that realities can be observed and justified (Dammak, 2015:5).

Furthermore, in the positivist paradigm, the researcher adopts a non-participative, neutral and distant position, resulting in a more in-depth understanding of the phenomenon (Thanh & Thanh, 2015: 24). Another crucial principle in positivism is that the study phenomenon accurately measures the relationship between variables (Bogdan & Biklen, 1998, cited in Kivunja & Kuyini, 2017:33). In addition, the nexus of positivist emanates from the belief that well-founded, logical and reasonable knowledge can only be justified based on direct observations of collected data (Dammak, 2015: 5). Unswerving evidence is only valid when proven empirically (Crotty, 1998, cited in Cresswell, 2009).

Consequently, positivism postulates a great emphasis on quantitative analysis to understand the subjects' viewpoints under study considering that these assumptions, reality exists externally and objectively (Bogdan & Biklen, 1998, cited in Kivunja & Kuyini, 2017: 33). As already highlighted in the first chapter, this study investigates the financial market liquidity position of level 2B common equity securities for banks operating in South Africa. Therefore, a positivist paradigm is appropriate as this forms part of an objective experience. By understanding the market liquidity of banks, appropriate interventions can be developed. Regarding the epistemological assumptions of positivists, knowledge is only valid if it can be observed. That is to say, attitudes, thoughts and feelings cannot be regarded as objective attributes which are not mind-dependent and abandon the notion of subjective research (Wilis, 2007:10). Correspondingly, positivists do not value subjectivity, disregarding meanings and interpretations to data analysis (Pring, 2000, cited in Dammak, 2015; Willis, 2007, cited in Thanh & Thanh, 2015). Finally, the epistemological knowledge that emerges via positivists assumes that the interactions between variables must be observed, and conclusions should be based on the findings rather than the interactions between people that are co-constructed and interpreted (Haverkamp & Young, 2007:268). In this study, the epistemological knowledge will be based on the observed level of interdependence between the dependent and independent variables from which conclusions will be drawn.

5.3 Research Approach

This study made use of a quantitative approach to analyse the research questions. A quantitative approach was deemed relevant for this study as it assumes a dual role of testing ideas against data and getting ideas from the data (Chigbu, 2019:3). This dual principle is the crux of quantitative data analysis and the relative strength of empirical analysis (Chigbu, 2019:4). The hypothesis developed was tested against the panel data collected from Bloomberg and Yahoo finance and Ycharts in order not to rely on ad hoc justification and subjective views but rather factual analysis. Also, important trends from the panel data, such as causality, were observed to provide meaningful analysis. Furthermore, conceptualising the

research problem in section 1.4 requires a quantitative approach to unpack the arguments and scrutinise the problem.

Also, a quantitative approach is closely linked with the positivist paradigm as positivists recognise that the research problem may also occur in a social context and therefore appropriate to state that the most fitting way to make sense of social problems is through numbers and meticulous statistical tests (Gichuru, 2017:2). In this approach, the researcher aims to get insightful and thorough information through facts from analysis (Thanh & Thanh, 2015:33). Thus, a quantitative methodology enables positivists to comprehensively understand the research problem in the relevant context (Thanh & Thanh, 2015:34). In addition, this approach resonates with positivism as quantitative methods allow the researcher to adequately grasp the relationship between cause and effect.

Regarding the current research problem, which investigates the market depth, market tightness and market resilience, the research approach and paradigm cannot be separated from the social context that gives rise to the abovementioned problem. Furthermore, the complexities of the context in which it is perceived show a lack of financial market liquidity, and banks may find it difficult to trade their level 2B common equity securities at fundamental values (Schmitz & Hesse, 2014; IMF, 2013). Finally, the researcher will use a quantitative methodology to uncover the financial market liquidity of level 2B common equities in South Africa.

5.3.1 Research design

A research design is a strategy used as a blueprint to logically and systematically integrate the different components to achieve the aims (Faryadi, 2019:769). In other words, a research design is an action plan to logically blend the data collection process and analysis to meet the research objectives (Akhtar, 2016:68). Silvia (2017:2) believes that research design coherently glues the different components of a study to arrive at a logical conclusion. A correlational research design will be used to test the existing theoretical underpinnings of financial market liquidity themes highlighted in section 1.4.4. The significance of market liquidity theories is the concession of the importance of liquidity management in banks. The three leading indicators, which are market depth, market tightness and market resilience, will be used to estimate the liquidity of the designated common equity securities. Analysing the market liquidity of level 2B common equity securities for commercial banks in South Africa requires a research design approach rooted in quantitative epistemology. The nature of the research questions and the hypothesis does not require subjective inputs. To this end, a correlational research design is suitable when a study aims to identify trends, estimate correlations and identify relationships between variables such as this study.

Correlational design studies are usually exploratory, where the researcher seeks to investigate and observe the relationship between the dependent and independent variables and the strength of the relationship, if any (Van Wyk, 2012). This type of research design portrays a vivid and accurate representation of variables pertaining to the research questions. Correlational designs do not involve manipulating variables using scientific methodology to confirm or disagree with the hypothesis (Bhattacharjee, 2012:35). In its simplest form, the design approach observes and estimates the relationship between variables without subjecting them to external conditions. Although this type of research design is backwards-looking and investigates the historical relationships which can cease to exist at any time, a static model was used to investigate the patterns and relationships between the variables. Therefore, a correlational research design was suitable and used in this study to achieve the aims and objectives.

5.3.2 Population, sample and sampling

The population of this study consist of all possible level 2B common equity securities for all the commercial banks operating in South Africa. There are currently 13 banks registered to operate in South Africa and trade on the JSE (SARB, 2022). In addition to this, there are three mutual banks, three co-operative banks, 15 local branches of co-operatives, and 31 foreign banks with local representative's offices. A table of the list of banks operating in South Africa is shown below.

Table 5.1. Registered Banks in South Africa as of July 2021

Institution	Value of assets as at July 2021	Ranking
Standard bank	~ R1550 billion	1
FirstRand Limited	~ R1400 billion	2
Absa bank	~R1260 billion	3
Nedbank	~ R 1110 billion	4
Investec Bank	~ R490 billion	5
Capitec Bank	~ R150 billion	6
Discovery Bank Limited	~ R12 billion	7
Tyme Bank Limited	~ R2 billion	8
other Banks	~ R480 billion	

Source: Writer (2021)

Considering the specific types of assets that need to meet the criteria for level 2B common equity shares, it is important to define the population boundaries so that the study remains focused. Firstly, this study only used the common equity securities that meet the criteria defined by the BCBS (2010:27) that qualifies for HQLA. This is necessary because the required data needed can be easily accessible. Also, the level 2B common equity securities that have been trading for a minimum of 5 years will be considered in this study as the needed data falls within the required sampling period and also considering the implementation time frame of the LCR and NSFR, which was in 2014 (BIS, 2015:4). These specific registrations and operational time boundaries were set as pro-market liquidity characteristics associated with the Basel III framework highlighted in chapter 3. Within the parameters of the population, researchers usually select samples suitable for data collection, which is known as sampling. This is to achieve the aims and objectives of the study by selecting the needed information by virtue of specific characteristics regarding the phenomenon of interest (Etikan, 2016). In this study, a stratified random sampling technique was used to select specific level 2B common equity securities in accordance with the characteristics of HQLA. This sampling technique is used when the population is heterogeneous, and certain homogenous groups can be separated based on specific parameters (Shi, 2014:3). The first step was to classify the population according to the characteristics indicated in section 3.5.1. the sampling frame was then established, which was from May 2016 to May 2021. A stratified sampling technique was used because not all common equity securities are a good representation of the specific securities that adheres to the BASEL III framework.

5.4 Data collection method

As already indicated, the required data was retrieved from Bloomberg and Yahoo Finance, which are databases. These information sites provide reliable financial information ranging from but not limited to share prices, trading information and trading frequencies, bid-ask prices. Bloomberg and Yahoo Finance currently have the financial information of more than 35000 (Wang, Li & Anupindi, 2015), and these data sites have all the necessary information pertaining to financial market liquidity required for this study.

The data collection phase began with applying and confirming an ethics clearance certificate from the Higher Degree Committee (HDC) at the Cape Peninsula University of Technology. The researcher first identified the standard equity securities trading on the JSE that qualify to be included in the level 2B as highlighted in chapter 3, section 2.6.1. The specific characteristics to be considered where;

- Ease and certainty of valuation.
- Low correlation with risky assets.
- Listed on recognised exchange.
- Market size and trading frequency.
- Low volatility.
- Low credit and market risk.

Although most banks could not disclose their specific equity securities used for the LCR, the researcher did an extensive investigation. According to BCBS (2010:13), ease and certainty of valuation depict the extent to which the information necessary for valuing security is readily available. In this study, audited financial statements and other financial market information from reliable sites such as Bloomberg and yahoo finance were easily retrieved for all the level 2B common equities used in this study. This information is widely used to provide an objective valuation with little or no assumptions.

The requirement of low correlation with risky assets seeks to ensure that the prices of HQLA do not move in the same magnitude as risky assets or portfolios. In meeting the low-risk requirement, HQLA should provide sound risk reduction benefits in minimising volatility and was measured based on the extent to which the returns fluctuate. Volatilities and correlations were calculated on excel using the *std.s* function and was based on the formula below;

Standard deviation = $\sqrt{\frac{\sum(X-u)^2}{N}}$

Where x is the return of security and u is the average return of the security

A correlation coefficient was computed between the selected level 2B common equity and a sample of three risky assets. The first table highlights the volatility of the sample 3 securities and then proceeds with the correlation between the securities. The correlation between the stocks was calculated by first computing the daily returns and then estimating the linear relationship between the securities.

Table 5.2. Volatility of risky assets and the market

Code	**Security monthly Volatility**	**Market (JSE Index) monthly Volatility**	**Monthly difference**
CMO	10.61%	2.22%	8.39%
BEL	7.82%	2.22%	5.60%
SNH	8.60%	2.22%	6.38%

Source: Author

Table 5.3. Correlation between level 2B common equity and risky assets from 2016-2021

CODE	CMO	BEL	SNH
ABG	2.44%	-1.16%	-3.20%
AFE	2.92%	-0.31%	-5.48%
AGL	-3.36%	1.21%	0.22%
ANG	4.17%	-2.34%	0.09%
APN	0.74%	-0.93%	-2.03%
AVI	-4.15%	3.56%	-4.31%
BAW	-3.67%	2.40%	0.59%
BHP	-1.11%	1.71%	-3.82%
BID	0.15%	-3.14%	-3.75%
BVT	0.41%	0.19%	-2.61%
BTI	-0.14%	-0.85%	0.20%
CLS	-1.46%	0.29%	-4.03%
CPI	-1.89%	-0.07%	-3.41%
DSY	1.25%	2.34%	0.16%
FSR	-0.86%	0.03%	-1.63%
GFI	6.04%	-0.43%	0.13%
GLN	-2.59%	3.37%	0.96%
HAR	6.92%	-3.09%	-0.56%
IMP	1.12%	-0.89%	-3.67%
INL	-4.23%	-1.61%	-1.44%
INP	-4.37%	0.21%	-1.40%
IPL	0.50%	1.06%	-4.64%
JBL	1.26%	-0.85%	2.75%
KAP	-0.47%	1.09%	0.55%
KIO	-1.59%	2.08%	-3.48%
LBH	1.05%	1.18%	-3.30%
LHC	1.45%	0.17%	-3.81%
MRP	3.09%	-1.62%	-0.98%
MSM	-2.36%	-0.28%	-0.65%
MTM	0.47%	1.83%	-2.43%
MTN	-6.17%	-2.29%	-1.62%
NED	-0.12%	0.97%	-2.31%
NHM	3.67%	1.51%	0.03%
NPN	-0.72%	-2.75%	0.42%
NTC	-1.14%	-3.62%	-5.50%

PIK	0.63%	2.88%	-3.27%
RBP	2.63%	3.06%	-0.15%
REM	0.69%	-1.53%	-3.48%
RMI	-2.48%	1.22%	1.87%
SAP	-0.40%	0.08%	-2.23%
SBK	-1.82%	-0.73%	-2.17%
SHP	-1.35%	0.26%	-4.12%
SLM	2.06%	-0.74%	1.50%
SNH	-0.41%	-0.18%	1.64%
SOL	-0.46%	-0.39%	-1.27%
SSW	4.81%	-1.57%	-4.87%
TFG	-1.04%	0.12%	-2.89%
TKG	3.12%	1.69%	-3.00%
TRU	-2.11%	-1.42%	-0.93%
VOD	-1.95%	-3.50%	-4.15%
WHL	2.44%	-1.16%	-3.20%

Source: Author

The correlation values between the level 2B HQLA common stock and risky assets are well below 7%, confirming the low correlation between the two sets of assets. As a norm, a correlation of 70% or higher is considered high and significant in the positive direction and vice versa (Reilly & Brown, 2003: 74; Schober, Boer & Schwarte, 2018:1765). Furthermore, the HQLA common equity securities selected in this study had the most significant market value and were the most traded as of the first of March 2021 as per the high-frequency data retrieved from the trading view (Trading view, 2021). Also, this site provided valuable information regarding high-frequency trading information useful for the purpose of this study. Regarding low volatility, a comparative volatility analysis was made between the level 2B HQLA common equities used in this study, the market and risky assets. The table below presents and highlights the analysis.

Table 5.4. Comparative volatility from 2016 -2021

CODE	**Security monthly Volatility**	**Market (JSE Index) monthly Volatility**	**Monthly difference**
ABG	3.21%	2.22%	0.99%
AFE	2.05%	2.22%	-0.16%
AGL	3.11%	2.22%	0.89%
ANG	2.17%	2.22%	-0.05%
APN	3.52%	2.22%	1.30%
AVI	2.13%	2.22%	-0.09%
BAW	3.28%	2.22%	1.06%

BHP	2.63%	2.22%	0.41%
BID	2.70%	2.22%	0.48%
BVT	2.74%	2.22%	0.52%
BTI	2.35%	2.22%	0.13%
CLS	2.54%	2.22%	0.33%
CPI	3.40%	2.22%	1.19%
DSY	3.10%	2.22%	0.88%
FSR	2.96%	2.22%	0.74%
GFI	2.51%	2.22%	0.29%
GLN	3.12%	2.22%	0.90%
HAR	2.91%	2.22%	0.70%
IMP	2.95%	2.22%	0.73%
INL	3.09%	2.22%	0.87%
INP	3.35%	2.22%	1.13%
IPL	3.79%	2.22%	1.57%
JBL	2.53%	2.22%	0.31%
KAP	2.30%	2.22%	0.09%
KIO	2.13%	2.22%	-0.09%
LBH	2.84%	2.22%	0.62%
LHC	2.88%	2.22%	0.66%
MRP	3.37%	2.22%	1.15%
MSM	3.93%	2.22%	1.71%
MTM	3.52%	2.22%	1.30%
MTN	3.84%	2.22%	1.63%
NED	3.36%	2.22%	1.14%
NHM	2.25%	2.22%	0.03%
NPN	2.75%	2.22%	0.53%
NTC	2.83%	2.22%	0.61%
PIK	2.55%	2.22%	0.34%
RBP	2.99%	2.22%	0.78%
REM	2.27%	2.22%	0.05%
RMI	2.60%	2.22%	0.38%
SAP	3.80%	2.22%	1.58%
SBK	2.95%	2.22%	0.73%
SHP	2.86%	2.22%	0.64%
SLM	2.81%	2.22%	0.59%
SNH	0.12%	2.22%	-2.10%
SOL	2.09%	2.22%	-0.13%
SSW	2.12%	2.22%	-0.10%
TFG	3.47%	2.22%	1.25%
TKG	3.97%	2.22%	1.76%
TRU	3.45%	2.22%	1.23%
VOD	2.12%	2.22%	-0.09%
WHL	2.88%	2.22%	0.66%

Source: author

The monthly volatility between the market unpredictability and the selected level 2B common equity differs by a small margin. The market's volatility is slightly lower than equity assets. In some cases, these assets had lower volatility than the JSE index. Comparing these values with the volatility values of the sample risky assets in table 5.4 shows that the selected level 2B common equity securities possess low volatility compared to the risky assets. In defining these specific parameters, it is clear that the common equities used in this study meet the requirements of liquid assets outlined in the BCBS (2013:3)

From the 60 levels, 2B HQLA common stock identified, 51 was used as a sample because nine equity shares did not have the required 5-year daily trading data (2016 – 2021). This resulted in an 85% representation of the total population. Once the specific common equity shares were identified, their specific codes were entered into the Bloomberg terminal to obtain the financial data. Bloomberg has a customised setting that allows the required data to be downloaded in excel. This function was activated on the top right-hand corner of the Bloomberg page. In addition to this, the Rand value function and export function was also activated. The researcher then navigated to the template page where the required variables were entered, and a customised report for each common equity share was generated. This process was repeated until all the data was retrieved.

However, not all the data was collected from Bloomberg; the number of shares outstanding was collected from Ycharts and Yahoo Finance. Logging to the websites, the specific codes for each common equity share was entered into the search button. The daily prices were collected for each security and were used to calculate the $ln\frac{P_1}{P_0}$ and Price effect.

5.4.1 Data Variables

As already mentioned, the required data needed for this study was retrieved from Yahoo Finance and Bloomberg databases. These data collection sites are viable, credible and provide reliable secondary data needed and have been widely used in other studies (Dicle & Levendis, 2011; Nayak, Pai & Pai, 2016; Borke, 2017; Xaba, 2017; Herzog, 2018; Weijden, 2020). In order to successfully gain an understanding of the research objectives, specific variables were used for market depth, tightness and resilience. These indicators were also used in the study of Kyle (1985); Bank, (2011); Olbrys & Mursztyn, (2019); Wanzala *et al.,* (2018); Saleemi, (2014); Goyenk, Holden & Trzcinka, (2009); Engle & Lange, (1997) to investigate market liquidity. A description of the dependent and independent variables highlighted in table 5.5 is described below.

$$DLR_1 = ln\frac{P_1}{P_0}$$

The first liquidity measure (DLR_1) that was used in this study is the logarithmic price scale. The price scale ($ln\frac{P_1}{P_0}$) is the log ratio of the closing price to that of the previous day and was also used in the study of Wanzala *et al*.,(2018); Vidovic, Poklepovic and Aljinovic (2014). The log price scale was regressed against the independent variables to measure the sensitivity of trading volume, buyer and seller initiated trade to price distribution changes. As already mentioned, liquid securities tend to be less sensitive to changes in trading activities. A significant positive relationship between the log of price scale and trading volume, buyer and seller initiated trade will indicate an illiquid asset (Black, 1971). This is because HQLA recognises the long term and short term price stability trends and the prices in these illiquid assets tend to move based on aggressions by market participants, which is in line with the notion that when there are more buyers than sellers. This is to say that the aptness of limit order books to suck up trading orders depends on the aggression of market participants. This measure will be used to measure market depth.

$$DLR_2 = \text{Price effect } (P_1 - P_0)$$

The second dependent liquidity ratio (DLR_2) is the price effect which is the difference between the closing prices (P1 – P0). According to Sueppel (2019), significant price changes due to TC and other market variables are critical determinants of financial market liquidity volatility. On the other hand, Santosa (2020:177) suggested that price effect is a better determinant of high-frequency trading and is free from size bias. Therefore, low financial market liquidity can cause a significant price effect because market participants trade off their positions at a significantly different market price. Conversely, a smaller price effect change indicates a high level of financial market stability and liquidity in the asset because of relatively constant prices. This sentiment was also echoed by Sueppel (2019), who pointed out that low market liquidity will precipitate significant changes in prices with respect to trading activities giving rise to liquidity premium. It is important to note that the two dependent variables are different. DLR_1 measures the distribution of returns from its mean while DLR_2 is the difference between prices measures changes in volatility with respect to transaction cost (Miskolczi, 2017:136)

Independent Variables

$$ILR_1 = TC$$

The first independent variable is the TC which is the difference between the bid price and ask price. TC is a standard measure of liquidity that represents the cost of trading (Patial & Sharma, 2016). The TC is also the highest price that the buyer is willing to pay minus the lowest price

a seller is willing to accept (Barardehi, Bernhardt & Davies, 2016). Therefore, the cost of executing a trade over a short period should be small with minimal effect on the market price for liquid financial assets (Sueppel, 2019). This is because low TC reinforces market dynamics, and market participants are under no selling pressures as the asset can be easily sold at its fundamental (Sueppel, 2019). Also, a wide TC may signal fewer bid or ask orders prevalent in an illiquid market (Barardehi, Bernhardt & Davies, 2016). This is considered essential to liquid assets and facilitates the functionality of a market. In this study, the cost of trading was considered for large orders and how it affects price distribution to reflect the financial market liquidity position of the level 2B common equity securities. This approach has been used in several studies, including the studies of Kapingura and Ikhide (2011), Saleemi (2014), Tayeh (2016), Hu and Cai (2019).

$$ILV_2 = TV$$

Trading volume (TV) was also used as an independent variable in this study. TV refers to the total amount of contracts traded on particular security for particular security (Kim & Ogden, 1996). TV is also the primary driver of liquidity and should have minimal impact on the price (Choridia *et al*., 2001). In addition, TV tends to have an absorptive impact on prices in illiquid assets and feeds positively on each other (Cheriyan & Lazar, 2018). Muktiyanto (2015); Bogdan, Baresa and Ivanovic (2012) also used TV to measure the independent variable to investigate market liquidity.

$$ILV_3 = BIT$$

Buyer initiated trade (BIT) was another independent variable used to investigate market liquidity. BIT refers to the number of trades executed from the bid side orders (Lu & Wei, 2009). BIT is a significant determinant of market liquidity because it determines the asset's order imbalance or order flow (Black, 1971). It is also used to establish the level of asymmetric information in a market (Lee & Radhakrishna, 2000). The study of Lee (1990) showed that BIT could be used to investigate the degree of market response to the number of trades initiated from the buyer's perspective, which is in line with the proposal of Black's (1971) price continuity theory of liquidity. It will be interesting to see how the BIT affects the dependent variable.

$$ILV_4 = SIT$$

Seller initiated trade (SIT) was the last independent variable used in this study. SIT are trades initiated from the short side, which may signal market risk if the number of participants increases within a short period (Zhou & Yang, 2019). An illiquid asset causes momentum in SIT, which causes deviation in asset prices from its fundamental value. Considering the nature of market liquidity, it is crucial to investigate if price movements are caused by trades initiated

from the sell and buy sides, as Black proposed (1971). The table below highlights the dependent and independent variables for each component of market liquidity.

