DOI: 10.32602/jafas.2023.005

JOURNAL OF ACCOUNTING, FINANCE AND AUDITING STUDIES

http://www.jafas.org

The Market Liquidity Of Designated 2B Equity Securities Under The Basel Accord: Empirical Evidence From South African Commercial Banks

Samuel Tabot Enow[a] **Sophie Kasse**[b] **Jobo Dubihlela**[c]

[a] Cape Peninsula University of Technology, Lecturer- Graduate Centre of Management, Department of Business and Management Science, enows@cput.ac.za

[b] Cape Peninsula University of Technology, Lecturer- Graduate Centre of Management, Department of Business and Management Science, nguepikasses@cput.ac.za

[c] University of Kwazulu Natal, Associate Professor- College of Law and Management Studies, School of Business and Leadership, dubihlelaj@cput.ac.za

Keywords

Market Liquidity, Market depth, Market tightness, Liquidity Coverage Ratio, Net Stable Fund Ratio.

Jel Classification

G12, G32.

Paper Type

Research Article

Received

14.10.2022

Revised

19.12.2022

Accepted

23.12.2022

Abstract

Purpose: The financial market liquidity of an asset has always been an important concept in banking and financial markets because it keeps leveraging in check. The objective of this study was to investigate the market liquidity of the level 2B common equity in the Liquidity Coverage Ratio and Net Stable Fund Ratio. Market liquidity measures where modelled and tested empirically to validate whether the LCR and NSFR needs to be improved.

Methodology: This study used a sample period from May 2016 – May 2021, and a fixed effect model to investigate the market liquidity of the selected level 2B High Quality Liquid Assets.

Findings: The findings of this study indicates that the common equity securities that qualifies to be included in level 2B HQLA category lack market depth. This was evident in the significant relationship between the 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.

Originality/Value: 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. As per the author's knowledge, this study is the first study to empirically investigate the liquidity of the selected level 2B HQLAs.

1. Introduction

In banking and financial management, risk, which represents exposures to losses, is mitigated through diversification (Roncoroni et al., 2014). The concept of diversification in financial systems makes it possible to obtain a relatively safe return from any investment (Benartzi and Thaler, 2001). Liquid equity securities provide safe returns by ensuring that the asset realises at least its face value when traded (Romanyuk, 2010). 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). 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). This means that the price of liquid securities is aligned to their fundamental values with no expectation of arbitrage opportunities (Ajello et al., 2012). Any arbitrage opportunity is automatically transmitted to the valuation of the asset hence improved market efficiency (Herschberg, 2012).

The idea of mitigating risk was the premise that the Basel Committee for Banking Supervision (BCBS) (2010) based the introduction of the concept of 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 and Wycisk, 2015).

Prior literature (Berger and Bouwman, 2009; Achary and Schnabl, 2010; Ivashina and 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 and 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.

Market liquidity in stock markets has been investigated (Pennings et al., 2003; Frank and Garcia, 2008; Boonvorachote and 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. 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.

2. Literature Review

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). Also, some of these matrices capturing this concept have shown deterioration over the years (Narayan and Zheng, 2011). More so, measures that may capture liquidity in one market may not necessarily apply in another market (Hodrea, 2015). 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), 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 and Kaserer, 2008).
- "The market liquidity of an asset refers to the ease of trading with lower transaction cost in a timely manner" (Lee and Chou, 2018).
- "Market liquidity in any asset is the ease of liquidating a position at a reasonable price timeously" (Singh et al., 2015)
- "A liquid asset is the extent to which funds can be quickly accessed when committed to long term investments" (Fang et al., 2013)
- "A financial liquid asset refers to the extent in which an asset can be liquidated at a price close to the consensus value" (Foucault et al., 2013).

According to Muktiyanto (2015), "a financial liquid asset is when trades are executed quickly and at low cost on demand". Finally, Wuyts (2007) 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). 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). 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 and Lybek, 2002). 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 and Praźników, 2020). 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 et al., 2019). 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). Increasing the number of market participants initiating trades is often associated with an increase in trading and high levels of liquidity (Saad and Samet, 2017). 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 and Lon, 2014). Liquidity risk causes financial markets to be fragile and prone to market shocks. According to Nikolaou (2009), 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). 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 and Zhao, 2017). 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 and Shamsuddin, 2008). 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.