Table 5.5. Variables and measures of liquidity (dependent and independent)

Source: Author

Dependent variables			
Variable	Measure as per this study		Data Source
DLR_1	$ln\frac{P_1}{P_0}$		Bloomberg
DLR_2	$P_1 - P_0$		Bloomberg
Independent Variables			
Variable	Measure as per this study	Expected outcome	Data Source
ILV_1	TC	Positive	Bloomberg and Yahoo Finance
ILV_2	TV	Positive	Bloomberg
ILV3	BIT	Positive	Bloomberg
ILV4	SIT	Positive	Bloomberg
Liquidity measure under BASEL III framework			
LCR	$\frac{\text{HQLA}}{\text{Cash inflows – Cash outflows}}$		Financial statements
NSFR	$\frac{\text{Available amount of stable funding}}{\text{Required amount of stable funding}} > 100$		Financial statements

The table below highlights the dependent and independent variables for each component of market liquidity.

Table 5.6. Financial Market liquidity breakdown

Market depth (Trading based measures)	
Dependent variable	Independent variables
logarithmic price scale	BIT, SIT, TV
Market tightness (Cost based measures)	
Dependent variables	Independent variables
Price effect	TC
Market resilience	
Ratio of long term market price variance to short term market price variance and the impact of trading volume on price effect.	

Source: Author

5.5 Data analysis

As already mentioned, the collected data was organised in the form of panel data. A panel data has two main characteristics denoted as $X_{it,}$ where i represent observations that run from 1 to the n^{th} term indicating the cross-sectional units, and t represents observations that run from 1 to T periods representing the time observations. A panel data was used because it provides an accurate prediction of the phenomenon under investigation than other types of data sets (Hsiao, 2007:6). Also, it has more variability, provides in-depth information and is the foundation of aggregation analysis (Hsiao, 2007:6). These descriptions fit the purpose of this study, where the aggregate changes in TV, SIT, BIT and TC were regressed against the dependent variables. According to Coakley, Fuertes & Smith (2006:2366), panel data has the following characteristics;

- Panel data allow for subject-specific variables taking heterogeneity into account
- Panel data is more informative, allowing for more degrees of freedom as well as less collinearity.
- Panel data can overcome the issue of omitted variable bias if the appropriate model is used.

EViews, an econometric software, was very useful in analysing the panel data. The workspace of EViews involves analysing, organising and offering insight into non-batched and batched statistical analysis, which is suitable for panel data analysis. Focusing on analysing the data

set, EViews enabled the researcher to generate chart reports, descriptive statistics and examine the relationship between variables. In so doing, the researcher gained rich and insightful understandings of the relationship between the dependent and independent variables. This software also has customised functions such as normality tests, which allowed the researcher to inspect the data and conduct inferential statistics visually. To facilitate the data analysis, the price effect and $ln\frac{P_1}{P_0}$ were calculated on excel before being exported to EViews. The data analysis process on EViews was in two stages; the first stage was from when the data was partly converted to ratio on excel to the unit root test as shown below.

5.5.1 Descriptive Statistics

Most quantitative studies involve describing the characteristics of specific variables to establish relationships between objects (Marshall & Jonker, 2010:4). A descriptive statistic summarises and categorises the data, explaining its nature regarding where it is concentrated and spread (Thompson, 2009:56). Descriptive statistics aims to provide summaries on uncertainty and variability of the data and the pattern of the collected data (Kaliyadan & Kulkarni, 2019:83). In this study, a descriptive analysis was conducted to summarise the independent and dependent variables. The standard deviation, mean and coefficient of variation (CV) values for the dependent and independent variables were estimated to summarise, categorise and describe the patterns of these variables. These were the only relevant measures deemed relevant for this study. CV is the ratio of standard deviation to the mean and is a meaningful measure of comparing two magnitudes of variations (Pélabon, Hilde, Einum & Gamelon, and 2020:181). According to Couto, Peternelli and Barbosa (2013:958), a CV of more than 30 indicates a greater variability and risk/reward trade-off, although there is no consensus on an appropriate CV value. This benchmark will be used in this study.

5.5.2 Unit root test

A prerequisite for choosing an appropriate analysis model is to establish if the variables involved in the data analysis are stationary at levels, first differencing order or second differencing order based on unit root testing (Coakley, Fuertes & Smith, 2006:2345). Stationary refers to the ability of a random process whose joint distribution is constant over time (Greunen, Heymans, Heerden & Vuurren 2014:2). This means the extent to which the mean and variance are constant over time, and the covariance is strictly dependent on the lag between the periods and not on time (Gimeno, Manchadoa & Minguez 1999:73). A panel data should meet three basic criteria to be considered stationary (Horváth, Kokoszkab & Rice, 2013:67). Firstly, the expectation of the process should be equal to a constant Mu (μ). Secondly, the variance (X_t) should be equal to sigma square (σ^2), where sigma square is not a function of time, and lastly, the covariance of X_t with X_{t+h} is a function of h and not a function of time as depicted below.

E(X_t) = μ ……. (1)

Var (X_t) = σ^2 ……. (2)

Cov (X_t, X_{t+h}) = f(h) ≠ g(t) ……. (3) (Horváth, Kokoszkab & Rice, 2013)

These three specifications imply that X_t is coming from a data generating process for all time, as shown below.

$X_t \leftarrow$ DÞP, $\forall_t$ (Horváth, Kokoszkab & Rice, 2013)

Also, stationary panel data simplifies the law of last numbers and allows the application of central limit theory required to make any inferences (Jönsson, 2011:671). Non-stationary panel data will produce dubious results, referred to as spurious regression (Pelagatti & Sen, 2013:92). According to Greunen et *al*. (2014:4), three methods are typically used to determine whether panel data is stationary. These are the graphical method, correlogram and unit root test (Jönsson, 2011:675). The unit root test provides the most reliable method of estimating stationary data, and it was therefore used in this study. There are three methods of conducting a unit root test, these are, the Augmented Dickey-fuller test (ADF), Kwiatkowski, Phillips, Schmidt and Shin test (KPSS test) and Phillip-Peron test (P-P test). The ADF test is used to test for a more complex autoregressive process where an additional lag term is included in the dependent variable to get rid of autocorrelation (Pelagatti & Sen, 2013:94). The ADF test is an advanced Dickey-Fuller test where lagged values are fitted in the model to ensure that the error term is not correlated with another observation's error term resulting in autocorrelation (Pelagatti & Sen, 2013:94). Autocorrelation presents a serious problem for most regression analyses. Therefore, an ADF test was used to test the presence or absence of stationarity. An ADF test follows the model below;

$$\Delta y_t = \alpha + \delta y_{t-1} + \sum_{i=1}^{n} \beta_i \Delta y_{t-1} + \varepsilon_t \quad \text{(Tam, 2013:3496)}$$

The logic of the ADF test is that when the p-value of the test statistics is less than 5%, then the null hypothesis is accepted and if greater than 5%, then the null is rejected (Tam, 2013:3496) as shown below.

$\boldsymbol{H_0}$: Stationary panel data. *P-values* is less than or equal to 5%.

$\boldsymbol{H_1}$: Non-Stationary panel data. *P-value* is more than 5%.

A P-P test was used to supplement the ADF test conducted. The P-P test is non-parametric and therefore needs no additional lags for the dependent variables (Kılıç, 2011:276). The P-P test allows for a wide range of classes, such as autoregressive integrated moving averages (ARIMA), which are heterogeneously distributed (Franco & Zakoïan, 2011:850). The P-P test

builds on the ADF test but eliminates the problem of serial correlation and Heteroscedasticity in the error term (Choi & Kim, 2017:5). The P-P test follows the following model;

$$y_t = \alpha + \text{ɞ}y_{t-1} + \varepsilon_t$$ (Choi & Kim, 2017:5)

Where ɞ is a form of t-test to correct the error ε_t for serial correlation and Heteroscedasticity. Therefore, the hypothesis below should hold

$\boldsymbol{H_0}$: Stationary panel data. P-values are less than or equal to 5%

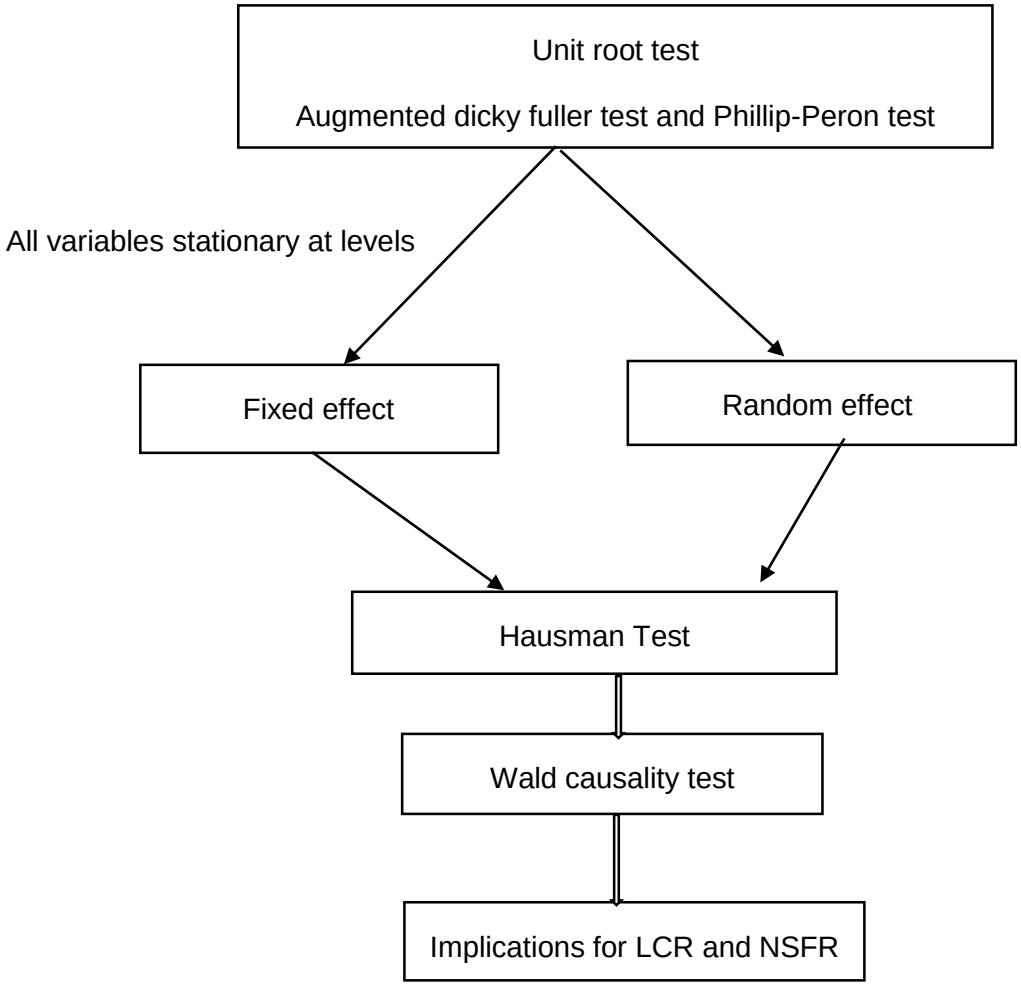
$\boldsymbol{H_1}$: Non-Stationary panel data. P-values are more than 5%

The second stage of the data analysis depended on the unit root test conducted. There are two outcomes of the unit root test that determined the choice of model. These alternatives are;

- All variables are stationary at levels.
- All variables are not stationary at levels.

All the variables used in this were stationary at levels, therefore the diagram below illustrate the data analysis blueprint

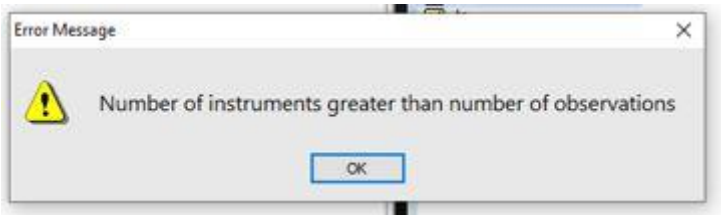
Figure 5.1. Data analysis method for stationary variables at levels.



Source: Adapted from Shrestha and Bhatta (2017)

Initially, the researcher wanted to use a dynamic model but the number of instruments in this study is greater than the number of observations as shown in the error message below.

Figure 5.2. Error message from Eviews



To this end, a static model was used in the form of a fixed effect and random effect test. The purpose of a fixed-effect model and random effect model is to examine the relationship between the dependent and independent variables and the response on one variable due to changes in another variable (Khamis, Razak & Abdullah, and 2018:383). A fixed-effect model investigates the relationship between the independent and the dependent variables where each has specific characteristics (Oscar Torres-Reyna, 2007:4). This specification allows the researcher to analyse the net effect of the independent variables on dependent variables and does not have any constant term.

$$y_{it} = \beta_1 + \beta_2 x_{2it} + \beta_3 x_{3it} + \mu_{it}$$

(Studenmud & Johnson, 2016:477)

On the other hand, a random effect is based on the intuition that the intercepts for each cross-sectional data are derived from the average intercept in the distribution, making the data variables independent of the error term (Hsiao, 2014:44). The random effect model is similar to the fixed effect model but assumes that the variation across variables is random and uncorrelated (Bell, Fairbrother & Jones, 2019:1060). A random-effect model is given by

$$y_{it} = \beta_1 + \beta_2 x_{2it} + \beta_3 x_{3it} + \mu_{it}$$ (Bell, Fairbrother & Jones, 2019)

A Hausman test was conducted to determine an appropriate model for the data set in this study. A Hausman test is appropriate when the error terms are correlated and not captured in the unobserved variable (Hausman, 1978: 1252). Also, this test is suitable when the

endogenous variables are determined by variables that are not affected by independent variables (Hausman, 1978: 1252). The model specification is shown below, where the null hypothesis indicates that the random effect is independent of the explanatory variables while the alternate hypothesis indicates that the random effect is not independent of the variables (Bell, Fairbrother & Jones, 2019:1058).

Table 5.7. Estimators of fixed effect and random effect

Specifications	Fixed effect	Random effect
H_0: Covariance = 0	Not reliable	Reliable
H_1: Covariance ≠ 0	Reliable	Not reliable

Source: Adapted from Aït-Sahalia and Xiu (2019:177)

Accordingly,

$\boldsymbol{H_0}$: Random effect model is appropriate; *p-value* is more than 5%

$\boldsymbol{H_1}$: Fixed effect model is appropriate; p-*value* is less than 5%

5.5.3. Models specifications

Model specification refers to the set of variables included in a model and the functional form of specific relationships (Allen, 1997:166). A specified model should not be under fitted or over fitted because relevant variables might be omitted or irrelevant variables may in included (Hawkins, 2003:1). The omission of variables may be due to unavailability of data or simply oversight leading to specification bias (Whitehead, Hoban & Clifford, 1994: 996). Conversely, adding more variables than required or irrelevant variables may lead to an increase in the variance of the estimated coefficient (Heinze, Wallisch & Dunkler, 2018:437). To avoid the potential problems of over fitting and under fitting, this study made use of the traditional variables used in the literature and the variables proposed by Black (1971) to test for market depth and market tightness. The output of the F-statistics in the model was used to determine if the model is a good fit (McNeish, 2018:3). The model is a good fit if the p-value of the F-statistics is less than 5% and vice versa (Frost, 2021). The specified model used was directly linked to the hypothesis being tested which was; TV, BIT & SIT will significantly impact

logarithmic of price scale and TC will have a significant impact on price effect respectively. Therefore, the following models were used;

$ln\frac{P_1}{P_0}$ it = $\beta_0 + \beta_1 TV_{it} + \beta_2 BIT_{it} + \beta_3 SIT_{it} + \mathcal{E}_{it}$ where $\mathcal{E}_{it}$ is the error term.

$P_1 - P_0 = \Upsilon_0 + \Upsilon_1 TC_{it} + \alpha_{it}$ where α_{it} is the error term.

The final analysis for this alternative was the Wald causality test. Regression statistical inferences do not logically imply causation. Although there might be evidence of an existing relationship, simple regression cannot determine the direction of influence. Hence the need for a Wald causality test to determine causality. Causality is appealing through the lens of a theoretical framework. The theoretical considerations used for the test are described in chapter 2. More specifically, the following causality relations will be investigated through the Wald causality test.

- TV, BIT and SIT causes changes in log of price scale
- TC cause changes in price effect.
-

To this end, the following hypothesis will apply to the Wald causality test.

H_0: TV, BIT and SIT cannot cause changes in the ln price scale. In this case, the p-value > 5%.

H_1: TV, BIT and SIT cause changes in ln price scale. In this case, the p-value < 5%.

For the second hypothesis, the following will apply

H_0: TC cannot cause changes in $P_1 - P_0$. In this case, the p-value > 5%.

H_1: TC can cause changes in $P_1 - P_0$. In this case, the p-value < 5%.

The result from the above findings will be used to make inferences about the adequacy of the LCR and NSFR.

5.6 Model for Market resilience

The price variations with financial market attributes are paramount for liquid assets (Bianchi & Frezza, 2018:378). According to Bhattacharya and Bhattacharya (2018:4), although there may be distortions in equilibrium prices, the prices of liquid security should follow a continuous random movement in which the long-term variance should be equal to the sum of the short term variance. Due to lower transaction costs and minimal fluctuations, the variance in liquid markets is expected to have smaller values. Therefore, the following should apply;

$$\frac{Var\ (RT)(Longterm\ Variance)}{T{+}VAR\ (RT)\ (sum\ of\ short\ term\ variance\ for\ period\ t)} = 1 \text{ or close to } 1$$

Bhattacharya and Bhattacharya (2018:4)

Where t = number of short term periods that make up the long term period. The ratio of long-term variance to short term variance is a standard measure for market resilience (Bhattacharya & Bhattacharya, 2018:4). This approach is used to estimate resilience by computing the asset price deviation from the random hypothesis. Consider an asset with price at time (t) to be S_t, if the asset price is continuous then,

$S_t = S_{t-1} + \pi_t$

Where π is a homoscedastic uncorrelated disturbance (Arellano & Bond, 1991:278). Since π_t is uncorrelated, the following should apply (Viceira & Campbell, 2004:20);

$E(\pi) = 0$, $Var(\pi_t) = \sigma_k^2$, where $E(\pi_t \pi_T) = 0$ for $T \neq t$

For continuous random movement, $\Delta S = \pi_t$ because $S_t \approx S_{t-1}$, therefore

$Var(S_t - S_{t-2}) = Var(S_t - S_{t-1}) + Var(S_{t-1} - S_{t-2}) = 2\sigma_k^2$

$Var(S_t - S_{t-T}) = T\sigma_k^2$

Therefore, for a continuous random price movement, the following should apply

$\Delta S = D_T$, Therefore the variance formula becomes;

$Var\, D_T = \frac{var(S_t - S_{t-T})}{T\sigma_k^2} = 1$

$Var\, D_T = 1$ implies that the deviation from one period to the other due to continuous price movement is the same. Considering the relevance of covariance (*CV*) the variance ratio (*VarR*) becomes

$Var(D_T - D_{T-1}) = 2Var(D_T) + 2CV(D_T, D_{T-1})$

5.7 Justification for model specifications

Econometric models have several advantages over traditional correlation models or mathematical models. These advantages are listed below, which justifies the use;

- In most empirical analyses, econometric models are extensively used to estimate the causality and volatility clustering between the independent and dependent variables (Moosa, 2019:10).
- In empirical analysis, parametric specifications are usually obdurate due to extensive parameters; therefore, the most suitable model should be able to capture contemporaneous variations between the dependent variables (DLR_1, DLR_2) and the

independent variables (ILV_1, ILV_2, ILV_3, ILV_4, ILV_5) which is the case of the abovementioned model (Studenmud & Johnson, 2016:3).

- When modelling financial theories, an econometric framework is usually preferred because of its perceived inclusion of all relevant information and reduces the bias in measurement (Heckman, 2001:4).
- Econometric analysis was used in this study because it is superior to traditional models such as simulation models in the context of this study. It also provides a better analysis of long and short term relationships between dependent and independent variables and empirically consistent results (Moosa, 2019:10).
- In addition, the model used in this study can adequately describe the explanatory ability between the dependent and independent variables of financial market liquidity.
- Furthermore, the econometric model provides better forecasting ability than other traditional models (Moosa, 2019:12).

5.8 Summary and conclusion

The purpose of this chapter was to outline the methodology and justify the identified approaches to meet the research objectives stated in chapter 1. The link between the hypothesis and objectives was expounded, and the models used to analyse the different components of market liquidity. The estimation models which were used to test the hypothesis were highlighted as well as the testing process. The data analysis began with a descriptive statistic where the basic features of the data was explained. The next section proceeded with a unit root test in order to determine whether the variables are stationary at levels, first difference or second difference. This step is an important stage in deciding on the type of analysis to be performed. A Hausman test was then used to select an appropriate data analysis method as described in section 5.5.2. The fixed effect is advantageous in terms of time-constraint heterogeneity while random effect is advantageous in controlling for heterogeneity.

In summary, the methodology outlined in this chapter is appropriate to address the research objectives of this study and meet the aims. The next chapter provides the data analysis results and a comprehensive analysis relating to the research objectives highlighted in chapter 1 and the introduction of this chapter.

CHAPTER 6

DATA ANALYSIS AND FINDINGS

6.1 Introduction

This chapter aims to present the findings and interpret the results of the research techniques applied in chapter 5. Accordingly, this chapter provides answers to the following research questions;

- What is the market depth position of level 2B common equity securities in the South African financial markets?
- What is the market tightness position of level 2B common equity securities in the South African financial markets?
- What is the South African financial markets' market resilience position of level 2B common equity securities?
- From the above questions, what will determine an adequate LCR?
- From the above question, what will determine an adequate NSFR?

To this end, section 6.1 begins with the descriptive statistics of the dependent and independent variables.

- Section 6.2 highlights the second phase of the data analysis
- section 6.3 indicates the market depth position of level 2B common equity securities
- Section 6.4 indicates the market tightness position of level 2B common equity securities
- Section 6.5 indicates the market resilience position of level 2B common equity securities
- Section 6.6 summary and conclusion

6.2 Descriptive statistics

The table below presents the results of descriptive statistical analysis conducted for the dependent and independent variables.

Table 6.1. Summary of descriptive statistics

	Observations	*Mean*	*Std. Dev.*	*CV*
P1 - P0	62549	5.4	862.55	159.73
BIT	63748	2745736	5724771	2.08
TV	63748	2742412	5717818	2.08
SIT	63748	2739055	5703634	2.08
TC	63748	28.21	76.26	2.70

Source: Author

Firstly, $ln\frac{P_1}{P_0}$ was excluded from the descriptive statistics analysis because describing the basic features of a log variable will not give a good picture of the phenomenon under consideration. The total number of observations from the above table was 63748 except for $P_1 – P_0$ due to the computation of the price effect from the previous closing prices, resulting in fewer observations. From table 6.1 above, the absolute mean price effect was 5.4 while the standard deviation was 862.55, which translates to a coefficient of variation of 159.73, indicating a relatively high degree of variation around the mean and risk/return trade-off. It was expected that the CV for the level 2B common equity securities to be less than 30 since the variability of these assets are expected to be low (Couto, Peternelli and Barbosa (2013:958). Another interesting finding was the BIT, TV and SIT, which are well below 30, indicating low values for all three measures. This may indicate that the variability moves in the same direction, and the market participants in the South African market may be trading within a particular range for each asset class resulting in a stable variability. As already indicated, liquid assets are expected to trade in large volumes with low standard deviations (Basel III, 2010). The standard deviation, mean and variability are similar. Although these descriptive statistics describe the basic features of the data set, an in-depth market liquidity examination of these variables are presented below.

6.3 Second phase of the data analysis

As already alluded to in the previous chapter, the second round of data analysis began with the unit root analysis test to determine whether the variables were stationary. The table below presents the results of the variables.

Table 6.2. Unit root test for all dependent and independent variables

Variable	Method	Statistic	Prob.**	Cross-sections	Observations
Dependent variables	Null: Unit root (assumes individual unit root process)				
$\ln \frac{P_1}{P_0}$	ADF - Fisher Chi-square	4993.82	0.0000	51	63630
	PP - Fisher Chi-square	4550.37	0.0000	51	63630
$P_1 - P_0$	ADF - Fisher Chi-square	4942.35	0.0000	51	63630
	PP - Fisher Chi-square	4687.56	0.0000	51	63630
Independent variables					
TC	ADF - Fisher Chi-square	973.096	0.0000	51	63749
	PP - Fisher Chi-square	5664.49	0.0000	51	63749
TV	ADF - Fisher Chi-square	933.205	0.0000	51	63749
	PP - Fisher Chi-square	7254.65	0.0000	51	63749
BIT	ADF - Fisher Chi-square	929.373	0.0000	51	63749
	PP - Fisher Chi-square	7256.13	0.0000	51	63749
SIT	ADF - Fisher Chi-square	932.572	0.0000	51	63749
	PP - Fisher Chi-square	7254.41	0.0000	51	63749

Source: EViews output

The above results in table 6.2 show that the *p-values* for both the dependent and independent variables are less than 5%. The literature on unit root testing (Choi & Kim, 2017:5; Tam, 2013:3496) indicates that p-values should be less than 5% for stationary variables, evident in table 6.2. Therefore, all the dependent and independent variables were stationary at levels which implies that H_0 is rejected and H_1 is accepted. These findings present a critical consideration for this study, considering that there are two mutually exclusive data analysis alternatives as highlighted in sections 5.5.3, 5.5.4, 5.5.5, 5.5.6, 5.5.7 and 5.5.8, respectively. In summary, a fixed-effect model and random effect model was used for the data analysis relying on the Hausman test.

6.4 What is the market depth position of level 2B common equity securities in the South African financial markets?

The above question aimed to investigate how the order size and other trading activities affect the price distribution. Trading activities in HQLA do not affect their prices because market participants can quickly match each other. Consequently, TV, BIT, SIT should not significantly affect the price distribution as HQLA can sustain large market volumes. In selecting an appropriate model, a Hausman test was conducted. The panel results for the Hausman test is presented below.

Table 6.3. Correlated Random Effects - Hausman Test

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	18.363367	3	0.0004

Cross-section random effects test comparisons:

Variable	Fixed	Random	Var(Diff.)	Prob
TV	-0.000000	-0.000000	0.000000	0.9836
BIT	0.000000	0.000000	0.000000	0.0001
SIT	0.000000	0.000000	0.000000	0.0418

Source: EViews output

**Prob. Are the p-values*

The p-value value of the Hausman test is less than 5% (0.0004) indicating that we reject the null and accept the alternate. Applying this finding to the current study, the fixed-effect model is more appropriate than the random effect because the covariance is not equal to zero. The results of the Fixed effect is highlighted below

Table 6.4. Summary of fixed effect model

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.000579	0.000126	-4.587859	0.0000
BIT	4.94E-08	5.34E-09	9.249836	0.0000
SIT	2.18E-08	3.11E-09	7.020229	0.0000
TV	-7.10E-08	6.18E-09	-11.48912	0.0000

Effect specification

F-statistics	4.214687
Prob(F-statistics)	0.00000

Source: EViews output

The p-values for the independent variables are less than 5% as shown in table 6.4 of the fixed effect. This means TV, BIT, SIT significantly affect the price distribution. In this case, the returns realised by market participants increases when the level of trading increases as a result of increasing market activity. Although this may be beneficial for investment practitioners, it is certainly not suitable for liquid assets. Therefore, the market depth of the selected level 2B common equity securities in the South African market is low due to the significant influence of trading activities on price distribution. As already mentioned, the trading activities for liquid assets are not expected to affect the price (Chueh, Yang, Yang & Fang 2010:157; Mu, Zhou, Chen & Kertesz, 2010:10). The results from table 6.4 also indicate that aggressive trading quantity move prices significantly for active trading due to price changes, and the ability to enter or exit the market with large volumes might not be appealing. Banks will find it difficult to quickly trade large volumes of the level 2B common equity securities without moving their prices, which might go in an unfavourable direction. This order imbalance might provide arbitrage opportunities that signal inefficiencies due to the assets inability to absorb large volumes. This lack of market depth does not provide an incentive for banks to judge the order flow, which will affect their LCRs and NSFR. This finding is in accordance with the findings of Kempf and Korn (1998); Pennings and Kuper (2009); Boonvorachote and Lakmas (2016) but is in contrast with the studies of Engle and Lange (2001); Bhattachary and Bhattachary (2018); Olbrys and Mursztyn (2019) who found high or stable market depth levels. A possible difference in the findings might be because of the type of asset used or the different geographic location. This finding proves otherwise from the BCBS (2010) characteristics of liquid assets, which is large volumes with little variability.

Apart from the significant effect, the coefficients also present some interesting findings. TV moves in the opposite direction to the log of price scale while BIT and SIT move in the same direction as the dependent variable. As TV increases, the price scale distribution decreases, making it more likely to reach the buy or sell price target (Chen, 2013). Also, the price distribution decreases when the number of BIT and SIT decreases and vice versa, meaning prices are more stable when sellers and buyers are less aggressive in trading. Also, from the F-statistics output, the model is a good fit since the p-value from the output is less than 5%. Although theoretically correct, the direction of influence must be confirmed with statistical evidence. To this end, the results of the Wald causality test are presented below;

Table 6.5. Wald causality Test for TV

Test Statistic	Value	df	Probability
F-statistic	131.9998	(1, 63642)	0.0000
t-statistics	-11.48912	63642	0.0000

Chi-square	131.9998	1	0.0000

Null Hypothesis: TV=0 Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
TV	-7.10E-08	6.18E-09

Source: EViews output

Table 6.6. Wald causality Test for SIT

Test Statistic	Value	df	Probability
F-statistic	49.28361	(1, 63642)	0.0000
t-statistics	7.020229	63642	0.0000
Chi-square	49.28361	1	0.0000

Null Hypothesis: SIT=0
Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
SIT	2.18E-08	3.11E-09

Source: EViews output

Table 6.7. Wald causality Test for BIT

Test Statistic	Value	df	Probability
F-statistic	85.55947	(1, 63642)	0.0000
t-statistics	9.249836	63642	0.0000
Chi-square	85.55947	1	0.0000

Null Hypothesis: BIT=0 Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
BIT	4.94E-08	5.34E-09

Source: EViews output

The above tables present the results of the causality test of the independent variables. The p-values in tables 6.6, 6.7 and 6.8 are less than 5%. This means that the causality test for the null hypothesis for TV and BIT are all rejected. Therefore, the following conclusions can be made;

- TV cause changes in $ln\frac{P_1}{P_0}$, therefore causality runs from TV to price scale
- BIT cause changes in $ln\frac{P_1}{P_0}$, therefore causality runs from BIT to price scale
- SIT cause changes in $ln\frac{P_1}{P_0}$, therefore causality run from the SIT to price scale

These results indicate the lack of market depth in the level 2B common equity assets and, perhaps, the presence of asymmetry in information. Buyers may probably have material information that triggers the price distributions.

6.5 What is the market tightness position of level 2B common equity securities in the South African financial markets?

The second research question investigated how the transaction cost, the difference between the bid and ask price, affects the price changes. In order to determine the appropriate model, the Hausman test was conducted; the results are presented below.

Table 6.8. Correlated Random Effects - Hausman Test

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	29.130891	1	0.0000

Cross-section random effects test comparisons:

Variable	Fixed	Random	Var(Diff.)	Prob.
TC	0.066640	-0.090071	0.000843	0.0000

Source: EViews output

The p-value value of the Hausman test is less than 5% (0.0000), confirming that we reject the null and accept the alternate hypothesis for the Hausman test. In this case, the fixed-effect model is more appropriate than the random effect because the covariance is not equal to zero. The results of the fixed effect model is presented below.

Table 6.9. Summary of fixed effect model

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-7.298791	3.768207	-1.936940	0.0528
TC	0.066640	0.053412	1.247657	0.2122

Effect specification

F-statistics	0.931590
Prob(F-statistics)	0.613000

Source: EViews output: (*Prob. Are the p-values)*

Regarding the fixed effect output, the transaction cost has an insignificant price effect. Looking at the F-statistics p-value, this implies that the model is not a good fit in explaining the effect of TC on price. The analyses of the causality effect are present in the table below

Table 6.10. Wald causality Test for TC

Test Statistic	Value	df	Probability
F-statistic	4.036618	(1, 62547)	0.0445
T-statistics	-2.009134	62547	0.0445
Chi-square	4.036618	1	0.0445

Null Hypothesis: TC=0

Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
TC	-0.090071	0.044831

Source: EViews output

The p-values are less than 5% indicating a causality relationship. This implies that the null hypothesis will be rejected in favour of the alternate hypothesis. In this case, the following should hold:

- TC cause changes in $P_1 - P_0$, therefore causality runs from TC to $P_1 - P_0$.

Considering that the model used in analysing market tightness is not a good fit, the attention was now on the average spread which is presented below

6.5.1 Analysis of the average spread

To provide more insight on the TC, the average ratio spreads to the lowest ask price (Hayes, 2019) was computed for each common stock for the five years. The table below presents the findings for the result.

Table 6.11. TC summary over five years

CODE	**Cost**
ABG	0.2%
AFE	0.3%
AGL	0.1%
ANG	0.1%
APN	0.2%
AVI	0.2%
BAW	0.2%
BHP	0.1%
BID	0.2%
BVT	0.2%
BTI	0.1%
CLS	0.2%
CPI	0.2%
DSY	0.2%
FSR	0.2%
GFI	0.2%
GLN	0.2%
HAR	0.2%
IMP	0.2%
INL	0.2%
INP	0.1%
IPL	0.3%
JBL	2.9%
KAP	0.6%
KIO	0.2%
LBH	0.2%
LHC	0.1%
MRP	0.2%
MSM	0.3%
MTM	0.2%
MTN	0.2%
NED	0.2%
NHM	0.3%
NPN	0.1%
NTC	0.2%

PIK	0.2%
RBP	1.6%
REM	0.2%
RMI	0.2%
SAP	0.2%
SBK	0.1%
SHP	0.2%
SLM	0.2%
SNH	0.9%
SOL	0.1%
SSW	0.2%
TFG	0.2%
TKG	0.2%
TRU	0.2%
VOD	0.1%
WHL	0.2%

Source: Excel output

From the above table, the average TC is either 0.1% or more indicating illiquidity in the equities securities that qualify for the level 2B HQLA asset class. As already alluded, large market orders under the best bid and ask prices create market pressures which causes the best bid price to move away from the best offer prices, causing larger spreads and increasing the transaction cost (Ganti, 2020). This may have a significant effect on the trading activities, creating more liquidity (Hayes, 2019). Also, large buy or sell trades signal some form of asymmetric information or private information from market participants resulting in the widening of TC beyond the 0.1% margin. This may further result in additional illiquidity premiums, which reduces the price of the asset (Asparouhova, Bessembinder & Kalcheva, (2010), Chalmers and Kadlec (1998); Eleswarapu, (1997). The existence of liquidity premiums further compounds price volatility. This finding indicates that banks may find it difficult to execute their trades quickly because traders on the opposite side may be unwilling to agree quickly due to wide TC. Considering that liquid assets should trade quickly with low transaction costs and minimal price risk (Ametefe, Devaney & Marcato, 2015:12; Ganti, 2020), the above findings present contrary views. As a result, banks will have to pay a larger mark-up or receive a lower price to exit their positions which may be compounded in distress situations where banks may be forced to accept fire sales. Also, it is worth noting that spreads trading beyond the 0.1% margin may increase the timing and market impact risks. The timing risk means that banks will have to accept a significant discount for their level 2B common equity securities, and the waiting period to execute the transaction may be longer.

The market risk will consequently increase due to moving the market in a particular direction. The time frame between when an order is placed to when it gets executed will increase. This implies that banks should expect a less efficient price discovery process and greater price movements as the TC changes. Also, the market's buy and sell price imbalances produce price distortions, and momentum trading will further widen the spread gap. These findings are in tandem with the findings of Mchinish and Wood (1992); George and Longstaff (1993); Saleemi (2014); Armitage et al. (2014) but contrary to the findings of Angerer et al. (2018); Bhattacharya and Bhattacharya (2018). Considering that this study used level 2B common equity securities trading in the South African market, a possible reason for the different findings might be the quality of assets used and the type of model used in the data analysis

Therefore, the following observations can be drawn;

- There is a lower probability of executing a trade because few traders do so under the bid and ask prices, which increases TC.
- The risk of losses arising from wide price differences in securities is not minimised in the level 2B common equity securities.
- Low market tightness reduces the option of opening simultaneous market positions, which decreases the trading activities of the 2B common equity securities.
- Banks can not follow a specific trading strategy when market tightness is low due to higher volatility in price movements.
- Larger TC in the 2B common equity securities do not offer transparency in future transaction costs. In this case, banks can not accurately predict and compare the cost involved in future trades.

6.6 What is the market resilience position of level 2B common equity securities in the South African financial markets?

The third and final research objective was to determine the market resilience of the level 2B common equity securities. The purpose of market resilience is to estimate how quickly the prices of the assets will recover from large orders and market shocks. Specifically, how the prices of level 2B common equity securities behave within short interlude and uncertain periods. Liquid equity securities can also be described based on their ability to recoil back to their previous prices, and the principle is best explained by analysing the volatility of the asset (Bhattacharya & Bhattacharya, 2018:1; BIS, 2019:19). The market resilience of level liquid equity securities will assuage short term shocks and optimise the returns on a risk-adjusted basis in the long run. Therefore, liquid asset classes are expected to provide flexibility in order

to capture changing market conditions. Price recovery provides a more vivid mechanism of analysing market resilience (Wanzala *et al*., 2017:3). In this case, the extent to which the ratio of long term variance to the sum of short term variance is equal (Bhattacharya & Bhattacharya, 2018:1).

In this study, the monthly variance was used as a proxy for long-term variance and was calculated based on 30 days, while five days were used as the short-term variance indicator (Bhahacharya *et al*., 2019). The short term and long term variance were based on the daily returns of the qualifying equity securities, and the computation was done using the VAR (Variance) function on excel. Table 6.14 below presents the results for the first three months of the data set (From April 2021 to May 2021). Unfortunately, all the output results could not be reported due to the vast output results. Therefore, the figures were reported based on two decimals from excel.

Table 6.12. Ratio of long term variance to the sum of short term variance

		M1	
Equity CODE	**Monthly variance (Long term)**	**Sum of short term variance for the same period**	**Ratio of Monthly variance to sum of short term variance for the same period**
ABG	0.02%	0.05%	0.41
AFE	0.01%	0.04%	0.31
AGL	0.06%	0.20%	0.29
ANG	0.08%	0.23%	0.35
APN	0.01%	0.05%	0.30
AVI	0.02%	0.06%	0.33
BAW	0.18%	0.38%	0.46
BHP	0.05%	0.17%	0.30
BID	0.03%	0.10%	0.29
BVT	0.02%	0.06%	0.32
BTI	0.01%	0.04%	0.33
CLS	0.01%	0.03%	0.40
CPI	0.01%	0.03%	0.30
DSY	0.02%	0.06%	0.36
FSR	0.02%	0.06%	0.32
GFI	0.05%	0.15%	0.33
GLN	0.06%	0.18%	0.31
HAR	0.11%	0.32%	0.36
IMP	0.09%	0.31%	0.29
INL	0.09%	0.30%	0.30
INP	0.07%	0.24%	0.31

IPL	0.03%	0.08%	0.36
JBL	0.10%	0.35%	0.30
KAP	0.05%	0.15%	0.31
KIO	0.07%	0.24%	0.30
LBH	0.02%	0.04%	0.48
LHC	0.05%	0.14%	0.31
MRP	0.11%	0.31%	0.35
MSM	0.09%	0.30%	0.31
MTM	0.02%	0.04%	0.37
MTN	0.03%	0.09%	0.34
NED	0.04%	0.10%	0.38
NHM	0.05%	0.19%	0.29
NPN	0.03%	0.07%	0.44
NTC	0.02%	0.08%	0.30
PIK	0.03%	0.08%	0.30
RBP	0.05%	0.16%	0.31
REM	0.03%	0.08%	0.36
RMI	0.01%	0.03%	0.29
SAP	0.10%	0.34%	0.29
SBK	0.02%	0.03%	0.47
SHP	0.02%	0.04%	0.44
SLM	0.01%	0.03%	0.33
SNH	0.12%	0.40%	0.29
SOL	0.02%	0.03%	0.48
SSW	0.06%	0.20%	0.29
TFG	0.09%	0.24%	0.36
TKG	0.15%	0.49%	0.32
TRU	0.07%	0.22%	0.31
VOD	0.01%	0.03%	0.35
WHL	0.05%	0.15%	0.30

M2

Equity CODE	Monthly variance	Sum of daily variance for the same period	Ratio of Monthly variance to sum of daily variance for the same period
ABG	0.05%	0.18%	0.31
AFE	0.01%	0.03%	0.38
AGL	0.03%	0.10%	0.30
ANG	0.05%	0.18%	0.29
APN	0.07%	0.23%	0.31
AVI	0.04%	0.13%	0.29
BAW	0.09%	0.29%	0.29
BHP	0.01%	0.04%	0.30
BID	0.02%	0.08%	0.32
BVT	0.02%	0.05%	0.36
BTI	0.07%	0.23%	0.31
CLS	0.04%	0.12%	0.31
CPI	0.02%	0.07%	0.34
DSY	0.02%	0.04%	0.53
FSR	0.04%	0.11%	0.33
GFI	0.07%	0.25%	0.29
GLN	0.04%	0.13%	0.30
HAR	0.07%	0.23%	0.31
IMP	0.05%	0.16%	0.31
INL	0.03%	0.09%	0.32
INP	0.03%	0.10%	0.30
IPL	0.04%	0.11%	0.33
JBL	0.06%	0.15%	0.40
KAP	0.04%	0.15%	0.29
KIO	0.03%	0.07%	0.37
LBH	0.01%	0.04%	0.36
LHC	0.02%	0.05%	0.45
MRP	0.02%	0.06%	0.34
MSM	0.02%	0.08%	0.33
MTM	0.02%	0.05%	0.37
MTN	0.04%	0.12%	0.34
NED	0.04%	0.10%	0.37
NHM	0.06%	0.19%	0.32
NPN	0.02%	0.05%	0.34
NTC	0.02%	0.07%	0.31
PIK	0.03%	0.08%	0.30
RBP	0.04%	0.11%	0.35

REM	0.02%	0.05%	0.34
RMI	0.01%	0.01%	0.68
SAP	0.03%	0.11%	0.32
SBK	0.03%	0.09%	0.31
SHP	0.01%	0.05%	0.29
SLM	0.01%	0.02%	0.39
SNH	0.11%	0.39%	0.29
SOL	0.09%	0.29%	0.31
SSW	0.06%	0.15%	0.40
TFG	0.03%	0.07%	0.38
TKG	0.03%	0.12%	0.29
TRU	0.04%	0.13%	0.33
VOD	0.01%	0.02%	0.31
WHL	0.02%	0.03%	0.80

M3

Equity CODE	Monthly variance	Sum of daily variance for the same period	Ratio of Monthly variance to sum of daily variance for the same period
ABG	0.05%	0.21%	0.25
AFE	0.01%	0.04%	0.23
AGL	0.07%	0.29%	0.23
ANG	0.09%	0.24%	0.38
APN	0.04%	0.09%	0.43
AVI	0.02%	0.08%	0.23
BAW	0.04%	0.10%	0.37
BHP	0.03%	0.13%	0.23
BID	0.02%	0.07%	0.32
BVT	0.03%	0.08%	0.43
BTI	0.03%	0.10%	0.24
CLS	0.02%	0.08%	0.21
CPI	0.02%	0.09%	0.25
DSY	0.04%	0.19%	0.22
FSR	0.03%	0.09%	0.33
GFI	0.13%	0.56%	0.23
GLN	0.05%	0.22%	0.24
HAR	0.13%	0.43%	0.30
IMP	0.05%	0.16%	0.34
INL	0.06%	0.18%	0.32
INP	0.06%	0.19%	0.31
IPL	0.03%	0.14%	0.23

JBL	0.06%	0.23%	0.24
KAP	0.10%	0.40%	0.25
KIO	0.11%	0.49%	0.23
LBH	0.06%	0.27%	0.24
LHC	0.03%	0.07%	0.34
MRP	0.05%	0.20%	0.23
MSM	0.20%	0.67%	0.30
MTM	0.07%	0.25%	0.27
MTN	0.09%	0.28%	0.33
NED	0.05%	0.17%	0.32
NHM	0.06%	0.23%	0.25
NPN	0.05%	0.19%	0.28
NTC	0.04%	0.12%	0.30
PIK	0.04%	0.15%	0.26
RBP	0.09%	0.35%	0.25
REM	0.03%	0.10%	0.27
RMI	0.03%	0.12%	0.25
SAP	0.11%	0.46%	0.25
SBK	0.03%	0.09%	0.38
SHP	0.06%	0.21%	0.27
SLM	0.02%	0.09%	0.25
SNH	0.12%	0.56%	0.22
SOL	0.13%	0.44%	0.30
SSW	0.09%	0.41%	0.22
TFG	0.04%	0.17%	0.24
TKG	0.04%	0.16%	0.26
TRU	0.05%	0.14%	0.38
VOD	0.04%	0.15%	0.25
WHL	0.02%	0.09%	0.26

Source: Excel output

**M stands for month*

Market resilience portrays the volatility of the level 2B common equity securities fundamental price changes over time. From table 6.14, the ratio of long term variance (1 month) is not equal to the sum of monthly variance. Although the long term variance is lower than the sum of the short term variance, this ratio is significantly lower than 1. Therefore, large market orders can create order imbalances in the long-term to short-term variance ratios (Bhattacharya & Bhattacharya, 2018:2). Of essence, the speed with which market prices return to their fundamental values or price recovery mechanism and equilibrium prices is languid. This issue may further create pricing errors and price changes. In addition, illiquidity caused by a lack of

market resilience may have severe consequences once the need for liquidity arise, especially if banks are over-reliant on the proceeds. This may cause banks to re-assess their market participation frequency, further impacting trading activities because they are not involved in day-to-day trading or trading off their positions daily.