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 and Green, 2002). 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). 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). A small catalyst can cause exacerbated and fast moves in asset prices, increasing market volatility (Prasanna and Bansal, 2014). A financial liquid asset can also prevent market failure by limiting excessive trading risk (Amihud and Mendelson, 2006). 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). 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 et al., 2014). 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). 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). 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 et al., 2008). 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 et al., 2012).

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). 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 and Benhima, 2015). 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 et al., 2013). Prior research (Caballero and Krishnamurthy, 2008; Calem et al., 2013; Carlin et al., 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 and Woodford, 2011). 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).

Mechanism of Market liquidity

A liquid asset has many market participants and market makers known as the main players (Panayides, 2007). 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 and Rindi, 2010). 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 and Seasholes, 2014). 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 et al., 2005). 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 and Gale, 2004). 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). 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 and Benhima, 2015).

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 et al., 2008). 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 et al., 2007). According to Engle and Ferstenberg (2007), 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) 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), 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 Gȯmez, Prado & Galacho (2019), 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.

Deterioration in Financial market liquidity

There have been concerns of deteriorating liquidity in financial assets (De Renzis et al., 2018; Blanqué and 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 and Wang, 2012). Consequently, the liquidity adjustment occurs through trading volume instead of prices (Gerhold et al., 2012). 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.

3. Research Methodology

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). Also, this test is suitable when the endogenous variables are determined by variables that are not affected by independent variables (Hausman, 1978). 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 et al., 2019). Accordingly,

H_0: Random effect model is appropriate; *p-value* is more than 5%

H_1: Fixed effect model is appropriate; p-*value* is less than 5%

Data Variables

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 and Levendis, 2011; Nayak et al., 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); Olbrys and Mursztyn, (2019); Wanzala et al, (2018); Saleemi, (2014); Goyenk et al., (2009); Engle and Lange, (1997) to investigate market liquidity. A description of the dependent and independent variables are 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 et al., (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) 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.

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 and 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 et al., 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 et al., 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 and Ogden, 1996). TV is also the primary driver of liquidity and should have minimal impact on the price (Chordia et al., 2001). In addition, TV tends to have an absorptive impact on prices in illiquid assets and feeds positively on each other (Cheriyan and Lazar, 2018). Muktiyanto (2015); Bogdan et al., (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 and 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 and 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 and 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.

4. Findings and Discussion

Descriptive statistics

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

Table 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 et al.,, 2013). 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. 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.

Table 2. 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
TC	0.066640	-0.090071	0.000843	0.0000

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 are highlighted below

Table 3. 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
TC	0.066640	0.053412	1.247657	0.2122

Effect specification

F-statistics	4.21469
Prob(F-statistics)	0.00000

Source: EViews output

The p-values for the independent variables are less than 5% except TC as shown in table 5 above. This means TV, BIT, SIT significantly affect the price distribution. 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 at al., 2010; Mu et al., 2010). The results from table 5 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%.

5. Conclusions

As observed in the findings, the lack of market depth 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

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

Source: Adapted from BCBS (2010)

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

Source: Adapted from BCBS (2010)

Where the risk coefficient is given by

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

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 and Skrzypacz, 2006). 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 Duffee (2013), 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). To this end, most large commercial banks indicated the need for additional measures in conjunction with Basel III (Claassen and Rooyen, 2012).

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) 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 TV, 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. The main limitation of this study is that market immediacy was excluded which is another important theme of liquidity. Further research should include market immediacy in exploring the liquidity position of the level 2B designated securities.

References

Acharya, V. V. & Schnabl, P. (2010). Do global banks spread global imbalances? Asset-backed commercial paper during the financial crisis of 2007–09. *IMF Economic Review*, 58(1), 37–73.

Ajello, A. Benzoni, L and Chyruk, O. (2012). No-arbitrage restrictions and the U.S. Treasury market. The Federal Reserve bank; Chicago

Allen, F. & Gale, D. (2004). Financial fragility, liquidity, and asset prices. *Journal of the European Economic Association*, 2(6),1015–1048.

Amihud, Y. & Mendelson, H. (2006). Stock and Bond Liquidity and Its Effect on Prices and Financial Policies. *Financial Markets and Portfolio Management*, 20(1), 19-32.

Arabsalehi, M. Beedel, M. & Moradi, A. (2014). Economic performance and stock market liquidity: Evidence from Iranian Listed Companies. *International Journal of Economy, Management and Social Sciences*, 3(9), 496-499.