Furthermore, the absence of market resilience might lead to price transmission signals and ineffective pricing mechanisms if banks perceive a lack of price concession due to lower or volatile prices. Summing up the above analysis, it can be concluded that there will be insufficient resilience in the specific equity securities that qualify for the level 2B HQLA based on the findings of table 6.17. The initial findings are in line with the findings of Hmaied *et al*. (2006); Thomas (2006); Dong *et al*. (2007); Wanzala *et al*. (2017); Hua *et al*. (2019) but in contrast with the findings of Coppejans *et al*., (2004); Chlistalla (2012); Bhattacharya, Bhattacharya & Basu (2019); Olbrys and Mursztyn (2019); Clapham *et al*., (2020). From the above findings, the following conclusion on market resilience;

- The risk of mitigating liquidity shocks is low, and the probability of destabilising liquidity cycles is high for level 2B common equity securities (BIS, 2011:21)
- The market resilience required to stabilise the procyclical trend of level 2B common equity securities is low.
- The low market resilience in level 2B common equity securities causes market liquidity to be more fragile, increasing the probability of disruptions in the financial system. (BIS, 2016:2)
- The low market resilience in level 2B common equity securities inhibits competitive capital markets and proper allocation of risk (BIS, 2019:5).
- Low market resilience will limit and also prohibit predictable access to adequate market liquidity (IMF, 2015:49)
- Level 2B common equity securities will not diversify price risk in the South African markets
- Duration and sensitivity risks are not minimised due to the difference in the ratio of long term variance and the sum of short term variance (Wanzala *et al*., 2017)
- Finally, low market resilience in level 2B common equity securities restrict effective monetary policy transmission through slow adjustments to these new policy changes.

6.7 Diagnostic test

A diagnostic test was also carried out to examine the validity and the quality of the model specification used in this study. This involves empirically testing the calibrated robustness of the model using a statistical test to ensure that the model will adequately analyse the data under consideration (Hong & Lee, 2003:1066). In addition, the selected model needs to

analyse the residual dependence among the independent and dependent variables, which is of paramount importance for this study. Therefore, this study made use of the residual diagnostic test to investigate the validity of the model. A residual diagnostic test was utilised because this study involved regressing the dependent and independent variables to investigate the financial market liquidity of liquid assets. A residual diagnostic test involves testing for serial correlation, Heteroscedasticity, residual dependency test, and normality test to ensure that the error term is independently and identically distributed, representing the white noise (Jiang & Knight, 2002:199). Serial correlated errors refer to the extent to which the covariance of an error with some other error within the population is not equal to zero, as shown below (Drukker, 2003:168).

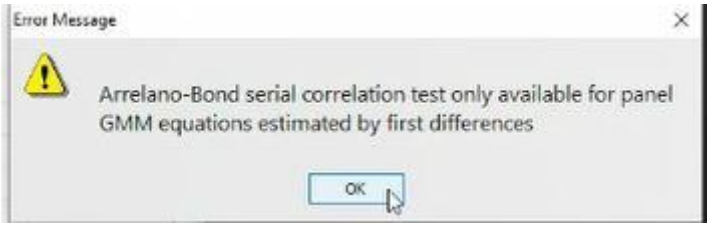
$\text{Cov}(u_i, u_s) \neq 0$ for i ≠ s (Drukker, 2003)

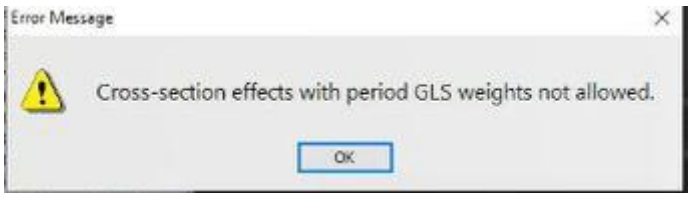
This means that least square estimators are no longer blue, which generally arises when there is a common error within the population. It is crucial to ensure the absence of serial correlation because, when present, least-square estimates will no longer be a good model for estimating financial market liquidity. There will be other linear unbiased estimators that have lower sampling variance. On the other hand, heteroscedasticity results from unequal variance in the error term for a given set of distributions (Klein, Gerhard, Büchner, Diestel, & Engel, 2016:568). In order words;

$Var(u_t/x_t) \neq \sigma^2$ for all variables at time T. (Klein et al., 2016)

The presence of Heteroscedasticity implies that the standard error is biased and incorrect. When this happens, the standard errors will be too small and incorrect. These incorrect standard errors are used to make inferences about the population which will also be incorrect. Also, the ordinary least squares (OLS) estimators are no longer effective, and other linear unbiased estimators are better than least squares. The figures below are pictures of error output for serial correlation and the Heteroscedasticity diagnostic test conducted.

Figure 6.1. Error messages for serial correlation and Heteroscedasticity test respectively on Eviews





This shortcoming was overcome by conducting another serial correlation test known as the Durbin-Watson test. According to Kenton (2021), a Durbin-Watson range between 1.5 and 2 indicates the absence of serial correlation, which was also used in the studies of Savin and White (1977); Bhargava, Franzini and Narendranathan (1982); Albertson, Aylen and Lim (2002); Born, Benjamin; Breitung, Jörg (2010); Karagoz and Caglar (2016). The results of the Durbin-Watson for both models are shown below.

Table 6.13. Effect specification for OLS model 1

Cross-section fixed (dummy variables)

Root MSE	0.027624	R-squared	0.003498
Mean dependent variance	-6.36E-05	Adjusted R-squared	0.002668
S.D. dependent variance	0.027673	S.E. of regression	0.027636
Akaike info criterion	-4.338550	Sum squared residual	48.60638
Schwarz criterion	-4.330867	Log likelihood	138228.1
Hannan-Quinn criteria	-4.336170	F-statistic	4.214687
Durbin-Watson stat	1.965119	Prob(F-statistic)	0.000000

Source: EViews output

Table 6.14. Effects Specification for OLS model 2

Root MSE	862.2131	R-squared	0.000760
Mean dependent variance	-5.404888	Adjusted R-squared	-0.000056
SD dependent variance	862.5477	SE of regression	862.5717
Akaike info criterion	16.35854	Sum squared residual	4.65E+10
Schwarz criterion	16.36088	Log likelihood	-511553.3
Hannan-Quinn criteria.	16.36088	F-statistic	0.931590
Durbin-Watson stat	1.980170	Prob(F-statistic)	0.613000

Source: EViews output

The Durban-Watson values in tables 6.15 and 6.16 indicate the absence of serial correlation, hence the low probability of data size distortions due to model specification, which confirms

the model's reliability. A cross dependence test was also conducted to determine if the residual values of the regressor are correlated with the disturbance term, which renders the fixed effect and random effect ineffective (Hoyos & Sarafidis, 2006:482). The output of the cross dependence analysis of models 1 and 2 are shown below

Table 6.15. Cross-sectional dependence test OLS model 1

Residual Cross-section dependence test

Null hypothesis: No cross-section dependence (correlation) in residuals

Periods included:1189

Cross-section included:51

Test	Statistics	d.f	Prob
Pesaran CD	334.8334	1275	1.95

Source: EViews

Table 6.16. Cross-sectional dependence test OLS model 2

Residual Cross-section dependence test

Null hypothesis: No cross-section dependence (correlation) in residuals

Periods included:1189

Cross-section included:51

Test	Statistics	d.f	Prob
Pesaran CD	283.2629	1275	1.96

Source: EViews

From the table above, we reject the alternative hypothesis (cross-sectional dependence) favouring the null. Therefore, the residual values of the error terms are not correlated to the regressor, which connotes that the models used in this study are reliable and have no serial correlation.

6.8 Summary and conclusion

The purpose of this chapter was to present the key findings of the data analysis used to investigate the research questions. In other to determine the appropriate analysis model, a unit root test was first conducted. From the unit root analysis, a fixed-effect model was deemed appropriate and used in the analysis because all the variables were stationary at levels. In addition to the fixed-effect model, a Wald causality test was also conducted to investigate whether the independent variables cause changes in the dependent variables. Several interesting findings were presented from the data analysis. The empirical analysis presented

in this chapter highlighted the following. Firstly, there is a significant relationship between $ln\frac{P_1}{P_0}$ and BIT, SIT, TV. The observation that BIT, SIT, TV significantly affects $ln\frac{P_1}{P_0}$ connotes a lack of market depth and creates illiquidity. Also, causality moves from the independent variables TV, SIT and BIT to $ln\frac{P_1}{P_0}$. Secondly, there is no significant relationship between TC and price effect (P_1 - P_0). Considering that the model could not be used to explain the relation, the attention was on the average spread where it was greater than 0.1%. The findings indicate low market tightness in level 2B common equity securities. Also, causality moves from TC to P_1 - P_0 as indicated by the Wald test. Finally, the ratio of the long term variance is not equal to the sum of individual variance for three months. To summarise the findings, the following three important themes where observed;

- There is sufficient evidence of low market depth among the selected common equity securities.
- Low market tightness among the qualifying level 2B common securities.
- Insufficient market resilience among the selected the selected equity securities.

Therefore, the objectives of the study were achieved. The next chapter presents the summary, implication of study and recommendations of further research.

CHAPTER 7

SUMMARY, DISCUSSION OF RESULTS, POLICY IMPLICATIONS AND RECOMMENDATION

7.1 Introduction

This chapter summarises the findings derived from investigating the financial market liquidity for level 2B common equity securities and the implications of the results and recommendations for future research. The study was conducted using level 2B common equity securities with low risk, listed on a recognised exchange, considerable large market size and trading frequency and ease and certainty of valuation.

Accordingly, this chapter outlines the re-statement of the research problem, the main research question and sub-questions as outlined in Chapter 1. This is followed by a summary of the theoretical framework presented in Chapter 2 in Section 6.2. Section 6.3 summarises the global liquidity standards proceeding to section 6.4, highlighting the literature review summary. A summary of the research methodology and analysis and discussion of the study results follows in Section 6.5. Section 6.6, respectively. Section 6.7 highlights the policy implications, followed by section 6.8 that provides the significance of the study. Finally, section 6.9 provides the limitations of the study and suggestions for further research.

7.2 Summary of the research problem, question and sub-questions and objectives

7.2.1 Problem statement

It is perceived that the LCR and NSFR still significantly underscored liquidity risk management as recommended in the Basel III framework (Schmitz & Hesse, 2014; IMF, 2013). Despite the depth of BASEL III, it is perceived that the LCR and NSFR still significantly underscored liquidity risk management as recommended in the Basel III framework (Schmitz & Hesse, 2014; IMF, 2013). This is following the report of (Schmitz & Hesse, 2014), which contends that some of the asset classes in the definition of HQLA, particularly equity securities, are still too volatile in terms of price changes and trading. Furthermore, BASEL III does not have a standard where banks report the financial market liquidity state for their respective level 2B HQLA, especially the common equity securities. That is, the interaction between the price of these assets and trading activities and how their market values differ from the fundamental prices, especially in unfavourable economic conditions. According to Gabrielsen, Marzo and Zagaglia (2011:21), these intuitive considerations are the crux of effective financial market liquidity and should be considered. This is particularly true because market liquidity is time-related and a significant challenge (Marozva, 2017:88).

According to KPMG (2020:4), the proposed Basel IV framework, which will be implemented in January 2023, considers robust measures of estimating capital requirements, managing credit risk, market risk and interest rate risk, which are a leap from Basel III. However, the LCR and NSFR, which are the two liquidity measures, are still based on simple standard ratios with no detailed analysis of the market depth, market tightness and market resilience state of the level 2B equity securities and may be a misrepresentation of the current status quo.

7.2.2 Purpose statement

The broad aim of this study is to investigate the financial market liquidity of the level 2B common equity securities for commercial banks in order to propose a more suitable framework for LCR and NSFR

7.2.3 Main research question

The main research question is, what is the financial market liquidity state of the level 2B common equity securities for banks in South Africa and its impact on LCR and NSFR?

7.2.4 Research sub-questions

- What is the market depth position of the level 2B common equity securities in the South African financial markets?
- What is the market tightness position of the level 2B common equity securities in the South African financial markets?

- What is the market resilience position of the level 2B common equity securities in the South African financial markets?
- From the above questions, what will determine an adequate LCR?
- From the above question, what will determine an adequate NSFR?

7.2.5 Summary of theoretical framework

The theoretical underpinning of this study was based on the price continuity theory of liquidity developed by Black (1971) and the transaction cost theory. The price continuity theory of liquidity holds that market participants, mainly individual investors and institutions, can raise the same amount of cash if they both hold liquid assets due to a fairly constant price over the long and short term, irrespective of large market orders Black (1971). As a result, a small number of stocks in a well-diversified portfolio can be traded without affecting prices. Furthermore, the trading cost of a liquid market is not exacerbated, and the price recovery from an uninformative shock is expected to be more continuous, which signifies a resilient market (Black, 1971). The price continuity theory of liquidity also holds that the market price of a liquid asset is relatively stable because market forces will always induce equilibrium quickly. This means deviations from the mean is expected to revert quickly. The additional dimension of the liquidity preference theory demonstrated some form of symmetry due to the notion that long term return variance of the liquid asset should be equal to the sum of the variance of the respective shorter term of the same asset (Isaenko, 2010:2376). In other words, price volatility should not affect order flow because prices will adjust quickly. In instances of bankruptcy or crisis, the assets are expected to trade at their fundamental values. Therefore, the price continuity theory of liquidity preference proposed by Black (1971) contends that there should be sufficient evidence of market depth, market tightness, market resilience, and immediacy for an asset to be considered liquid.

This study also applied the transaction cost theory in investigating market liquidity. An understanding of an asset's liquidity can also be gleaned through the interaction between the transaction cost, which is the bid-ask spread and price changes. Banks or institutional investors will prefer securities that offer a high degree of trading confidence where the asset can be easily bought or sold in the open market. The TC will have to be small to enhance trading, considering that banks do not want to spend much time searching for counterparties (Lin, Sanger & Booth, 1995:1154). Also, the market will not want the price of their liquid securities to be affected to quickly trade off the position and profit from the spread (Wang & Yau, 2000:950). These two theories were used to provide the rationale of market liquidity, framing the research questions and the hypothesis stance and data analysis.

7.2.6 Summary of global liquidity standards

This chapter highlighted the critical discourse on the liquidity management standards proposed by BCBS (2010). Basel accords. These Basel accords are banking and supervisory norms, which constitute a series of recommendations on prudential banking and financial regulations set by the Basel committee and supervisory (BCBS, 2008). Of importance to this study, the BCBS also introduced the global liquidity standards to protect banks from acute liquidity crises and long term stress liquidity scenarios. In addition, the BCBS (2010) introduced the LCR and NSFR to curb liquidity risk and promote a more resilient banking sector while decreasing the risk profile. In addition, the LCR and NSFR act as shock absorbers to reduce the spillover risk from the banking sector to the global economy. The composition of these liquidity standards is mainly HQLA comprising different classes of assets which are level 1 assets and level 2 assets. The chapter ended by highlighting the new and upcoming Basel IV standards, which will be implemented in January 2023.

7.2.7 Summary of literature review

The literature review chapter began elucidating the concept of market liquidity as well as the relevance and mechanism. The chapter then proceeded with trends in liquidity over the past twelve years. Several concerns were raised of the deteriorating liquidity in financial assets despite relatively stable spreads in most European markets ((De Renzis, Guagliano & Loiacono, 2018; Blanqué & Mortier, 2019). Some of these concerns were the widening spreads where the adjustments in liquidity occur through trading volume as opposed to prices ((Vayanos & Wang, 2012:227). Regulatory changes have also impacted commercial banks in which most of them are no longer taking market marking positions. In addition, higher capital requirements have caused a shift in trading patterns (BCBS, 2019). These concerns are further amplified in fragmented markets and the presence of asymmetric information, which is material information about the nature of an asset that the other party does not have (Gwizdala, 2018:4).

It then reviewed prior studies on the themes of market liquidity, which are market depth, market tightness and market resilience. Concerning market depth, prior literature suggests a lack of market depth where the majority of the studies found a significant relationship between the dependent and independent variables. Furthermore, reviewing prior studies on market tightness showed a mixed result where some studies found a significant relationship between the spread and dependent variables while others did not. Finally, the findings of market resilience also highlighted some studies with low market resilience and others with high levels of resilience. The chapter highlighted gaps and the unanswered research questions by reviewing this literature, which provided the basis for this study.

7.2.8 Summary of research methodology

The research methodology chapter described the blueprint technique used to analyse the research questions in this study. First, the chapter commenced with the paradigm, and then the research approach closely linked with the positivist paradigm. Also, this approach was selected because it achieved a fruitful report that was necessary to comprehensively gain a vivid understanding of the research problem in the relevant context. Next, the chapter highlighted the research design and the population of the study, the sampling technique adopted in this study, and the data variables in the study. Finally, the data collection and analysis method was highlighted, where the selected data analysis method was based on the unit root test. Chapter 5 then concluded with the justification of research methods and ethical considerations.

7.2.9 Data analysis and findings

The data analysis chapter presented and discussed the findings of the empirical data used to investigate this study's objectives. The chapter began by restating the research questions, followed by a description of the basic features of the independent and dependent variables. The chapter then proceeded with the results and analysis of the unit root test to establish an appropriate data analysis method. In addition, the chapter presented the stationary test results where all the variables were found to be stationary at levels. Therefore, the appropriate data analysis method was a fixed-effect model.

The chapter then proceeded with the presented results and analysis of market depth. The focus was to establish whether market activities in the designated common equity securities such BIT, SIT, TV affect the price log. For liquid assets, order quantity changes do not change the price, not applying illiquid assets. However, prices move significantly with new market orders in an illiquid asset due to poor fit between the market orders.

Chapter 6 further analysed and discussed the results on market tightness which focused on the effect of TC and price. Liquidity in financial instruments is characterised by narrow TC with no significant effect on price changes. In addition to this, the chapter also analysed and discussed the results of the average TC for each security.

Finally, the data analysis chapter also presented and analysed the market resilience of the specific financial instruments used. The aim was to investigate how the prices adjust quickly to changes when large order imbalances or uninformative shocks are determined by looking at the ratio between the long-term variance for three months to the sum of monthly variance over the same period. Analysing the research questions posed in the first chapter partly required a proposed framework framed into hypotheses.

7.3 What is the market depth position of level 2B common equity securities in the South African financial markets?

The price continuity theory of liquidity preference contends that there is a lack of market depth in the presence of asymmetric information. The results of the market depth analysis show that TV, BIT, SIT significantly affect the price distribution. This was evident in the significant relationship (p-values less than 5%) between the independent variables (TV, BIT, SIT) to the dependent variable ($ln\frac{P_1}{P_0}$). The above results suggest that level 2B common equity securities trading on the JSE lack market depth. This lack of market depth also suggests that there may be limited or declining market participants, and it will be challenging to uncover numerous positions from both the buyer's and seller's perspectives. Large trades with minimal effect on price distributions are used to gauge the accuracy of quoted prices (Sarr & Lybek, 2002:7). Distortions in these quoted prices create order imbalances and unwarranted price movements away from their fundamentals (Michael & Michael, 2015:214). This lack of market depth in the level 2B common equity securities implies that frequent trading will result in price discontinuity, and banks will be taking a certain amount of risk when executing the market orders. This could imply that banks, whether from the buy side or sell side, cannot easily identify trading partners with whom to readily trade, confirming the lack of market depth. Also, the willingness of banks to risk their capital will be low considering that there is a significant price deviation from its fundamental. This price disconnect creates severe price path consequences, which affects the execution cost (Pennings *et al*., 2003:2).

The study of Kapingura and Ikhide (2011) indicated that the bond market in South Africa also lacks market depth. Therefore, combining the lack of market depth in the bond and level 2B common equity securities is another serious implication for the LCR and NSFR for banks to reiterate the need to improve these ratios. Therefore, the first research objective was met by empirically investigating and understanding the level of market depth.

7.4 What is the market tightness position of level 2B common equity securities in the South African financial markets?

The second objective was to test the transaction cost theory, which proposes that the transaction cost in a tight market that signals liquidity should be less than 0.1% with no significant impact on the price difference. The market tightness analysis results showed no significant effect of TC on the price effect. The F-statistics p-value revealed that the model cannot be used to explain the relationship. From the average spread output, the results suggest a lack of market tightness because TC should be less than 0.1%. This finding suggests a high risk of buying the level 2B common equity securities at a higher price and selling at a lower price. These wide TC may decrease the TV due to the higher fixed cost that needs to

compensate for the illiquidity premiums. Also, exceptionally few market participants may be willing to trade at the existing bid and ask prices. High TC impacts the demand for trades and regulates the number of active participants, which may cause fragmented markets and asymmetric information. As already mentioned, banks will find liquidity scares in these markets and face difficulty raising the required funds. The asymmetric information and market fragmentation will execute many transactions around the bid-ask spread rather than the equilibrium price (Sarr & Lybek, 2002:9). Also, TC that affects prices will lead to additional costs in holding capital which further increases the risk-adjusted cost of funding for banks. This low levels of market tightness inhibits effective price mechanisms through efficient information dissemination and encourages market participants to look for alternative trading partners outside the market, increasing search costs. This will also constrain the ability of banks to raise the required capital needed.

7.5 What is the market resilience position of level 2B common equity securities in the South African financial markets?

The third objective was to investigate the market resilience using the price continuity theory of liquidity preference by analysing the relationship between the long term variance and the sum of short term variance. The data analysis results indicate that the ratio of long term variance to that of the sum of short term variances is not equal to or close to 1. The values of the ratios are below 50%, indicating a lack of market resilience. The results show that the qualifying level 2B common equity securities trading on the JSE lacks market resilience. Due to the normality in price movements, liquid assets are expected to break any trend and temporary market pricing errors, which should be eliminated quickly due to the stability in price variance. From the findings in the previous chapter, banks should expect significant gains and great losses regarding holding the level 2B equity securities because of a lack of market resilience.

Furthermore, market timing, which enables quick entry and exit, may be impossible due to price disparity, and event-driven factors may also move prices in either direction without quickly returning to their fundamental values. Also, this finding implies that there is a high vulnerability of the level 2B equity securities due to the difficulty in market timing, entry and exit. This means that the current market sentiments drive the price levels and will be trading away from their fundamental values. These findings are contrary to the proposition put forth by the price continuity theory, where the leverage to trade over a long period at the equilibrium price is not distorted, and the security prices are not distorted (Black, 1971).

Although there are liquidity stress testing in banking, the initial results confirm the need for a more effective approach in estimating market liquidity. Liquidity measures in the Basel accords are predominantly static and driven by regulatory requirements (BCBS, 2010; BCBS, 2013;

BCBS, 2014). Stress testing in banks does not consider the market liquidity of the different types of liquid assets. Adopting an effective approach to liquidity management will improve the resilience in the banking sector, where the profile of the banking portfolios will be effectively monitored and managed. The state and the analysis of liquid assets need to be visible in the liquidity profile and reporting in banking. These analyses will provide a good picture of whether the liquidity profiles of the respective banks are in tandem with the projected growth in the medium and short term. This means having a granular and plausible approach rather than a static liquidity framework such as the current LCR and NSFR. In addition to an improved LCR and NSFR, integrating the current findings to the contingency funding plans (CFP) in banking means that the liquidity state of the level 2B equity securities needs to be reported on an ongoing basis, especially for banks holding the level 2B common equity securities. In summary, the following hypothesis where accepted.

- The level 2B common stock equities lack market depth due to asymmetry information.
- The level 2B common stock equities lack market tightness due to asymmetry information.
- The level 2B common stock equities lack market resilience due to asymmetry information.

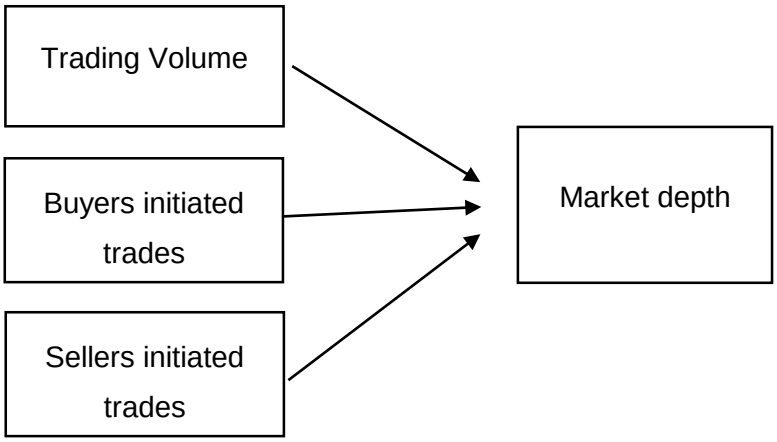
7.6 Theoretical application

The foundation of a robust economy and a well-functioning financial system depends on the banking sector (Hermes & Lensink, 1996:25). Liquidity in banking is the masterpiece that catalysis stability and efficiency in organised banks (Marozva, 2017:20). This was evident from the global financial crises in 2008, where the need for an effective and comprehensive liquidity management framework was absent. Before the crisis, the main focus was on capital and credit risk management which was emphasised in Basel I and Basel II with little attention on liquidity risk. Due to these shortcomings, the BCBS (2010) introduced the LCR and NSFR in Basel III. However, these static liquidity management measures need to be improved due to the dynamic and elusive nature of financial markets and the economic environment. Also, the Basel III liquidity management standards do not capture the multidimensional liquidity characteristics as proposed by the price continuity theory of liquidity preference instituted by Black (1971) and transaction cost theory. These lapses may be very costly in instances where banks are solely dependent on the LCR and NSFR. Several authors have also expressed these views (Brunnermeier *et al*., 2013; Bai *et al*., 2014; Krishnamurthy, Bai & Weymuller, 2016). These authors argue that the nexus between the LCR and NSFR and liquidity risk management is a

fallacy. This study used the price continuity theory of liquidity preference to ascertain the viewpoint mentioned above. Like other comprehensive measures, the price continuity theory includes all the dimensions of assessing the liquidity of security in the financial market.

From a social science perspective, the inter construct relationship necessary for establishing the adequacy of financial market liquidity was presented by the price continuity theory of liquidity preference that has not yet been used to investigate the aptitude of equity securities in line with the theory. Furthermore, the theoretical insights of the price continuity theory of liquidity preference and the transaction cost theory demonstrate how market depth, market tightness, and market resilience shape the understanding of financial market liquidity and the casual maps. Therefore, the current study contributes by explaining some of the constructs that have not been articulated well enough in prior literature: BIT and SIT. Hence, assisting in gaining a better understanding of the market depth of the level 2B common equity securities. The results of market depth analysis in section 6.4 indicates that SIT and BIT significantly affect price distribution and must be used for market depth. In this regard, the current findings reinforce the need for a more comprehensive measure for accessing market depth which is very important because existing literature is almost silent on the topic. Adopted the price continuity theory of liquidity preference, market depth analysis should be based on the framework below

Figure 7.1. Update market depth framework.



Source**:** Black (1971)

7.7 Policy implications and recommendations

As already mentioned, the lack of market depth, market tightness and market resilience in the level 2B common equity securities means that the current LCR and NSFR need to be revised. Setting up an improved LCR and NSFR framework is of paramount importance to curb liquidity risk. These improved ratios should capture the illiquidity of level 2B HQLA, especially the common equity securities. The recommendations are therefore as follows;

The LCR should be adjusted to

$$\text{LCR} = \frac{Level\ 1\ HQLA + Level\ 2\ A\ HQLA + (risk\ coefficient \times level\ 2B\ HQLA)}{Total\ net\ cash\ outflows} \geq 100\%$$

Source: Adapted from BCBS (2010)

$$\text{NSFR} = \frac{Available\ amount\ of\ stable\ funding \times risk\ coefficient}{Required\ amount\ of\ stable\ funding} \geq 100\%$$

Source: Adapted from BCBS (2010)

Where the risk coefficient is given by

$$\text{Risk coefficient} = \left| Cov(\Delta p_t, \Delta p_{t-1}) \right|$$ (adapted from Reilly & Brown, 2003:102)

The above formula is similar to the current LCR and NSFR but includes a risk coefficient to the numerator. The risk coefficient is the absolute value of the coefficient of variation of price changes ($\Delta p_t, \Delta p_{t-1}$). The absolute value of the coefficient measures the normalised value of the price changes away from the mean (Konieczny & Skrzypacz, 2006:7). This risk measure was applied in the study of Marek (2013), where it gave reliable estimates for the coal estimates under consideration. This is in tandem with the views expressed by Duffie (2013:388), who believes that an adequate liquidity standard should include systemic risk. Also, the study of Claassen and Rooyen (2012) on liquidity risk management in South African banks reveals that 66.67% of large banks operating in the country feel the need to revise the current liquidity management strategy where banks should be aware of their liquidity positions daily. In addition, some of the major banks in South Africa think that the current LCR ignores the benefit of diversified portfolios, which may be partly attributed to the absence of a risk coefficient (Claassen and Rooyen, 2012:41). To this end, most large commercial banks indicated the need for additional measures in conjunction with Basel III (Claassen and Rooyen, 2012:42).

The improved LCR and NSFR take into consideration systemic risk, which is captioned risk coefficient. This risk coefficient normalises volatility at any given time and will enable South African banks to determine the level of risk assumed in their level 2B common equity securities. Also, Sanford and Shiller (1981:2) contend that the most appropriate method of capturing price changes in security from market shock or new information is to include a risk measure. In addition, this risk coefficient will also capture the expected drawdowns for level 2B common equity securities. For large order imbalance, the risk coefficient will estimate the sensitivity of trading volume, BIT, SIT and other market factors which may affect the price distribution. This measure should be applied to aggregate data rather than a transaction to transaction basis

because order imbalances do not scale up aggregation data. Although the level 2B common stock equity has a maximum haircut, it still needs to capture the illiquidity premiums where the value of the risk coefficient will be based on the level of illiquidity. For highly liquid assets, the value will be equal to or close to one and vice versa. Banks can use econometric analysis or their internal models to determine the values of these risk coefficients. For the NSFR, the risk coefficient will minimise the volatility of the amount in stable funding hence a more reliable estimate.

Also, the researcher agrees with the price continuity theory of liquidity preference, where Black (1971), supported by Wolfson and Russo (1970:708), advocates for establishing a specialist system to increase market liquidity which means, in the context of this study, establishing a specialist system in South African financial markets. A specialist in financial markets enhances liquidity by always being willing to trade at a reasonable price (Wolfson & Russo, 1970:710). Introducing a specialist system in South Africa will allow multiple orders to be executed quickly, which may not happen in a stock exchange. This system can also execute orders on behalf of the exchange, assuming the role of a trader but with no interest in underwriting operations or trading accounts, as this will impact the bid-ask spread and eventually raise the TC above the 0.1% margin (Black, 1971). According to Wolfson and Russo (1970:709), a specialist system should not be seen as a competitor to the exchange, but on the contrary, a price oligopolist merging demand and supply of a particular security. Merging these demand and supply needs will minimise the makeshift price disparities and enhance a fair and orderly market. Depending on other considerations, the specialist will act as a market dealer administering a price close to the bid, further improving the financial market liquidity (Wolfson & Russo, 1970:712). Therefore, the specialist is expected to add depth, improve the market tightness position, and increase market resilience in the South African markets devoid of these characteristics.

In summary, the implementation of the above recommendations may result in the following;

- The risk coefficient in the new LCR and NSFR will capture the illiquidity premiums in banks that can rely on these ratios to curb liquidity risk.
- The specialist system will induce the bid and ask prices to be close to the fundamental price, facilitating the execution of trades without significantly moving the price.
- The specialist system will further reduce the TC with no significant price effect.

7.8 Contribution of the study

In the South African context, market liquidity in banks is a research area that is almost non-existent because very few studies have been conducted on this topic. The study of Luvuno (2018), Marozva (2017), Claassen and Rooyen (2012), Jacobs (2008) are amongst the very

few studies that have investigated liquidity in South African banks. The empirical study of Luvuno (2018) explored the determinants of liquidity where capital adequacy had a positive effect on the liquidity position while the number of loans granted had a negative effect on liquidity. Marozva (2017) study analysed liquidity in the context of assets and liability mismatch, where the author constructed a new aggregate liquidity mismatch index. This index was based on improved measures of liquidity proposed by Brunnermeier *et al*. (2012), which investigated liquidity from the frontier of funding liquidity and market liquidity based gearing. Marozva (2017) investigated market liquidity in terms of scaled volume of bid and ask spread, including the weights of different assets and liabilities. The author also used the spread between treasury bills and South Africa benchmark overnight rate to investigate the variations in the money market. Claassen and Rooyen (2012) surveyed how banks perceived Base III with no particular emphasis on liquidity ratios, where their study revealed that some banks perceived Basel III to neither be effective nor ineffective.

Furthermore, the study of Jacobs (2008) used questionnaires to investigate the regulatory treatment of liquidity risk in South African banks based on the BASEL II framework. Specifically, Jacobs (2008) investigated the gaps between BASEL II recommendation of liquidity management and practical management of liquidity risk in South African banks. The author also proposed that considering the different nature of sophistications across banks and their different sizes, each bank should develop its liquidity risk models in compliance with the regulatory standards and constantly disclose this risk to the SARB as part of good governance.

Firstly, this study improves the frontier of knowledge regarding liquidity management, particularly financial market liquidity, by empirically investigating the state of the level 2B common equity securities as proposed in the Basel III reform for liquidity management. The financial market liquidity of liquid assets cannot be appropriately measured without empirical evidence of market depth, market tightness and resilience because these components are the main drivers of liquidity. Furthermore, the fixed-effect model used was a deep, exquisite, comprehensive and outstanding method in estimating market liquidity which is a leap from BASEL III and other traditional liquidity measures as it captures the liquidity spirals. Also, the paradigm used in estimating market liquidity includes the effect of high-frequency trading on price distribution and price effect free from size bias. Therefore, this study empirically advances the body of knowledge by using a pragmatic and intuitive measure.

Secondly, the two modified liquidity ratios proposed in this study integrate systemic risk, which captures illiquidity premiums. These new ratios are a notable advancement of the existing LCR and NSFR, which can be relied on in periods of stress. Also, these measures can be used to predict how banks will emerge out of crises in the context of the specific level 2B common

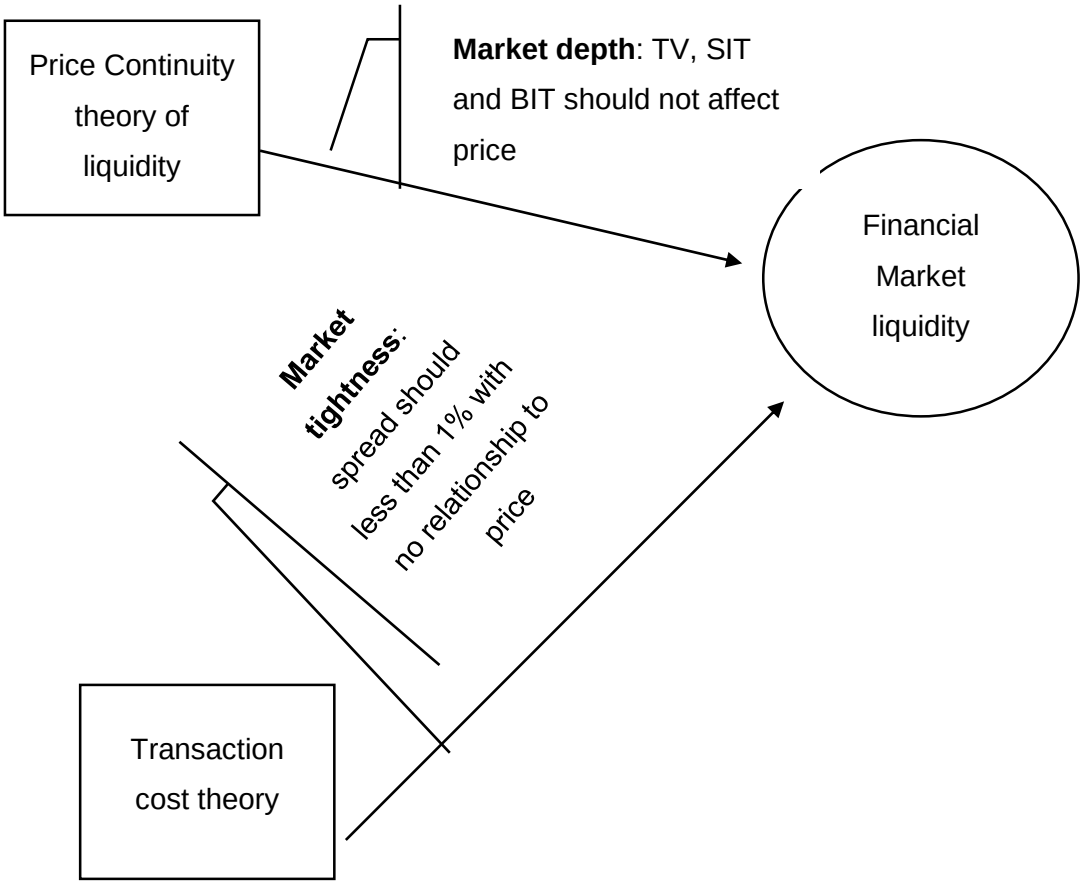
equity liquidation. The risk coefficient considers how banks can incur losses when liquidating their level 2B common equities, which portrays an accurate picture of a non-friction market. Additionally, this study introduced the concept of reporting the state of market liquidity in the CFP framework, which is vital for promoting liquidity risk management in banking.

Thirdly, this study provides valuable insights to the BASEL committee as they will be made aware of how to improve the existing LCR and NSFR measures. With this awareness, the BASEL committee may amend its current regulation or devise new interventions, especially revising the LCR and NSFR to include risk coefficients that may help provide a more resilient system. Notably, the implementation of Basel IV, which will come into effect on the 1st of January 2023, may adopt this new method of estimating market liquidity in the banking sector. In addition, this new approach may be beneficial to South African banks, enabling them to prove their long-term sustainable value.

Fourthly, this study will also contribute to the body of knowledge on financial market liquidity management where it is one of the few studies conducted in the South African context to empirically investigate the financial market liquidity of the level 2B HQLA focusing on level 2B common equity securities for South African banks. In addition, the study has introduced to the academic literature another framework for evaluating liquidity based on the price impact and price distribution. Therefore, this study has uniquely re-contextualised liquidity despite the shortcomings in the BASEL III policy framework.

This study makes a noteworthy contribution by testing the effectiveness of these theories in the South African market. Moreover, this is the first study (as per the author's knowledge) to systematically contextualise these theories in explaining financial market liquidity, thus new insight. Therefore, this study proposes a new framework for estimating market liquidity, as shown below.

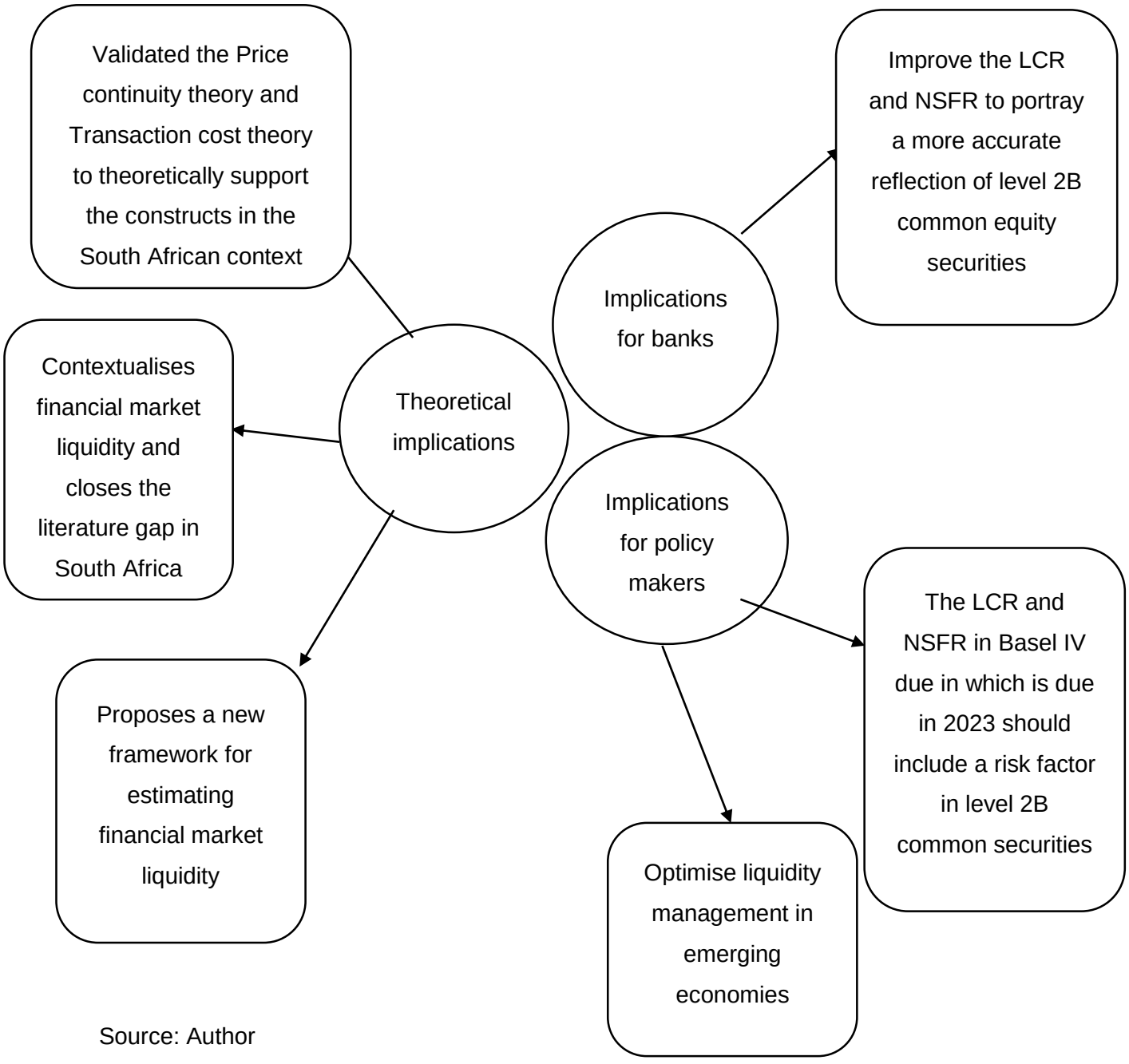
Figure 7.2. Financial market liquidity framework



Source: Author

Lastly, this study is of significant interest to the SARB and risk departments in the various banks considering that these different bodies undertake the task of formulating and implementing new legislation and guidelines in managing liquidity risk. The current study's findings provide invaluable insights on the current status, which may be used to inform future guidelines concerning liquidity management and reporting. This is especially crucial as previous interventions from the Basel committee have had limited success, as alluded to in the literature. Where appropriate, the findings may be embedded into the reporting and guidelines of liquidity management. By pinpointing these shortcomings, this study will change the context of financial market liquidity management in South Africa and make a noteworthy contribution. A summary of the contribution of this study is depicted below.

Figure 7.3. Contribution of study



Source: Author

7.9 Limitation and recommendation of future research

Despite the significant insights presented in the current study, the following limitations are highlighted below.

- The current findings reflect the financial market liquidity position of qualifying level 2B common equities in the South African market, which may not be generalisable to other emerging markets and European banks.
- Market immediacy, which is another component of liquidity, was excluded in this study. However, this concept was another important theme of liquidity; therefore, the conclusions of this study may not present the complete liquidity position.
- Due to the difficulty in disclosing the specific common stock equity used in level 2B, the study used all the common stock equity that met the requirements of HQLA. Therefore, one shortcoming may be that certain securities used in this study are not probably part of current LCR and NSFR bank holdings.
- Further research can test the new ratio by calculating the LCR and NSFR with and without the risk coefficients to determine if there is any significant difference.