Ausubel, L. M. (2004). An efficient ascending-bid auction for multiple objects. *The American Economic Review*, 94(5), 1452-1475.

Bacchetta, P. & Benhima, K. (2015). The demand for liquid assets, corporate saving, and international capital flows. *Journal of the European Economic Association*, 13(6), 1101-1135.

Barardehi, Y.H. Bernhardt, D. & Davies, R.J. (2016). Trade-Time Measures of Liquidity. *The Review of Financial Studies,* 32(1), 126-179.

Basel Committee on Banking Supervision. (2006). International coverage of capital measurement and capital standards. Basel: Bank of international settlement.

Basel Committee on Banking Supervision. (2010). Calibrating regulatory minimum capital requirements and capital buffers: a top down approach. Basel: Bank of international settlement.

Basel Committee on Banking Supervision. (2013). The Liquidity Coverage Ratio and liquidity risk monitoring tools. Basel: Bank of international settlement.

Basel Committee on Banking Supervision. (2019). Minimum capital requirements for market risk. Basel: Bank of international settlement.

Bekaert, G. Harvey C, R. & Lundblad, C. (2007). Liquidity and Expected Returns: Lessons from Emerging Markets. *Review of Financial Studies*, 20, 1783-1831.

Bell, A. Fairbrother, M. & Jones, K. (2019). Fixed and random effects models: making an informed choice. *Quality & Quantity*, 53,1051–1074.

Benartzi, S and Thaler, R. (2001). Naive Diversification Strategies in Defined Contribution Saving Plans. *The American Economic Review*, 91(1),79-98.

Berger, A. N. & Bouwman, C. H. (2017). Bank liquidity creation, monetary policy, and financial crises. *Journal of Financial Stability*. Retrieved from: https://pdfs.semanticscholar.org/3c27/701b153cf53c36be66b529e89e3456db0756.pdf. February 27, 2021.

Bhattacharya, S. N. & Bhattacharya, M. (2018). Persistence in liquidity measures: evidence from India. *Academy of Accounting and Financial Studies Journal*, 22 (2),1-11.

Black, F. (1971a). Toward a Fully Automated Stock Exchange, Part I. *Financial Analysts Journal*, 27 (6), 29–34.

Black, F. (1971b). Toward a Fully Automated Stock Exchange, Part II. *Financial Analysts Journal*, 27(6), 24–8.

Blanqué, P. & Mortier, V. (2019). How investors should deal with the liquidity dilemma. Paris. Amundi Asset management. Retrieve from: https://research-center.amundi.com/article/how-investors-should-deal-liquidity-dilemma. March 5, 2021.

Bogdan, S. Baresa, S. & Ivanovic, S. (2012). Measuring Liquidity on stock market: Impact on liquidity ratio. *Tourism and Hospitality Management*, 18(2), 183-193.

Boonvorachote, T. & Lakmas, K. (2016). Price volatility, trading volume, and market depth in Asian commodity futures exchanges. *Kasetsart Journal of social science*, 37, 53-58.

Borke, L. (2017). Risk Analytics: An R package for real time processing of Nasdaq and Yahoo finance data and parallelized quantile lasso regression methods, SFB 649. Discussion Paper, No. 2017-006, Humboldt University of Berlin, Collaborative Research Center. 649 - Economic Risk, Berlin.

Brunnermeier, M. K., Gorton, G., & Krishnamurthy, A. (2013). Liquidity mismatch measurement. In M. Brunnermeier & A. Krishnamurthy (Eds.), Risk topography: Systemic risk and macro modeling (pp. 99–112). University of Chicago Press. USA.

Brutti, F. (2011). Sovereign defaults and liquidity crises. *Journal of International Economics*, 84(1), 65-72.

Busse, J.A. & Green, T.C. (2002). Market efficiency in real time. *Journal of Financial Economics*, 65(3),415-437.

Caballero, R. J. & Krishnamurthy, A. (2008a). Collective risk management in a flight to quality episode. *The Journal of Finance*, 63(5), 2195–2230.

Calem, P. Covas, F. & Wu, J. (2013). The impact of the 2007 liquidity shock on bank jumbo mortgage lending. *Journal of Money, Credit and Banking*, 45(1), 59-91.