Irrespective of the limitations mentioned above, the findings of this study contribute significantly to the understanding of financial market liquidity of common equities in commercial banks in South Africa. It can therefore be concluded that the above limitations have a limited effect when benchmarking to the key findings made in this study, particularly in the area of market depth, market tightness and market resilience in South Africa, where little research has been done.

The above limitations also present conceivable areas for future research. From the research findings and conclusion, this study assumes that market depth, market tightness and market resilience are the only determinants of market liquidity. Future research should include market immediacy to have a complete liquidity picture. Also, specific level 2B common equity securities for each bank should be used to have an in-depth understanding of the liquidity position. Finally, future research should consider a comparative study where the financial market liquidity for emerging market banks is benchmarked.

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APPENDICES

Appendix A

Daily Market and Risky asset returns for period under consideration.

Risky equity 1	Risky equity 2	Risky equity 3	Market returns
-5.00%	0.91%	-3.00%	-0.25%
-5.00%	8.11%	1.01%	1.04%
15.79%	-0.83%	-1.97%	0.08%
4.55%	0.00%	-1.12%	-1.10%
21.74%	0.00%	0.18%	-0.04%
0.00%	-2.52%	-0.32%	0.65%
-10.71%	-9.48%	-2.07%	1.20%
-4.00%	0.00%	2.96%	-0.24%
-4.17%	0.00%	-0.87%	-0.61%
0.00%	0.00%	-1.99%	0.92%
0.00%	0.00%	-1.50%	0.31%
13.04%	-3.71%	6.24%	0.17%
0.00%	0.00%	0.17%	0.51%
3.85%	0.00%	-2.86%	-0.61%
0.00%	-0.10%	-1.21%	-0.06%
-3.70%	0.00%	0.26%	-1.66%
7.69%	6.44%	-0.06%	0.09%
0.00%	5.12%	-2.23%	0.97%
0.00%	0.00%	0.04%	0.33%
7.14%	0.00%	-0.57%	0.11%
-3.33%	-2.65%	-0.04%	-0.13%
0.00%	2.73%	-1.02%	-1.02%
-3.45%	0.00%	-2.67%	-0.34%
-3.57%	0.00%	2.46%	0.64%
0.00%	0.00%	-0.60%	0.26%
0.00%	0.53%	1.82%	0.00%
0.00%	21.94%	-0.81%	-0.46%

0.00%	-4.90%	-1.30%	-0.50%
14.81%	0.00%	0.83%	-1.44%
-19.35%	0.00%	1.02%	0.76%
20.00%	0.00%	-0.13%	-0.15%
0.00%	-0.08%	-1.36%	0.28%
0.00%	0.00%	-0.88%	-0.58%
0.00%	-5.70%	-2.48%	1.14%
-10.00%	0.00%	1.51%	-0.87%
3.70%	-3.67%	1.10%	-3.17%
3.57%	0.00%	-1.35%	0.01%
6.90%	0.00%	-0.37%	1.72%
-3.23%	-2.54%	-2.81%	-0.85%
0.00%	1.30%	0.18%	-0.54%
0.00%	0.00%	-0.11%	-1.01%
0.00%	0.00%	-1.11%	-0.51%
6.67%	0.00%	6.35%	-0.05%
0.00%	0.00%	-6.51%	-0.43%
9.38%	0.00%	-2.05%	0.82%
0.00%	3.00%	-0.10%	0.03%
2.86%	0.00%	1.40%	2.54%
-2.78%	0.00%	3.09%	1.77%
0.00%	0.00%	0.35%	-0.31%
-2.86%	0.00%	-2.82%	-0.16%
2.94%	0.00%	0.80%	-0.35%
8.57%	0.00%	-1.51%	-3.10%
-2.63%	0.00%	-2.01%	-2.94%
0.00%	0.00%	2.06%	-1.45%
0.00%	1.67%	-0.66%	1.84%
8.11%	-1.56%	-0.04%	1.06%
-2.50%	0.00%	-1.72%	0.67%
-2.56%	0.00%	0.83%	0.67%
2.63%	-0.08%	-3.39%	0.82%
-12.82%	0.00%	1.03%	-0.37%
14.71%	0.42%	-0.36%	-1.34%
0.00%	0.00%	9.50%	-0.09%
-10.26%	-0.41%	6.21%	0.35%

0.00%	0.42%	1.08%	-0.59%
11.43%	0.00%	-1.24%	-1.15%
0.00%	0.00%	2.75%	2.30%
-5.13%	0.00%	-7.11%	3.49%
-2.70%	0.00%	-2.98%	-0.03%
0.00%	0.00%	0.00%	-0.25%
0.00%	0.00%	2.22%	1.52%
8.33%	0.00%	0.19%	0.06%
0.00%	0.00%	-0.30%	-0.71%
-7.69%	0.00%	-0.74%	-1.91%
8.33%	0.00%	0.14%	2.17%
0.00%	0.00%	0.00%	-0.82%
0.00%	0.00%	0.00%	-2.72%
0.00%	0.00%	1.47%	-0.53%
-7.69%	0.41%	0.24%	-2.72%
0.00%	0.00%	0.83%	-0.39%
0.00%	0.00%	0.00%	0.33%
0.00%	0.00%	0.11%	-0.09%
8.33%	0.00%	-1.50%	0.90%
-5.13%	2.48%	-3.26%	0.41%
5.41%	-2.42%	1.44%	0.06%
0.00%	0.00%	-2.29%	1.92%
0.00%	0.00%	0.37%	0.69%
2.56%	9.50%	1.70%	0.58%
-12.50%	9.43%	0.54%	-2.70%
0.00%	-10.34%	2.43%	-0.04%
0.00%	0.00%	2.95%	0.21%
0.00%	0.00%	-1.43%	-0.38%
0.00%	0.08%	-1.60%	1.20%
0.00%	0.00%	2.22%	-0.24%
0.00%	0.00%	-2.50%	-0.11%
0.00%	0.00%	-0.43%	-0.90%
5.71%	0.00%	-0.75%	-1.14%
0.00%	11.07%	-2.91%	-1.03%
-2.70%	-3.11%	0.87%	0.54%
0.00%	0.07%	-1.06%	-1.76%

0.00%	1.71%	-2.41%	2.34%
-5.56%	0.00%	-1.65%	0.99%
0.00%	0.00%	3.55%	0.63%
0.00%	-1.40%	-0.46%	-0.09%
2.94%	0.14%	0.67%	0.44%
0.00%	0.00%	0.34%	-0.70%
0.00%	6.61%	1.93%	0.53%
-5.71%	0.00%	-2.24%	2.99%
6.06%	-6.67%	2.07%	-1.21%
-5.71%	0.00%	2.45%	1.43%
-3.03%	0.00%	0.28%	-0.32%
0.00%	0.36%	-2.23%	0.34%
0.00%	0.00%	-1.45%	0.00%
0.00%	-0.36%	-0.29%	0.00%
0.00%	0.00%	-1.37%	-0.25%
0.00%	0.07%	4.96%	0.67%
0.00%	0.00%	2.70%	-0.42%
-6.25%	1.36%	-1.47%	-0.74%
0.00%	-1.41%	-0.25%	0.42%
-3.33%	0.00%	-2.15%	1.21%
3.45%	0.00%	2.40%	-0.83%
0.00%	-7.14%	-1.51%	0.52%
0.00%	0.00%	-1.32%	1.65%
0.00%	0.00%	-3.93%	-0.56%
0.00%	3.85%	-0.98%	-2.66%
0.00%	-3.70%	-1.56%	0.56%
-13.33%	2.46%	-2.51%	0.08%
7.69%	0.00%	-0.67%	3.73%
0.00%	0.00%	2.18%	-0.88%
0.00%	1.43%	0.86%	-1.52%
-7.14%	0.07%	4.02%	-1.86%
3.85%	-3.77%	-0.39%	-0.24%
11.11%	7.61%	-0.22%	0.72%
-13.33%	0.00%	-1.21%	1.39%
0.00%	0.00%	-0.14%	-1.47%
11.54%	0.00%	-0.74%	-0.17%

-10.34%	0.00%	-2.01%	-1.67%
0.00%	0.00%	-0.80%	-0.91%
7.69%	-1.00%	-0.78%	-3.35%
7.14%	0.07%	0.48%	-1.77%
-6.67%	-7.71%	1.35%	-1.37%
7.14%	1.56%	0.24%	-0.71%
0.00%	0.00%	0.78%	1.08%
0.00%	-2.31%	-0.20%	1.94%
0.00%	0.00%	-0.58%	0.89%
0.00%	10.24%	1.25%	1.04%
0.00%	-0.07%	4.88%	1.02%
0.00%	-0.64%	1.11%	-0.12%
-3.33%	0.00%	-1.09%	2.30%
-10.34%	0.00%	0.66%	0.13%
0.00%	0.00%	1.03%	1.08%
0.00%	-8.56%	0.44%	-1.90%
7.69%	0.00%	-0.09%	-1.28%
-7.14%	0.00%	-3.86%	-0.78%
0.00%	0.00%	-2.06%	-0.19%
11.54%	-0.08%	-0.92%	1.84%
0.00%	0.00%	-0.78%	-0.42%
-3.45%	0.00%	5.30%	0.17%
0.00%	0.00%	-0.88%	-0.18%
0.00%	0.00%	3.28%	0.06%
0.00%	-6.38%	-1.29%	1.06%
0.00%	0.00%	0.00%	0.83%
0.00%	-0.76%	0.19%	-0.36%
-7.14%	-6.78%	1.01%	-0.49%
3.85%	5.45%	1.35%	-1.23%
-3.70%	0.00%	-0.72%	3.12%
0.00%	-1.29%	0.36%	-4.24%
3.85%	0.00%	0.22%	1.62%
-3.70%	-1.75%	-2.22%	0.32%
0.00%	-2.13%	0.44%	-0.32%
7.69%	1.73%	-1.17%	2.44%
0.00%	-1.79%	-0.24%	0.29%

0.00%	0.00%	0.53%	-0.38%
-7.14%	0.00%	-1.33%	0.14%
7.69%	0.00%	3.16%	2.05%
0.00%	19.91%	6.16%	0.16%
0.00%	0.00%	-0.93%	-1.44%
0.00%	-0.68%	0.89%	-0.99%
-7.14%	1.37%	-0.48%	-2.08%
-7.69%	0.00%	-1.27%	-0.09%
-4.17%	0.00%	0.46%	-0.21%
0.00%	0.00%	0.69%	0.91%
-8.70%	-17.32%	-1.19%	1.67%
0.00%	0.00%	-2.82%	0.08%
0.00%	-4.74%	0.79%	-0.42%
0.00%	0.00%	1.63%	1.68%
0.00%	0.00%	-1.39%	-0.19%
9.52%	-0.76%	-1.78%	4.00%
-17.39%	0.00%	-5.67%	0.09%
26.32%	0.00%	-1.18%	1.05%
0.00%	0.00%	2.04%	0.33%
-20.83%	-6.55%	-0.53%	-3.95%
0.00%	-16.70%	1.52%	-1.99%
0.00%	23.76%	-1.80%	-0.47%
0.00%	0.00%	-1.65%	-1.84%
0.00%	0.00%	0.00%	3.59%
0.00%	-3.00%	0.47%	-0.71%
0.00%	-1.13%	0.60%	-1.12%
0.00%	0.52%	1.83%	-0.40%
0.00%	-1.76%	0.08%	-0.25%
0.00%	0.00%	-0.87%	0.09%
0.00%	-4.12%	-1.40%	3.04%
0.00%	0.00%	1.74%	-4.77%
5.26%	0.00%	1.26%	0.72%
-30.00%	3.52%	-1.21%	-0.63%
0.00%	-3.40%	1.59%	-0.78%
42.86%	0.00%	1.89%	0.18%
-25.00%	0.00%	0.23%	0.16%

13.33%	-0.88%	0.93%	-0.43%
0.00%	0.00%	-0.03%	0.00%
0.00%	0.00%	-0.14%	1.00%
0.00%	0.00%	-0.68%	2.80%
-5.88%	1.11%	-2.32%	-4.90%
25.00%	-1.10%	-0.06%	-2.16%
0.00%	0.00%	1.55%	2.66%
15.00%	0.00%	0.22%	1.59%
17.39%	0.00%	0.40%	-1.17%
0.00%	0.56%	-1.54%	1.89%
0.00%	0.00%	0.91%	2.44%
0.00%	0.00%	1.03%	0.09%
0.00%	0.00%	-1.38%	1.69%
0.00%	0.00%	0.86%	-0.79%
0.00%	0.00%	-1.47%	1.35%
0.00%	0.00%	0.92%	1.99%
0.00%	0.00%	-0.50%	0.18%
0.00%	-0.55%	0.18%	0.00%
0.00%	0.00%	-2.44%	-2.11%
0.00%	-8.78%	1.21%	-0.29%
0.00%	9.01%	0.75%	1.43%
0.00%	-2.23%	0.65%	1.03%
0.00%	-3.77%	1.61%	-2.96%
0.00%	-9.14%	1.77%	2.37%
-33.33%	4.58%	-1.07%	1.29%
0.00%	0.00%	0.00%	-1.15%
0.00%	-3.75%	-2.19%	-0.06%
0.00%	0.00%	-0.27%	0.27%
11.11%	23.38%	-0.87%	-2.16%
-20.00%	7.89%	-1.51%	1.42%
25.00%	2.44%	0.45%	3.76%
25.00%	-4.76%	-1.78%	2.58%
0.00%	-2.00%	-0.83%	-3.23%
0.00%	7.14%	-0.73%	1.68%
-12.00%	-0.86%	1.98%	-0.46%
0.00%	0.00%	1.06%	1.57%

0.00%	4.03%	-9.81%	-4.95%
0.00%	0.00%	2.87%	0.23%
9.09%	-2.59%	-0.73%	2.03%
0.00%	0.00%	1.28%	-5.53%
0.00%	0.00%	-0.63%	-0.61%
0.00%	-0.47%	2.65%	-0.54%
-8.33%	0.00%	-0.80%	0.13%
0.00%	0.00%	1.67%	0.23%
0.00%	0.95%	0.55%	-1.69%
18.18%	-0.94%	-0.86%	2.46%
0.00%	0.00%	1.27%	-2.81%
-3.85%	-4.76%	2.58%	-1.94%
8.00%	0.00%	-1.37%	0.44%
0.00%	-2.00%	-0.42%	-1.57%
0.00%	0.00%	-0.43%	-1.46%
0.00%	0.00%	-1.87%	0.00%
-7.41%	0.00%	-1.51%	2.20%
0.00%	4.08%	0.92%	0.98%
-12.00%	2.94%	0.34%	-0.54%
18.18%	1.94%	-1.11%	-3.06%
0.00%	0.00%	-2.46%	-1.68%
-15.38%	0.00%	-0.17%	-4.70%
0.00%	0.00%	0.00%	-2.63%
0.00%	0.00%	-2.12%	-1.03%
0.00%	-1.90%	0.32%	2.62%
13.64%	1.94%	-0.22%	2.57%
0.00%	0.00%	1.27%	0.96%
-4.00%	0.95%	-0.83%	5.53%
0.00%	0.00%	-0.89%	-3.60%
-8.33%	0.00%	0.51%	-3.31%
0.00%	3.77%	0.02%	3.21%
0.00%	0.00%	2.01%	4.73%
0.00%	0.00%	-1.64%	0.05%
0.00%	15.91%	-0.44%	-5.85%
-4.55%	1.88%	1.27%	0.37%
-9.52%	-3.77%	0.00%	5.64%

10.53%	0.00%	1.52%	0.37%
0.00%	0.40%	-0.84%	2.40%
0.00%	3.59%	-0.66%	2.36%
0.00%	0.00%	1.25%	-5.43%
0.00%	0.00%	0.05%	-1.78%
0.00%	0.00%	1.02%	-1.29%
0.00%	1.08%	-0.39%	-5.79%
0.00%	0.38%	0.39%	-1.46%
0.00%	5.38%	-0.41%	-1.74%
-14.29%	-9.71%	0.90%	3.41%
11.11%	0.08%	0.36%	1.07%
0.00%	0.72%	0.05%	1.93%
0.00%	0.00%	-0.87%	-0.33%
0.00%	3.56%	-2.05%	-3.01%
0.00%	0.00%	0.58%	-4.84%
-5.00%	1.53%	2.15%	-0.89%
5.26%	-1.13%	-0.06%	-1.85%
-10.00%	0.76%	0.23%	2.92%
0.00%	0.00%	-4.20%	-1.49%
-5.56%	-0.38%	-1.37%	9.67%
-5.88%	0.38%	-4.26%	-3.49%
0.00%	4.15%	-0.89%	1.95%
0.00%	0.14%	-2.94%	-2.18%
6.25%	0.22%	-3.16%	-2.12%
0.00%	-2.53%	2.65%	1.86%
5.88%	0.00%	1.70%	0.36%
-5.56%	0.00%	0.07%	0.29%
0.00%	0.00%	1.23%	0.69%
-5.88%	0.00%	2.32%	-2.41%
-12.50%	0.00%	-0.80%	-1.48%
21.43%	0.00%	-0.20%	2.00%
0.00%	0.00%	-2.52%	6.74%
0.00%	1.48%	1.03%	-4.40%
0.00%	0.36%	2.65%	0.50%
-11.76%	-1.75%	-0.42%	4.21%
13.33%	-0.07%	-0.80%	-1.59%

0.00%	0.00%	-9.96%	-0.03%
0.00%	-0.07%	-9.15%	0.76%
-5.88%	0.07%	-61.42%	0.53%
0.00%	0.00%	-43.21%	-0.78%
-25.00%	0.00%	-40.00%	1.24%
33.33%	0.00%	55.83%	0.10%
0.00%	0.00%	25.78%	0.33%
0.00%	0.00%	-16.67%	-0.51%
0.00%	-3.63%	-8.98%	3.95%
0.00%	-0.08%	-9.98%	0.14%
0.00%	0.00%	5.60%	-1.05%
0.00%	0.00%	-17.45%	-1.28%
0.00%	0.00%	-34.00%	0.46%
0.00%	0.00%	-1.08%	-1.23%
0.00%	0.00%	2.41%	0.32%
0.00%	0.00%	0.00%	1.50%
0.00%	0.00%	0.00%	0.50%
0.00%	0.00%	-1.28%	-0.50%
0.00%	0.00%	1.08%	1.02%
-25.00%	0.00%	-0.43%	0.76%
25.00%	-1.08%	7.53%	0.75%
0.00%	-0.08%	37.40%	1.43%
-13.33%	0.08%	25.18%	3.65%
0.00%	0.00%	2.33%	-1.04%
-7.69%	1.09%	-1.36%	1.26%
0.00%	0.00%	-13.02%	-0.44%
-16.67%	0.00%	0.00%	-1.93%
30.00%	0.00%	-10.60%	-0.77%
15.38%	0.00%	-7.85%	-1.34%
0.00%	0.00%	-4.82%	-0.63%
0.00%	0.00%	-1.01%	-0.80%
-13.33%	0.00%	12.29%	-0.78%
15.38%	0.00%	5.02%	2.56%
0.00%	0.00%	10.13%	1.69%
0.00%	0.00%	7.75%	0.96%
0.00%	0.00%	-4.39%	0.34%

-6.67%	0.00%	-4.08%	2.07%
0.00%	0.00%	-1.06%	-0.83%
0.00%	0.00%	1.48%	0.69%
-14.29%	0.00%	1.32%	-1.61%
-8.33%	0.00%	-13.07%	0.43%
-9.09%	-0.23%	-0.30%	1.45%
0.00%	0.23%	1.81%	1.00%
0.00%	0.00%	-2.52%	-0.62%
0.00%	0.00%	-6.53%	-5.10%
0.00%	-0.77%	-0.49%	2.27%
0.00%	-0.08%	10.13%	-0.08%
0.00%	0.00%	-10.68%	-2.22%
0.00%	0.00%	-1.66%	4.04%
0.00%	0.08%	-6.25%	0.21%
0.00%	-2.71%	-2.70%	-1.65%
0.00%	2.63%	-2.22%	-0.97%
0.00%	0.16%	4.92%	0.64%
20.00%	0.00%	-1.81%	0.59%
0.00%	0.00%	0.00%	2.97%
-25.00%	0.00%	-3.49%	0.00%
11.11%	0.00%	-9.90%	-0.06%
0.00%	0.00%	0.85%	-0.59%
0.00%	0.78%	10.69%	2.77%
20.00%	-0.08%	7.01%	1.49%
0.00%	-0.08%	2.30%	1.19%
0.00%	-0.69%	0.35%	0.26%
-16.67%	0.85%	-12.07%	-0.13%
0.00%	3.85%	-19.41%	-0.12%
0.00%	0.00%	7.30%	0.53%
0.00%	0.00%	1.59%	-0.07%
0.00%	7.41%	-4.69%	-1.26%
0.00%	3.10%	-0.47%	0.59%
10.00%	-0.07%	0.47%	1.37%
0.00%	4.42%	3.04%	-0.13%
0.00%	-0.32%	-3.41%	0.30%
0.00%	-0.64%	1.18%	0.97%

0.00%	0.00%	-3.49%	-1.15%
0.00%	3.56%	-1.69%	-0.36%
0.00%	0.00%	-4.66%	-0.34%
0.00%	-1.56%	-8.74%	0.34%
-9.09%	-4.76%	-12.96%	-0.82%
0.00%	0.00%	0.00%	1.47%
-10.00%	0.00%	3.56%	-2.16%
11.11%	0.00%	0.00%	-0.20%
0.00%	0.00%	1.56%	1.76%
0.00%	-0.07%	1.54%	1.31%
10.00%	-0.13%	1.52%	0.53%
0.00%	1.43%	-9.85%	-0.30%
-9.09%	0.00%	1.66%	-0.03%
10.00%	-0.20%	0.98%	0.40%
0.00%	0.00%	-4.19%	-2.03%
27.27%	-6.04%	-15.49%	0.82%
0.00%	3.50%	-3.98%	-0.99%
0.00%	0.00%	1.66%	0.33%
14.29%	2.83%	-11.84%	0.01%
-6.25%	0.67%	-6.02%	-1.94%
6.67%	-0.20%	14.78%	1.19%
6.25%	0.07%	5.15%	0.60%
-5.88%	-1.87%	4.49%	0.88%
0.00%	-2.04%	1.95%	-1.81%
0.00%	-2.78%	-15.33%	-0.11%
-6.25%	3.57%	-0.90%	1.25%
0.00%	-1.38%	0.91%	0.78%
0.00%	0.00%	-11.31%	0.47%
-6.67%	0.00%	-2.04%	-1.16%
0.00%	3.85%	8.33%	-0.93%
-28.57%	-0.74%	0.96%	0.56%
0.00%	0.07%	-9.05%	0.30%
0.00%	-1.69%	-0.52%	1.27%
0.00%	2.41%	-4.21%	0.27%
0.00%	-0.74%	-0.55%	0.63%
0.00%	-0.27%	-3.87%	1.82%

20.00%	0.00%	-8.05%	-1.32%
0.00%	0.00%	-0.63%	-0.80%
25.00%	-0.07%	-4.40%	-1.75%
13.33%	-3.34%	3.95%	2.52%
0.00%	-1.76%	1.27%	-0.64%
0.00%	-0.50%	12.50%	-1.31%
0.00%	0.00%	-6.11%	-0.57%
0.00%	-0.14%	-0.59%	-0.84%
0.00%	0.00%	-7.74%	-1.09%
0.00%	-0.51%	-3.87%	0.21%
0.00%	-0.73%	-2.01%	0.96%
0.00%	-2.48%	-2.05%	-2.81%
0.00%	-8.01%	-9.09%	-1.48%
17.65%	1.79%	-1.54%	-1.49%
0.00%	9.20%	-12.50%	0.48%
0.00%	-0.37%	2.68%	-2.89%
-5.00%	0.00%	-6.96%	0.47%
0.00%	-0.81%	9.35%	0.00%
0.00%	0.00%	-2.56%	-0.28%
0.00%	0.00%	11.40%	-0.29%
0.00%	0.00%	-2.36%	1.57%
0.00%	0.00%	4.03%	0.19%
0.00%	0.00%	0.00%	-0.68%
0.00%	0.07%	-3.10%	0.08%
0.00%	-3.56%	0.00%	1.37%
-5.26%	-0.15%	-3.20%	0.63%
0.00%	0.00%	0.83%	-0.33%
0.00%	0.00%	2.46%	1.35%
-5.56%	0.00%	-0.80%	-1.72%
0.00%	0.00%	-1.61%	2.02%
5.88%	0.00%	2.46%	1.72%
0.00%	0.00%	-0.80%	1.78%
0.00%	2.31%	0.81%	0.10%
-5.56%	0.00%	-1.60%	0.60%
0.00%	-9.70%	-1.63%	1.38%
0.00%	7.91%	6.61%	1.94%

0.00%	-0.08%	6.20%	1.50%
0.00%	0.31%	31.39%	-0.44%
-11.76%	0.00%	-2.22%	1.09%
0.00%	0.00%	-9.09%	2.95%
0.00%	6.24%	4.38%	-1.07%
0.00%	0.00%	4.79%	-1.04%
0.00%	-0.07%	6.86%	1.70%
0.00%	1.52%	20.86%	-0.96%
0.00%	0.00%	27.43%	0.89%
0.00%	0.00%	8.33%	0.54%
-6.67%	0.00%	-5.45%	-2.28%
0.00%	-0.79%	-4.41%	-2.07%
0.00%	0.00%	6.38%	2.26%
-21.43%	0.00%	18.67%	-1.85%
27.27%	0.00%	-9.27%	2.13%
0.00%	0.00%	-14.24%	1.04%
-7.14%	-0.29%	-22.38%	0.04%
7.69%	-0.07%	13.95%	0.45%
7.14%	-0.36%	1.63%	0.00%
-20.00%	0.07%	0.00%	-0.36%
0.00%	0.00%	4.42%	-1.79%
0.00%	-0.72%	-4.23%	-1.90%
25.00%	-2.19%	0.40%	-0.36%
0.00%	-0.15%	-4.00%	10.58%
0.00%	4.63%	2.08%	-0.11%
0.00%	-0.36%	-0.82%	-0.29%
0.00%	0.00%	-4.94%	-0.02%
-6.67%	-0.36%	1.30%	-3.03%
0.00%	-0.43%	-5.13%	0.76%
0.00%	-3.25%	-2.70%	0.64%
0.00%	-2.17%	-3.70%	0.00%
0.00%	-1.15%	-1.92%	1.03%
0.00%	0.00%	-3.43%	-0.20%
0.00%	1.16%	18.78%	0.21%
0.00%	0.00%	-5.56%	-0.34%
-14.29%	2.29%	-0.90%	-0.64%

0.00%	0.00%	-0.91%	1.56%
0.00%	0.00%	0.92%	-1.20%
25.00%	0.00%	5.48%	0.45%
13.33%	0.00%	-2.16%	0.55%
5.88%	0.75%	-2.65%	-1.37%
-5.56%	-0.74%	25.00%	-0.94%
0.00%	0.00%	3.27%	-0.04%
-5.88%	4.33%	-1.41%	-0.40%
0.00%	0.00%	-7.50%	-0.35%
0.00%	-2.72%	1.16%	-0.16%
0.00%	-1.47%	5.73%	-0.08%
0.00%	0.00%	-6.14%	-0.11%
0.00%	0.00%	-4.23%	2.06%
0.00%	-1.79%	-1.61%	0.06%
0.00%	-0.08%	0.00%	1.23%
-6.25%	0.00%	-0.82%	0.82%
0.00%	-1.90%	1.23%	-0.76%
-6.67%	0.78%	2.44%	-1.27%
7.14%	-5.38%	6.75%	1.37%
0.00%	1.63%	2.60%	-0.27%
0.00%	1.63%	0.00%	-3.44%
0.00%	0.00%	-7.97%	0.18%
0.00%	0.00%	-2.76%	-2.21%
0.00%	2.96%	2.02%	0.70%
13.33%	0.00%	-0.40%	1.95%
0.00%	0.00%	-4.38%	-0.63%
0.00%	0.00%	-4.17%	0.93%
0.00%	-6.76%	0.87%	1.17%
29.41%	7.25%	-1.72%	-0.01%
9.09%	-6.76%	1.75%	0.87%
-37.50%	4.17%	0.43%	-1.87%
-13.33%	0.00%	6.44%	-1.36%
30.77%	-4.00%	-1.21%	0.98%
-11.76%	0.00%	-4.08%	-1.71%
0.00%	-4.17%	-5.11%	0.85%
6.67%	0.00%	-6.28%	0.08%

0.00%	0.00%	-4.31%	-1.42%
0.00%	11.91%	-1.00%	0.86%
-6.25%	-6.76%	6.06%	-0.53%
0.00%	0.00%	-4.29%	-0.01%
0.00%	7.25%	7.46%	-1.87%
0.00%	0.00%	1.85%	0.46%
-13.33%	0.00%	-1.36%	-4.09%
0.00%	-6.76%	-3.69%	2.04%
15.38%	0.00%	-1.91%	0.50%
0.00%	-0.83%	-2.93%	2.58%
6.67%	7.48%	0.00%	0.02%
-6.25%	0.63%	-2.51%	1.99%
0.00%	-0.93%	0.52%	1.95%
0.00%	0.00%	-7.69%	1.02%
0.00%	0.00%	9.44%	5.68%
0.00%	0.00%	-1.52%	-1.72%
0.00%	0.00%	-0.52%	-0.45%
13.33%	-1.18%	-4.66%	2.81%
0.00%	1.19%	-1.09%	0.57%
0.00%	-3.92%	-3.85%	1.26%
0.00%	0.00%	-1.14%	-0.24%
0.00%	4.00%	-5.20%	0.00%
-11.76%	1.02%	3.05%	-0.71%
0.00%	-1.32%	13.02%	0.65%
0.00%	0.39%	-1.05%	0.31%
0.00%	0.00%	-3.17%	0.00%
13.33%	0.00%	8.20%	0.96%
0.00%	0.00%	-7.58%	1.22%
0.00%	-0.39%	-0.55%	-0.25%
0.00%	0.00%	2.20%	1.13%
0.00%	0.00%	-2.15%	-1.37%
0.00%	0.00%	4.40%	-2.14%
-11.76%	-3.46%	-0.53%	-1.38%
6.67%	0.00%	-1.06%	-0.89%
0.00%	0.00%	-2.14%	0.62%
0.00%	0.00%	-2.73%	-1.94%

0.00%	-2.12%	1.12%	-0.01%
12.50%	0.00%	0.00%	1.75%
0.00%	0.00%	-1.11%	1.52%
-16.67%	0.00%	-10.11%	-1.17%
26.67%	-4.17%	-2.50%	1.38%
0.00%	0.00%	-4.49%	0.70%
-21.05%	0.00%	2.68%	1.25%
0.00%	4.35%	16.34%	-0.22%
0.00%	-4.17%	-2.81%	-0.19%
0.00%	0.00%	1.16%	1.11%
-6.67%	0.00%	-2.86%	0.66%
-14.29%	-4.35%	-2.35%	-2.13%
0.00%	15.45%	-1.81%	3.20%
8.33%	-0.08%	0.61%	1.59%
-7.69%	0.00%	4.27%	0.30%
16.67%	0.00%	-4.09%	-0.12%
0.00%	0.00%	3.66%	0.00%
0.00%	-0.32%	1.18%	0.30%
-7.14%	0.00%	-4.07%	-0.22%
0.00%	0.00%	3.03%	0.25%
0.00%	0.00%	0.00%	-0.50%
0.00%	0.00%	0.00%	0.00%
7.69%	-0.40%	-0.59%	0.06%
7.14%	0.00%	-1.18%	-0.27%
0.00%	0.00%	1.20%	1.11%
0.00%	-4.76%	0.59%	-0.59%
0.00%	0.00%	2.94%	-0.15%
0.00%	0.00%	6.29%	-0.50%
0.00%	0.00%	10.22%	-1.66%
0.00%	1.25%	-10.73%	1.36%
0.00%	0.00%	4.37%	-1.82%
0.00%	-9.38%	-1.57%	-0.41%
0.00%	0.00%	-1.60%	1.17%
0.00%	0.00%	1.08%	-0.31%
0.00%	-1.00%	0.53%	0.58%
0.00%	0.00%	-1.60%	-1.64%

0.00%	0.00%	-0.54%	0.20%
0.00%	0.00%	-0.54%	1.03%
0.00%	-3.67%	-0.55%	1.34%
0.00%	14.19%	-8.79%	0.30%
0.00%	-12.34%	3.01%	-0.45%
0.00%	4.66%	-1.17%	-2.71%
0.00%	0.00%	0.59%	-1.05%
-6.67%	0.00%	1.18%	1.86%
0.00%	-4.55%	1.74%	1.83%
0.00%	0.00%	-4.57%	1.43%
0.00%	4.76%	2.40%	0.90%
0.00%	0.00%	-0.58%	-1.55%
0.00%	0.00%	0.59%	3.41%
0.00%	-0.09%	0.58%	-0.87%
0.00%	-3.55%	5.23%	-4.00%
0.00%	3.68%	2.21%	-0.53%
-7.14%	0.00%	3.24%	0.17%
0.00%	0.09%	-0.52%	-0.17%
0.00%	7.27%	-3.16%	0.18%
0.00%	-0.51%	1.09%	-0.62%
0.00%	0.00%	5.91%	0.62%
0.00%	0.00%	9.14%	1.52%
0.00%	0.00%	0.47%	-0.81%
0.00%	0.00%	-4.63%	1.12%
0.00%	0.00%	1.94%	-0.30%
0.00%	0.00%	-2.38%	-2.26%
0.00%	0.00%	-6.83%	-0.28%
-7.69%	-0.34%	0.00%	-0.15%
0.00%	0.00%	4.19%	0.14%
0.00%	0.00%	-0.50%	0.74%
0.00%	-1.88%	0.51%	1.14%
0.00%	-4.18%	-0.50%	2.03%
0.00%	6.73%	1.01%	-3.06%
0.00%	-0.34%	-2.50%	0.61%
0.00%	-6.92%	-5.64%	-0.31%
8.33%	1.01%	7.07%	-0.44%

0.00%	-0.36%	-4.06%	-0.16%
0.00%	-3.28%	-3.17%	-0.36%
0.00%	-0.94%	-3.28%	-1.10%
0.00%	-1.14%	-4.52%	-0.20%
0.00%	-11.37%	3.55%	-0.50%
0.00%	8.70%	4.00%	-1.84%
0.00%	6.50%	1.65%	-0.95%
0.00%	0.00%	1.62%	0.83%
0.00%	-0.47%	-1.60%	0.13%
0.00%	-1.23%	-1.62%	-0.32%
7.69%	-1.17%	-0.55%	-1.97%
0.00%	-4.95%	-0.55%	-0.55%
-7.14%	4.17%	-5.00%	0.75%
15.38%	0.00%	1.75%	1.04%
0.00%	5.00%	-1.15%	-3.88%
0.00%	-4.76%	-1.16%	0.25%
0.00%	0.00%	3.53%	-0.11%
0.00%	0.00%	-1.70%	0.03%
0.00%	-0.50%	0.00%	0.00%
0.00%	0.00%	1.73%	0.80%
-6.67%	0.00%	0.57%	2.84%
7.14%	0.00%	-1.13%	-0.82%
0.00%	-1.01%	1.14%	1.93%
0.00%	-6.60%	6.21%	1.27%
0.00%	8.15%	1.06%	0.60%
0.00%	0.00%	0.53%	-0.33%
0.00%	-0.50%	2.09%	-1.07%
0.00%	-4.04%	5.13%	-2.72%
0.00%	0.00%	-5.37%	0.51%
0.00%	8.42%	2.58%	1.35%
0.00%	0.00%	0.00%	0.13%
0.00%	0.00%	1.01%	-0.93%
0.00%	0.97%	-20.40%	-0.46%
0.00%	-0.96%	-11.25%	-2.85%
0.00%	0.00%	7.04%	-0.59%
0.00%	0.00%	2.63%	-0.17%

-13.33%	-2.91%	0.00%	2.13%
0.00%	0.00%	-4.49%	1.89%
0.00%	0.00%	-0.67%	-0.90%
0.00%	0.00%	-2.03%	2.73%
-7.69%	1.00%	0.00%	0.75%
8.33%	0.00%	-2.07%	-0.53%
-7.69%	-0.89%	-4.93%	2.38%
8.33%	0.00%	0.74%	-4.30%
0.00%	0.00%	7.35%	1.01%
0.00%	7.29%	-1.37%	2.55%
0.00%	-5.40%	-3.47%	-2.29%
0.00%	0.89%	-1.44%	-1.00%
0.00%	-1.46%	-2.19%	-0.02%
0.00%	0.00%	-1.49%	-0.18%
0.00%	0.99%	2.27%	-0.29%
0.00%	0.49%	2.96%	-0.58%
0.00%	0.00%	-2.16%	0.82%
0.00%	-1.46%	1.47%	0.71%
0.00%	1.49%	-0.72%	-2.58%
0.00%	0.00%	4.38%	1.32%
0.00%	0.00%	6.29%	-0.97%
0.00%	0.00%	1.32%	1.64%
0.00%	1.46%	-4.55%	1.30%
0.00%	-3.75%	2.04%	-0.20%
0.00%	0.00%	-8.67%	-1.08%
0.00%	-5.09%	-5.84%	5.16%
0.00%	0.11%	-2.33%	0.33%
0.00%	0.00%	0.79%	2.24%
0.00%	6.20%	-3.15%	-0.53%
0.00%	-0.99%	3.25%	-0.53%
0.00%	0.00%	0.79%	-2.03%
0.00%	0.00%	1.56%	1.74%
0.00%	-4.00%	-2.31%	-0.16%
0.00%	0.52%	0.00%	0.08%
0.00%	-0.52%	-0.79%	-0.83%
0.00%	0.00%	-0.79%	2.85%

0.00%	13.44%	3.20%	-3.01%
0.00%	-8.17%	-3.10%	-0.61%
0.00%	0.00%	-0.80%	4.32%
-7.69%	-4.00%	1.61%	-4.29%
0.00%	0.00%	0.79%	-1.21%
0.00%	0.00%	13.39%	0.76%
0.00%	4.17%	-10.42%	-1.24%
0.00%	0.00%	-3.88%	1.57%
0.00%	0.00%	-0.81%	1.39%
0.00%	0.00%	0.00%	0.09%
0.00%	0.00%	3.25%	-0.19%
0.00%	5.00%	-4.72%	1.77%
0.00%	0.00%	-1.65%	-0.90%
0.00%	0.00%	-0.84%	-1.54%
0.00%	0.00%	-0.85%	-0.20%
0.00%	0.00%	2.56%	-2.83%
0.00%	0.00%	4.17%	0.25%
0.00%	0.00%	-1.60%	0.47%
0.00%	-9.52%	-4.07%	0.20%
0.00%	10.53%	2.54%	3.52%
0.00%	0.00%	-0.83%	-0.65%
-25.00%	-9.52%	0.00%	3.27%
33.33%	-3.16%	0.00%	-0.98%
0.00%	0.00%	0.83%	2.88%
0.00%	0.00%	4.13%	0.84%
0.00%	-17.83%	1.59%	0.83%
0.00%	30.95%	-3.13%	0.49%
-8.33%	0.00%	0.81%	2.14%
0.00%	-14.14%	-5.60%	0.46%
0.00%	0.00%	-11.86%	0.81%
0.00%	-2.94%	-4.81%	1.22%
0.00%	15.15%	-5.05%	2.20%
-9.09%	-0.11%	21.28%	-1.62%
0.00%	-1.58%	2.63%	1.33%
0.00%	0.00%	0.85%	-4.37%
0.00%	1.71%	0.00%	1.26%

0.00%	-1.79%	0.85%	0.10%
-10.00%	-0.54%	0.00%	0.72%
0.00%	0.00%	2.52%	2.50%
0.00%	0.22%	-1.64%	0.39%
11.11%	0.00%	-6.67%	-0.82%
20.00%	-1.08%	2.68%	1.72%
-8.33%	0.00%	0.00%	0.56%
9.09%	3.26%	-3.48%	-0.03%
0.00%	5.26%	0.00%	0.86%
0.00%	0.00%	0.00%	0.02%
0.00%	0.00%	-1.80%	1.63%
0.00%	0.00%	-2.75%	-0.43%
0.00%	-1.00%	3.77%	0.85%
0.00%	-1.52%	-2.73%	2.06%
0.00%	1.54%	2.80%	0.15%
0.00%	0.00%	3.64%	-1.46%
0.00%	0.00%	1.75%	-0.69%
0.00%	0.00%	-4.31%	0.92%
0.00%	0.00%	-0.90%	0.92%
0.00%	0.00%	-3.64%	-2.27%
0.00%	-7.22%	-1.89%	3.07%
-16.67%	5.56%	-3.85%	-3.11%
20.00%	-24.11%	0.00%	0.76%
0.00%	24.83%	-2.00%	-3.84%
0.00%	-5.56%	7.14%	1.37%
0.00%	16.47%	4.76%	-0.54%
0.00%	-1.62%	-3.64%	2.35%
0.00%	0.00%	-2.83%	-0.10%
0.00%	-12.42%	0.00%	-0.46%
0.00%	5.51%	1.94%	-0.86%
0.00%	-5.44%	0.95%	-1.50%
0.00%	-0.12%	0.94%	-0.42%
0.00%	0.00%	0.00%	-0.13%
0.00%	0.00%	0.00%	1.69%
0.00%	0.00%	0.93%	0.01%
0.00%	4.00%	-1.85%	0.52%

0.00%	0.00%	-2.83%	-4.69%
0.00%	-3.85%	-1.94%	0.03%
0.00%	-2.35%	0.99%	-0.96%
0.00%	-1.20%	-0.98%	0.99%
-8.33%	0.00%	-0.99%	0.70%
0.00%	0.00%	0.00%	-1.43%
0.00%	15.85%	0.00%	0.18%
0.00%	2.53%	-1.00%	-1.94%
0.00%	-2.46%	-1.01%	1.81%
-9.09%	4.11%	2.04%	-0.43%
20.00%	-0.40%	-2.00%	-1.23%
0.00%	0.00%	-1.02%	-1.69%
0.00%	0.00%	1.03%	0.14%
0.00%	-13.71%	-2.04%	2.39%
-8.33%	14.00%	-1.04%	-0.85%
0.00%	0.31%	3.16%	1.77%
0.00%	0.31%	-3.06%	0.95%
-9.09%	0.00%	1.05%	-0.47%
0.00%	0.00%	1.04%	2.16%
0.00%	0.00%	-4.12%	0.01%
0.00%	0.00%	1.08%	0.94%
20.00%	0.00%	-1.06%	0.16%
0.00%	0.00%	-1.08%	1.97%
0.00%	-1.23%	-2.17%	1.44%
0.00%	-0.42%	-6.67%	0.54%
0.00%	0.00%	2.38%	0.00%
0.00%	-0.94%	-5.81%	-2.94%
0.00%	0.00%	2.47%	-3.91%
0.00%	0.00%	1.20%	-4.86%
-16.67%	-5.26%	-2.38%	1.38%
0.00%	1.89%	25.61%	2.00%
0.00%	0.33%	-3.88%	-1.50%
0.00%	-2.28%	0.00%	1.80%
0.00%	-0.44%	-8.08%	-0.90%
0.00%	-0.56%	-3.30%	-0.80%
0.00%	1.01%	-4.55%	0.44%

0.00%	-1.11%	-2.38%	-1.79%
0.00%	-1.35%	6.10%	0.27%
0.00%	-3.19%	1.15%	0.39%
0.00%	3.65%	-3.41%	0.09%
0.00%	2.27%	-2.35%	-2.85%
0.00%	0.00%	2.41%	-0.72%
0.00%	0.00%	0.00%	3.52%
0.00%	2.78%	0.00%	-1.61%
0.00%	-10.81%	-1.18%	4.25%
0.00%	12.12%	-2.38%	-4.48%
0.00%	0.00%	1.22%	0.68%
0.00%	0.00%	-2.41%	3.64%
0.00%	0.00%	2.47%	-0.61%
0.00%	0.00%	0.00%	-2.56%
0.00%	0.00%	1.20%	-1.77%
0.00%	-3.24%	0.00%	-1.03%
0.00%	0.00%	0.00%	-2.13%
0.00%	0.00%	-2.38%	-0.87%
0.00%	0.56%	1.22%	-1.60%
0.00%	0.00%	-1.20%	0.74%
0.00%	0.00%	0.00%	-0.77%
0.00%	0.00%	1.22%	0.77%
0.00%	0.00%	1.20%	-1.41%
0.00%	-0.56%	1.19%	0.53%
0.00%	0.00%	-1.18%	-1.49%
0.00%	0.00%	1.19%	-1.51%
0.00%	0.00%	0.00%	0.00%
0.00%	-3.35%	0.00%	-1.12%
0.00%	-0.12%	0.00%	-1.71%
0.00%	0.00%	0.00%	-3.11%
0.00%	-1.62%	-3.53%	0.88%
0.00%	0.00%	3.66%	-0.55%
0.00%	-17.53%	-1.18%	-1.30%
0.00%	0.00%	5.95%	-0.82%
0.00%	0.00%	-4.49%	0.00%
0.00%	0.00%	3.53%	0.00%