Carlin, B. I. Lobo, M. S. & Viswanathan, S. (2007). Episodic liquidity crises: Cooperative and predatory trading. *The Journal of Finance*, 62(5), 2235–2274.

Chacko, G. C. Jurek, J. W. & Stafford, E. (2008). The price of immediacy. *The Journal of Finance*, 63(3), 1253–1290.

Chen, J. M. (2013). Measuring market risk under the Basel accords: VaR, stressed VaR, and expected shortfall. *The IEB international Journal of finance*, 8, 184-201.

Cheriyan, N. K. & Lazar, D. (2018). Relationship between Liquidity, Volatility and Trading Activity: An Intraday Analysis of Indian Stock Market. *International Journal of Economics and Financial Issues*, 9(1), 17-22.

Chueh, H. Yang, D.Y. Yang, J.A. & Fang, Y. (2010). Market Depth of Price Duration in the Taiwan Stock Index Futures Market. *International Research Journal of Finance and Economics*, 48,154-167.

Claassen, S. & Rooyen, J.H. (2012). Bank liquidity risk management: A South African survey to determine future change. *Risk governance & control: financial market & institutions*, 2(3), 33-53.

Couto, M.F. Peternelli, L. & Barbosa, M.H. (2013). Classification of the coefficients of variation for sugarcane crops. *Ciencia Rural*, 43,957-961.

Curdia, V. & Woodford, M. (2011). The central-bank balance sheet as an instrument of monetary policy. *Journal of Monetary Economics*, 58(1), 54-79.

De Renzis, T. Guagliano, C & Loiacono, G. (2018). Liquidity in fixed income markets–risk indicators and EU evidence. (Working Papers No. 1). Paris.

De Wet, W.A. (2004). The role of asymmetric information on investments in emerging markets. *Economic Modelling*, 21(4),621-630.

Dicle, M.F. & Levendis, J. (2011). Importing financial data. *The Stata Journal*, 11(4),620–626.

Dudycz, T. & Praźników, J. (2020). Does the Mark-to-Model Fair Value Measure Make Assets Impairment Noisy? *A Literature Review' Sustainability*, 12, 1-24.

Duffee, G. (2013). Forecasting Interest Rates. *Handbook of Economic Forecasting Elsevier*, 1(2), 385-426.

Elliott, D.J. (2015). A Primer on Bank Capital, The Brookings Institution. Retrieve from: http://www.brookings.edu/~/media/Research/Files/Papers/2010/1/29-capital-elliott/0129_capital_primer_elliott.PDF. February 15, 2020.

Engle, R. & Ferstenberg R. (2007). Execution Risk: It's the Same as Investment Risk. *Journal of Portfolio Management*, 33(2), 34-44.

Engle, R. & Lange, J. (1997). Measuring, Forecasting and Explaining Time Varying Liquidity in the Stock Exchange. (Working Paper, No. 6129) NBER.

Fang, V. W. Noe, T. H. & Tice, S. (2009). Stock market liquidity and firm value. *Journal of financial Economics*, 94(1), 150-169.

Foucault, T. Kadan, O. & Kandel, E. (2005). Limit order book as a market for liquidity. *Review of Financial Studies*, 18, 1171-1217.

Foucault, T., Pagano, M. & Roell, A. (2013). Market Liquidity: Theory, Evidence, and Policy. Oxford University Press. London.

Frank, J & Garcia, P. (2008). Market Depth in Lean Hog and Live Cattle Futures Markets', In proceedings of the NCCC-134 Conference on Applied commodity price analysis, forecasting and market risk management, St. Louis, MO. Retrieve from http://www.farmdoc.uiuc.edu/nccc134.

Fung, J.K. (2007). Order imbalance and the pricing of index futures. *Journal of Futures Markets*, 27(7), 697-717.

George, T.J & Longstaff, F.A. (1993). Bid-Ask Spreads and Trading Activity in the S&P 100 Index Options Market. *The Journal of Financial and Quantitative Analysis*, 28(3), 381-397.

Gerhold, S. Guasoni, P. Karbe, J.M & Schachermayer, W. (2012). Transaction Costs, Trading Volume, and the Liquidity Premium. Retrieved from: http://ssrn.com/abstract=1905077. March 06, 2021.

Gȯmez, J.P. Prado, M.P & Galacho, R.Z. (2019). Capital Commitment and Investment Decisions: The Role of Mutual Fund Charges. Retrieved from: http://finance.darden.virginia.edu/wp-content/uploads/2019/02/spillover_gomez.pdf.

Goyenko, R.Y. Holden, W. C. & Trzcinka, C.A. (2009). Do liquidity measures measure liquidity? *Journal of financial Economics*, 92(2),153-181.

Hausman, J.A. (1978). Specification Tests in Econometrics. *Econometrica*, 46 (6), 1251-1271.

Hendershott, T. & Seasholes, M.S. (2014). Liquidity provision and stock return predictability', *Journal of Banking & Finance*, 45,140-151.

Herschberg, M. (2012). Limits to Arbitrage: An introduction to Behavioral Finance and a Literature Review. *Palermo Business Review*, 7,7-21.

Herzog, B. (2018). Valuation of Digital Platforms: Experimental Evidence for Google and Facebook. *International journal of financial studies*, 6(87),1-13.

Hodrea, R. (2015). An intraday analysis of the market efficiency-liquidity relationship: the case of BVB stock exchange. *Procedia Economics and Finance*, 32,1432 – 1441.

Hu, S. Z, M. & Cai, Y. (2019). Impact of Investor behaviour and stock market Liquidity: Evidence from China. *Entropy*, 21(1111), 1-15.

Hussain, S.M. (2011). The intraday behaviour of bid-ask spreads, trading volume and return volatility: evidence from DAX30. International Journal of Economics and Finance, 3(1), 23–34.

International Monetary Fund, (2013, October). Changes in bank funding pattern and financial stability risks, in: Global Financial Stability Report. Washington, DC: Author.

Ivashina, V. & Scharfstein, D. (2010). Bank lending during the financial crisis of 2008. *Journal of Financial Economics*, 97(3), 319–338.

Jorion, P. (2007). Value at Risk: The Benchmark for Controlling Market Risk. 3. Ed., McGraw-Hill Publishing Co, USA.

Kapingura, F. & Ikhide, S. (2011, October 26 – 28). Econometric determinants of Liquidity of the bond markets. Addis Ababa, Ethiopia.

Kempf, A. & Korn, O. (1999). Market Depth and Order Size. *Journal of Financial Markets*, 2, .29-48.

Kim, J.H. & Shamsuddin, A. (2008). Are Asian stock markets efficient? Evidence from new multiple variance ratio tests. *Journal of Empirical Finance*, 15(3), 518-532.

Kim, S.H. & Ogden, J.P. (1996). Determinants of the Bid and Ask spread on stock. *European financial market Journa*l, 1(1), 127-145.

Konieczny, J. & Skrzypacz, A. (2006). Search, Costly Price Adjustment and the Frequency of Price Changes – Theory and Evidence. (Working Papers No.0054). Wilfrid Laurier University, Ontario, Canada.

Kyle, A.S. (1985). Continuous auctions and insider trading. *Econometrica*, 53(6), 1315-1335.

Lee, C.H. & Chou, P.I. (2018). Financial openness and market liquidity in emerging markets. *Finance Research Letters*, 25, 124-130.

Lee, C.M.C. (1990). Information Dissemination and the Small Trader: An Intraday Analysis of the Small Trader Response to Announcements of Corporate Earnings and Changes in Dividend Policy, Unpublished Ph.D. dissertation, Cornell University.

Lee, C.M.C. & Radhakrishna, B. (2000). Inferring Investor Behavior: Evidence from TORQ data. *Journal of Financial Markets*, 3(2), 83-111.

Lei, C. C., & Lai R. N. (2007). The Role of Liquidity in Value at Risk – The Case of Hong Kong. Retrieved from: SSRN: https://ssrn.com/abstract=1009578. December 10, 2021.

Loebnitz, K. (2006). Market Liquidity Risk: Elusive No More Defining and quantifying market liquidity risk. Unpublished Masters Project. University of Twente. Netherlands.

Loudon, G. (2017). The impact of global financial market uncertainty on the risk-return relation in the stock markets of G7 countries. *Studies in Economics and Finance*, 34(1), 2-23.

Lu, Y.C. & Wei, Y. C. (2006). Classification of trade direction for an equity market with price limit and order match: Evidence from the Taiwan Stock market. *Investment management and financial innovations Journal*, 6(3), 135-147.