0.00%	0.00%	2.27%	1.55%
0.00%	21.26%	20.00%	1.19%
0.00%	0.00%	47.22%	-1.87%
0.00%	0.00%	1.89%	-0.33%
0.00%	0.00%	-12.35%	-3.63%
0.00%	0.00%	-4.23%	-0.18%
0.00%	0.00%	5.88%	-2.91%
0.00%	-5.29%	2.78%	-4.59%
0.00%	-6.71%	14.86%	1.18%
0.00%	6.52%	3.53%	0.89%
0.00%	0.00%	-0.57%	-0.27%
0.00%	-5.63%	1.14%	1.22%
0.00%	0.00%	1.69%	0.73%
0.00%	12.45%	-10.00%	-1.86%
0.00%	0.00%	-4.32%	-2.22%
0.00%	0.00%	6.45%	-0.41%
0.00%	-1.65%	-2.42%	-1.89%
0.00%	0.00%	7.45%	1.07%
0.00%	-9.58%	7.51%	-0.55%
0.00%	0.00%	-13.44%	-1.76%
0.00%	1.32%	-16.77%	-0.52%
0.00%	4.58%	4.48%	1.25%
0.00%	-0.13%	22.86%	-1.38%
0.00%	-1.75%	-1.16%	0.19%
0.00%	-5.73%	0.00%	0.14%
0.00%	0.00%	-2.94%	-0.77%
0.00%	-18.92%	-15.15%	0.14%
0.00%	0.00%	1.43%	3.52%
-20.00%	16.83%	-0.70%	1.44%
0.00%	-0.29%	-24.11%	2.28%
25.00%	0.00%	-4.67%	-2.17%
0.00%	-11.30%	-14.71%	0.37%
0.00%	1.61%	3.45%	-1.85%
0.00%	0.00%	-4.44%	0.18%
0.00%	-12.70%	2.33%	-0.35%
0.00%	0.00%	-10.23%	1.89%

0.00%	0.00%	11.39%	-0.21%
0.00%	-54.55%	2.27%	-0.69%
0.00%	0.00%	7.78%	-0.03%
0.00%	0.00%	8.25%	-2.23%
0.00%	131.60%	-5.71%	0.81%
0.00%	-1.55%	-1.01%	1.81%
0.00%	14.04%	13.27%	-0.23%
0.00%	-1.54%	-11.71%	1.36%
0.00%	0.00%	1.02%	0.60%
0.00%	0.00%	-1.01%	-1.30%
0.00%	0.00%	3.06%	2.35%
0.00%	-6.25%	0.00%	-1.78%
0.00%	-8.33%	-1.98%	-0.93%
0.00%	0.00%	3.03%	-0.36%
0.00%	9.09%	35.29%	-2.51%
0.00%	0.00%	-0.72%	-2.45%
0.00%	0.00%	-3.65%	-2.15%
0.00%	6.67%	3.03%	-1.35%
0.00%	-5.31%	-5.88%	-2.45%
-10.00%	2.31%	-13.28%	2.50%
-11.11%	0.00%	6.31%	0.14%
12.50%	-3.23%	4.24%	3.13%
0.00%	0.00%	3.25%	-2.50%
0.00%	-2.50%	-8.66%	0.00%
0.00%	0.85%	-2.59%	-0.69%
0.00%	0.00%	-1.77%	0.41%
11.11%	0.85%	-1.80%	1.50%
0.00%	0.00%	0.00%	1.23%
-10.00%	0.00%	-0.92%	0.00%
0.00%	0.00%	1.85%	-0.28%
0.00%	-21.01%	-4.55%	0.68%
0.00%	6.38%	-0.95%	-0.08%
11.11%	-1.00%	0.00%	0.12%
0.00%	0.00%	2.88%	1.22%
0.00%	0.81%	-6.54%	-1.55%
-10.00%	0.00%	0.00%	-0.20%

0.00%	0.00%	1.00%	0.19%
11.11%	-7.82%	-1.98%	0.40%
-10.00%	0.00%	7.07%	0.00%
0.00%	0.00%	-1.89%	0.39%
11.11%	8.26%	-1.92%	1.09%
0.00%	-0.80%	3.92%	4.09%
-20.00%	0.20%	2.83%	-0.07%
25.00%	-12.93%	-3.67%	1.04%
-10.00%	0.23%	1.90%	-0.90%
0.00%	12.27%	-5.61%	-0.24%
11.11%	0.00%	7.92%	0.26%
-20.00%	23.09%	0.00%	0.37%
0.00%	-2.01%	7.34%	1.26%
12.50%	5.98%	-2.56%	1.54%
0.00%	1.61%	5.26%	-0.09%
0.00%	-1.59%	0.00%	0.36%
0.00%	-5.65%	2.50%	-1.46%
-11.11%	0.85%	-6.50%	-0.33%
0.00%	1.69%	0.00%	1.97%
0.00%	-0.83%	-5.22%	0.57%
0.00%	-2.52%	-0.92%	-0.28%
12.50%	6.90%	1.85%	-1.26%
0.00%	0.00%	-5.45%	-1.68%
11.11%	-4.84%	-3.85%	-0.74%
0.00%	0.00%	0.00%	-2.41%
0.00%	0.85%	0.00%	0.00%
0.00%	0.00%	0.00%	-1.25%
0.00%	0.00%	-1.00%	0.09%
0.00%	-7.56%	1.01%	0.60%
0.00%	0.00%	0.00%	0.76%
0.00%	0.00%	2.00%	-0.15%
0.00%	0.00%	-6.86%	0.15%
0.00%	0.00%	-5.26%	-0.38%
0.00%	-3.64%	4.44%	0.56%
0.00%	3.77%	11.70%	-0.94%
0.00%	-3.64%	-5.71%	-0.74%

0.00%	-0.94%	-2.02%	-0.06%
0.00%	0.95%	1.03%	1.50%
0.00%	-5.28%	-2.04%	0.97%
0.00%	-0.20%	-1.04%	0.06%
0.00%	9.58%	0.00%	-2.30%
0.00%	0.00%	-2.11%	0.61%
0.00%	-0.73%	2.15%	-1.15%
0.00%	-0.37%	1.05%	-1.68%
0.00%	0.00%	0.00%	-0.65%
0.00%	0.00%	-2.08%	0.00%
0.00%	2.76%	0.00%	0.50%
0.00%	-3.23%	1.06%	-0.50%
0.00%	11.11%	-1.05%	0.02%
0.00%	-10.00%	10.64%	-1.83%
0.00%	11.11%	-4.81%	-0.17%
0.00%	0.00%	1.01%	-0.65%
0.00%	0.00%	-2.00%	-0.56%
0.00%	0.00%	2.04%	0.92%
0.00%	0.00%	-1.00%	0.83%
0.00%	0.00%	1.01%	2.23%
0.00%	0.00%	0.00%	-0.09%
0.00%	-0.17%	-1.00%	-0.35%
0.00%	-8.18%	1.01%	-1.37%
0.00%	8.18%	0.00%	2.28%
0.00%	-0.84%	-3.00%	-1.94%
0.00%	0.00%	3.09%	0.62%
0.00%	0.00%	0.00%	0.46%
0.00%	0.00%	-3.00%	0.00%
0.00%	-6.78%	-1.03%	-0.22%
-10.00%	0.00%	1.04%	-0.63%
66.67%	0.00%	0.00%	0.61%
-6.67%	0.00%	-2.06%	-0.61%
-28.57%	0.00%	0.00%	-1.07%
10.00%	-0.91%	2.11%	1.76%
0.00%	0.92%	0.00%	2.25%
-9.09%	0.00%	0.00%	1.43%

0.00%	0.00%	1.03%	0.43%
0.00%	-11.27%	-5.10%	-3.18%
0.00%	0.41%	-2.15%	3.50%
0.00%	0.00%	-6.59%	2.88%
0.00%	0.00%	2.35%	-0.23%
0.00%	-6.53%	-3.45%	0.91%
0.00%	26.20%	2.38%	0.43%
0.00%	26.64%	1.16%	-0.57%
0.00%	5.19%	-8.05%	1.59%
0.00%	0.00%	-3.75%	0.79%
0.00%	-6.36%	2.60%	-0.14%
0.00%	-0.28%	-1.27%	-0.29%
-10.00%	0.28%	-5.13%	-2.07%
0.00%	-0.14%	4.05%	0.08%
0.00%	0.00%	-1.30%	1.02%
0.00%	0.00%	-1.32%	1.41%
0.00%	-0.14%	-5.33%	1.72%
0.00%	0.00%	2.82%	0.18%
0.00%	0.00%	5.48%	0.00%
0.00%	-0.14%	-5.19%	-0.92%
0.00%	0.00%	4.11%	0.98%
0.00%	-0.56%	-1.32%	0.68%
0.00%	-0.70%	-6.67%	0.79%
0.00%	0.00%	0.00%	0.69%
0.00%	-8.32%	-1.43%	-2.33%
0.00%	-7.69%	5.80%	0.00%
0.00%	0.00%	-1.37%	-1.69%
0.00%	0.00%	0.00%	0.00%
0.00%	0.00%	1.39%	-0.86%
0.00%	0.00%	2.74%	-3.46%
0.00%	3.33%	36.00%	0.37%
0.00%	0.00%	-12.75%	0.37%
-11.11%	11.61%	-4.49%	1.48%
0.00%	-0.29%	-5.88%	-3.65%
0.00%	0.00%	15.00%	-0.74%
0.00%	0.00%	-6.52%	-2.30%

-12.50%	0.00%	0.00%	-2.34%
14.29%	-0.87%	0.00%	-1.09%
0.00%	2.19%	-1.16%	-0.34%
0.00%	0.14%	1.18%	0.10%
0.00%	-4.86%	-3.49%	1.55%
0.00%	1.35%	-4.82%	0.60%
0.00%	2.81%	-1.27%	2.27%
0.00%	-2.02%	12.82%	1.88%
12.50%	-4.26%	-2.27%	0.55%
0.00%	1.38%	-1.16%	-0.26%
0.00%	0.61%	3.53%	-2.01%
0.00%	5.12%	-4.55%	2.78%
0.00%	0.00%	8.33%	1.81%
0.00%	-1.15%	-7.69%	0.61%
0.00%	0.00%	0.00%	0.40%
0.00%	-1.45%	3.57%	-0.32%
0.00%	0.00%	1.15%	0.63%
0.00%	-1.47%	-1.14%	-2.91%
0.00%	0.00%	-4.60%	0.64%
0.00%	0.00%	0.00%	3.64%
-11.11%	0.00%	2.41%	0.96%
0.00%	0.15%	1.18%	0.36%
-12.50%	2.09%	-1.16%	0.40%
0.00%	-2.19%	-2.35%	1.57%
0.00%	2.99%	-2.41%	1.23%
0.00%	0.00%	1.23%	-3.20%
14.29%	-2.75%	0.00%	2.55%
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0.00%	-0.30%	1.19%	7.78%
0.00%	2.24%	3.53%	0.00%
-14.29%	-4.23%	-2.27%	1.14%
0.00%	-0.15%	3.49%	0.21%
16.67%	4.58%	2.25%	-1.22%
0.00%	-0.88%	1.10%	-0.61%
0.00%	-7.22%	1.09%	0.00%
-14.29%	2.38%	22.58%	1.70%

-16.67%	4.65%	21.05%	-1.12%
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0.00%	0.00%	7.44%	-1.23%
0.00%	-5.38%	-1.54%	-0.39%
0.00%	2.69%	-12.50%	-0.95%
0.00%	0.00%	-9.82%	1.35%
0.00%	-1.85%	-1.98%	-0.16%
0.00%	0.31%	8.08%	2.07%
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0.00%	-1.52%	-1.89%	2.26%
0.00%	-1.54%	2.88%	2.04%
0.00%	0.47%	13.08%	0.15%
0.00%	1.09%	1.65%	-0.64%
0.00%	-0.31%	-0.81%	-3.47%
0.00%	-1.23%	-1.64%	-0.82%
0.00%	-0.63%	1.67%	0.60%
0.00%	0.31%	-1.64%	0.30%
0.00%	1.57%	0.00%	-0.11%
-20.00%	0.00%	-0.83%	0.42%
0.00%	3.40%	-8.40%	-1.85%
0.00%	4.48%	9.17%	0.29%
0.00%	4.43%	7.56%	2.11%
0.00%	2.19%	-5.47%	0.00%
0.00%	-2.14%	4.13%	-0.09%
0.00%	16.28%	2.38%	-0.09%
25.00%	5.88%	15.50%	0.25%
0.00%	0.56%	6.04%	1.25%
0.00%	-0.77%	31.65%	0.62%
0.00%	-10.69%	-2.88%	0.78%
0.00%	5.99%	1.98%	0.00%
0.00%	-5.88%	4.37%	-0.08%

0.00%	0.00%	-7.44%	-3.10%
0.00%	3.00%	-10.05%	-0.90%
0.00%	-1.70%	1.12%	0.00%
0.00%	1.85%	7.73%	0.00%
0.00%	-1.21%	3.59%	0.98%
0.00%	1.84%	1.98%	0.46%
20.00%	2.41%	-0.97%	-1.71%
0.00%	5.88%	2.94%	-1.64%
0.00%	1.11%	6.19%	1.16%
16.67%	1.65%	22.87%	0.00%
0.00%	-0.32%	-15.33%	1.00%
14.29%	13.88%	-15.52%	-0.92%
0.00%	9.52%	-1.53%	-0.39%
-12.50%	1.30%	6.22%	0.26%
14.29%	-12.45%	-4.88%	0.11%
0.00%	-0.98%	-5.13%	-0.93%
-12.50%	0.20%	3.78%	-1.97%
0.00%	1.28%	3.13%	0.47%
-14.29%	2.15%	-1.52%	0.49%
0.00%	-7.83%	-5.13%	0.93%
0.00%	3.63%	-2.70%	2.15%
0.00%	-4.30%	2.78%	2.43%
16.67%	2.82%	0.00%	-0.25%
14.29%	-8.43%	1.62%	-0.36%
0.00%	1.44%	-1.06%	-0.16%
12.50%	0.66%	0.54%	0.23%
0.00%	-1.20%	-1.60%	1.01%
11.11%	1.32%	-2.17%	-2.93%
-10.00%	5.75%	4.44%	-0.43%
0.00%	-2.46%	2.13%	-0.64%
0.00%	-3.58%	3.65%	-1.43%
0.00%	2.51%	-3.02%	-0.53%
11.11%	-2.13%	0.00%	-1.49%
0.00%	0.76%	11.40%	1.71%
0.00%	-1.08%	5.12%	3.50%
0.00%	3.71%	-4.87%	0.53%

-30.00%	2.11%	-1.40%	0.79%
0.00%	-4.64%	6.13%	-1.56%
0.00%	-0.11%	0.44%	-2.68%
71.43%	2.81%	0.00%	0.49%
0.00%	-4.21%	3.54%	0.17%
0.00%	6.59%	-0.85%	0.97%
0.00%	-4.12%	0.86%	0.32%
-8.33%	-2.15%	-0.43%	-2.08%
-9.09%	8.35%	0.43%	1.27%
0.00%	-0.10%	-3.85%	0.87%
10.00%	-0.10%	-3.56%	-0.76%
0.00%	-1.42%	-5.53%	0.93%
-18.18%	-4.12%	6.34%	0.88%
11.11%	3.76%	-4.13%	-0.44%
-10.00%	3.63%	0.96%	1.11%
0.00%	-7.60%	0.47%	-0.07%
0.00%	6.39%	-2.36%	-3.10%
0.00%	-0.31%	-0.97%	0.48%
0.00%	0.00%	-0.49%	-1.21%
0.00%	0.00%	0.98%	2.04%
0.00%	0.00%	1.46%	1.21%
33.33%	0.00%	4.31%	0.33%
-8.33%	0.00%	-0.92%	0.41%
0.00%	-3.06%	0.93%	-1.25%
0.00%	0.00%	-5.50%	2.49%
0.00%	0.00%	-1.94%	-0.54%
0.00%	-3.16%	3.96%	-0.66%
0.00%	0.00%	-2.38%	0.00%
0.00%	0.00%	-0.49%	1.69%
0.00%	1.63%	-1.96%	-0.38%
0.00%	-3.53%	-3.00%	-0.06%
-9.09%	0.33%	-0.52%	-0.90%
10.00%	3.87%	0.52%	-0.02%
0.00%	0.96%	4.64%	-1.25%
0.00%	-3.58%	-3.94%	-1.74%
9.09%	1.09%	-2.05%	-1.12%

0.00%	-2.16%	-1.05%	0.38%
0.00%	0.00%	0.53%	-1.47%
0.00%	3.87%	1.05%	2.82%
0.00%	1.06%	-3.65%	0.00%
0.00%	-4.74%	7.03%	0.92%
0.00%	4.97%	-1.01%	-0.78%
0.00%	0.00%	-6.63%	2.84%
0.00%	-3.16%	1.64%	-0.81%
0.00%	3.26%	0.54%	0.24%
0.00%	-3.05%	-0.53%	0.22%
8.33%	3.04%	0.00%	-0.83%
0.00%	-2.95%	-1.08%	-0.85%
0.00%	0.11%	0.00%	-1.27%
0.00%	-2.39%	5.98%	0.00%
-7.69%	-2.78%	-2.56%	4.46%
0.00%	2.86%	3.16%	0.48%
0.00%	0.00%	-1.02%	0.16%
0.00%	1.11%	-2.06%	1.08%
0.00%	4.18%	2.63%	2.43%
-16.67%	-0.32%	-1.03%	3.06%
0.00%	-3.17%	1.04%	-1.43%
0.00%	7.10%	-1.54%	-0.35%
0.00%	0.00%	1.04%	0.05%
0.00%	-3.06%	0.52%	-1.09%
0.00%	0.00%	1.03%	-0.06%
0.00%	8.21%	0.51%	0.81%
0.00%	-3.21%	0.00%	-1.52%
20.00%	-1.01%	-4.55%	0.72%
0.00%	1.42%	1.06%	2.65%
0.00%	0.00%	-1.05%	-1.43%
0.00%	-5.31%	7.94%	0.00%
0.00%	-0.21%	-0.98%	2.15%
0.00%	-1.48%	-16.34%	-2.01%
-8.33%	0.00%	-14.20%	1.82%
-36.36%	-3.23%	21.38%	0.00%
14.29%	0.00%	-3.41%	0.40%

-12.50%	-2.67%	0.59%	-3.46%
0.00%	8.33%	-1.17%	3.00%
0.00%	-0.21%	-1.18%	1.71%
14.29%	1.27%	0.00%	0.56%
0.00%	-4.07%	-5.39%	-1.16%
0.00%	4.24%	12.66%	0.05%
0.00%	0.00%	-3.37%	3.39%
-12.50%	0.10%	-2.33%	-0.11%
0.00%	-4.69%	-0.60%	-1.53%
0.00%	3.83%	0.60%	0.00%
0.00%	5.05%	0.60%	-0.91%
0.00%	0.00%	-1.78%	1.48%
14.29%	-9.22%	0.00%	-1.74%
25.00%	8.72%	0.60%	2.33%
0.00%	0.41%	0.00%	-0.21%
0.00%	-3.94%	-3.59%	-0.61%
-30.00%	0.00%	1.24%	-0.91%
42.86%	0.00%	5.52%	-0.90%
-10.00%	0.00%	-2.91%	1.06%
0.00%	-0.53%	-3.59%	2.52%
0.00%	-2.75%	5.59%	-0.07%
0.00%	3.26%	-1.18%	0.83%
0.00%	0.00%	23.21%	-4.33%
-11.11%	-0.42%	-1.45%	0.20%
12.50%	0.00%	0.98%	-4.71%
0.00%	-1.27%	-4.85%	4.14%
0.00%	-1.39%	2.55%	1.40%
0.00%	0.54%	-0.50%	-0.12%
-11.11%	0.00%	3.00%	-0.71%
0.00%	0.00%	3.40%	-0.68%
-12.50%	-1.62%	0.47%	-4.41%
0.00%	4.40%	1.87%	-2.57%
0.00%	-0.42%	7.34%	0.00%
0.00%	0.21%	-0.43%	0.14%

Appendix B

Certificate of Editing

PROFESSIONAL EDITING SERVICES
Stand out for the Write reasons

Gerald T du Preez
PhD
22 Clivia Avenue
Brantwood, Kuils River, 7580
+27 (21) 903-3145 | +27 (83) 325 1842
geralddu9@gmail.com

Certificate of Editing

This serves to confirm that copy-editing and proofreading services were rendered to

SAMUEL TABOT ENOW

for a doctoral thesis entitled

The market liquidity of designated 2B equity securities under the Basel accord. Empirical evidence from South African Commercial Banks

with final word count of 70 247 on 21 November 2021

I am a member of the Professional Editors' Guild (member number DUP015) and commit to the following codes of practice (among others):

- *I have completed the work independently and did not sub-contract it out*
- *I kept to the agreed deadlines and/or communicated changes within reasonable time frames*
- *I treated all work as confidential and maintained objectivity in editing*
- *I did not accept work that could be considered unlawful, dishonest or contrary to public interest*

I uphold the following editing standards:

- *proofreading for mechanical errors such as spelling, punctuation, grammar*
- *copy-editing that includes commenting on, but not correcting, structure, organisation and logical flow of content, formatting (headings, page numbers, table of contents, etc.), eliminating unnecessary repetition*
- *checking citation style is correct, punctuating as needed and flagging missing or incorrect references*
- *commenting on suspected plagiarism and missing sources*
- *returning the document with track changes for the author to accept*

I confirm that I have met the above standards of editing and professional ethical practice. The content of the work edited remains that of the student.

Gerald T du Preez, PhD

Membership: Southern African Freelancers' Association and Professional Editors' Guild (Membership #DUP015)

Appendix C

Turnitin Report

Thesis

ORIGINALITY REPORT

12%	5%	5%	9%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	Submitted to Cape Peninsula University of Technology Student Paper	6%
2	Submitted to University of Reading Student Paper	1%
3	www.bis.org Internet Source	<1%
4	vbook.pub Internet Source	<1%
5	hdl.handle.net Internet Source	<1%
6	Submitted to IUBH - Internationale Hochschule Bad Honnef-Bonn Student Paper	<1%
7	Submitted to University of Wales, Bangor Student Paper	<1%
8	dl.booktolearn.com Internet Source	<1%
9	eprints.bournemouth.ac.uk	