Malik, A. & Lon Ng, W. (2014). Intraday liquidity patterns in limit order books. *Studies in Economics and Finance*, 31(1), 46-71.

Marek, M. (2013, October). Practical application of coefficient of variation. Retrieved from: https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKEwjxyPysvYX0AhUCiFwKHRFlDnQQFnoECAkQAQ&url=https%3A%2F%2Fwww.researchgate.net%2Fpublication%2F275648121_Practical_application_of_coefficient_of_variation&usg=AOvVaw1jRI3F2a6f0YCC7Tm5F-KU. January 20, 2022.

Marozva, G. (2017). *An empirical study of liquidity risk embedded in banks' asset liability mismatches*. Unpublished PhD dissertation. University of South Africa.

Mu, G.H. Zhou, W.X. Chen, W. & Kertesz, J. (2010). Order flow dynamics around extreme price changes on an emerging stock market. *New Journal of Physics*, 12,3-22.

Muktiyanto, I. (2015). *Determinant factors of Market Liquidity in the Indonesian Equity Market*. Unpublished PhD dissertation. Victoria University, Melbourne.

Narayan, P. K. & Zheng, X. (2011). The relationship between liquidity and returns on the Chinese stock market. *Journal of Asian Economies*, 22,259–266.

Nayak, A. Pai, M.M.M. & Pai, R.M. (2016). Prediction Models for Indian Stock Market. *Procedia Computer Science*, 89, 441 – 449.

Neijs, T. & Wycisk, M. (2015). Robust Intraday Liquidity Management. In: Zanders Treasury and Finance Solutions.

Nikolaou, K. (2009). Liquidity (risk) concepts definitions and interactions (Working paper no. 1008/2009): Frankfurt: European Central Bank.

Nyawata, O. (2012). Treasury Bills and/or Central Bank Bills for Absorbing Surplus Liquidity: The Main Considerations (Working paper no. 40/2012). Washington, DC: International Monetary Fund.

Olbrys, J. & Mursztyn, M. (2019). Depth, tightness and resiliency as market liquidity dimensions: Evidence from the polish stock market. *International Journal of computational Economics and Econometrics*, 9(4),308-326.

Ostry, J. A. Gosh, M. & Chamon, M.Q. (2012). Tools for managing financial-stability risks from capital inflows. *Journal of International Economics*, 88(2), 407– 421.

Panayides, M. (2007). Affirmative Obligations and Market Making with Inventory. *Journal of Financial Economics*, 86, 513-542.

Patial, R.R. & Sharma, N.K. (2016). Do trading volume and bid-ask spread contain information to predict stock returns? Intraday evidence from India. *Asian Economic and Financial Review,* 6(3),135-150.

Pennings, J.M.E. Garcia, P. & Marsh, J.W. (2003). The Underlying Structure of Market Depth. In proceedings of NCR-134 Conference: Applied Commodity Price Analysis, Forecasting, and Market Risk Management, April 21-22, St. Louis, Missouri, USA

Perotti, P. & Rindi, B. (2010). Market Makers as Information Providers: The Natural Experiment of Star. *Journal of Empirical Finance*, 17, 895-917.

Pham, M.C. Anderson, H.M. Duong, H.N. & Lajbcygier, P. (2020). The effects of trade size and market depth on immediate price impact in a limit order book market. *Journal of economics Dynamics & Control*, 120, 2-27.

Poon, S.H. Rockinger, M. & Stathopoulos, K. (2013). Market liquidity and institutional trading during the 2007–8 financial crisis. *International Review of Financial Analysis*, 30, 86-97.

Prasanna, K. & Bansal, B. (2014). Foreign Institutional Investments and Liquidity of Stock Markets: Evidence from India. *International Journal of Economics and Finance*, 6(6), 103-120.

Rehse, D. Riordan, R. Rottke, N. & Zietz, J. (2019). The effects of uncertainty on market liquidity: Evidence from Hurricane Sandy*. Journal of Finance Economics*, 134(2), 318-332.

Reilly, F. K. & Brown, K. C. (2003). Investment analysis and portfolio management. Mason, Ohio: South-Western/Thomson Learning.

Roncoroni, A., Battiston, S. D'Errico, M. Hałaj, G. & Kok, C. (2014). Interconnected banks and systemically important exposures. (working paper No. 2331), European central bank.

Romanyuk, Y. (2010, September). Liquidity, Risk, and Return: Specifying an Objective Function for the Management of Foreign Reserves. Retrieved from:

https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&ved=2ahUKEwi_w9GPhPTzAhUJiFwKHZgoDXMQFnoECAQQAQ&url=https%3A%2F%2Fwww.econstor.eu%2Fbitstream%2F10419%2F66912%2F1%2F635660040.pdf&usg=AOvVaw2COw5-aEMi-gTbC1V0pR4Y. June 6, 2021.

Saad, M. & Samet, A. (2017). Liquidity and the implied cost of equity capital. *Journal of International Financial Markets, Institutions & Money*, 51, 15-38.

Saleemi, J. (2014). *An empirical Analysis of cost based market liquidity measures for US & Norwegian Banks*. Unpublished Master's dissertation. University of Nordland, BodØ.

Sanford, G. & Shiller, R.J. (1981). The determinant of the variability of stock prices. (Working paper no. 564). Cambridge, USA.

Santosa, P.W. (2020). Determinants of price reversal in high-frequency trading: empirical evidence from Indonesia. *Investment Management and Financial Innovations*, 17(1),175-188.

Sarr, A. & Lybek, T. (2002). Measuring Liquidity in financial markets (Working paper no. 232/2002). Washington, DC: International Monetary Fund.

Schmitz, S.W. & Hesse, H. (2014, February 28). Recent studies reinforce the case for the Liquidity Coverage Ratio. Retrieved from: https://voxeu.org/article/liquidity-coverage-ratios-new-evidence. October 23, 2021.

Shen, J., Yu, J. & Zhao, S. (2017). Investor sentiment and economic forces*. Journal of Monetary Economics*, 86, 1-21.

Shen, P. & Starr R.M. (2002). Market-makers' supply and pricing of financial market liquidity. *Economics Letters*, 76,53-58.

Singh, T. Gupta, M. & Sharma, A. (2015). Stock market liquidity and firm performance. *Accounting*, 1, 29-36.

Stange, S. & Kaserer, C. (2008). The Impact of Order Size on Stock Liquidity- A Representative Study. (working paper No. 9). Technische Universität München, München.

Sueppel, R. (2019). How market liquidity causes price distortions. Retrieved from: http://www.sr-sv.com/how-market-liquidity-causes-prices-distortions/. May 5, 2021.

Tayeh, M. (2016). Determinants of market liquidity: Evidence from Jordanian Stock Market. *International Journal of Economics and Finance*, 8(10), 48-59.

Vayanos, D. & Wang, J. (2012). Theories of Liquidity. *Foundation and trend in finance*, 6(4), 221-317.

Vidovic, J. Poklepovic, T. & Aljinovic, Z. (2014). How to measure illiquidity on European Emerging stock markets? *Journal of Business Systems Research*, 5(3), 67-81.

Wanzala, R. W. Muturi, W. & Olweny, T. (2017). Market resiliency conundrum: is it a predicator of economic growth? *The Journal of Finance and Data Science*, 4, 1-15.

Wanzala, R.W. Muturi, W. & Olweny, T. (2017). The nexus between market tightness and economic growth- a case of Kenya. *J Finance Econ*, 5(6), 259e268.

Weijden, A.V. (2020). The effect of COVID-19 on stock prices. Unpublished Master's thesis. Erasmus University Rotterdam. Rotterdam

Werner, I. (2003). NYSE Order Flow, Spreads and Information. *Journal of Financial Markets*, 6, 309-335.

Wuyts, G. (2007). Stock market liquidity: Determinants and implications. *Tijdschrift voor Economie en Management*, 2, 279 – 316.

Xaba, N. (2017). *The impact of interest rates on savings and investments in South Africa*. Unpublished Master thesis. University of the Witwatersrand. Johannesburg.

Yartey, C. A. (2008). The Determinants of Stock Market Development in Emerging Economies: Is South Africa Different? (Working paper No. 08/32), International monetary fund.

Zhang, M.Y. Russell, J. R. & Tsay R. S. (2008). Determinants of Bid and Ask Quotes and Implications for the Cost of Trading. *Journal of Empirical Finance*, 15(4), 656-678.

Zhou, L. & Yang, C. (2019). Differences in the effects of seller initiated versus buyer initiated crowded trades in stock markets. *Journal of Economic Interaction and Coordination*, 14, 859–890.