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Factors that Influence illiquidity in the South African Banking Industry: Empirical Evidence of Commercial Banks

By

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Abstract

This paper investigates the determinants of illiquidity in the South African banking industry using listed commercial banks. We selected two theoretically established illiquidity measures and perform empirical analysis using firms' specific variables and macroeconomic variables. A fixed effect regression model was adopted and the empirical results indicate that total cash to assets ratios and firms' market size as proxy by market capitalization are the significant factors that influence illiquidity in the South African banking industry. These results are consistent with the findings in the literature. Furthermore, we find no difference between the illiquidity measures used in the study as they lead to the same conclsuion.

Keywords: Commercial banks, illiquidity, firms' specific factors

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Declaration

I, Sifiso Tsela declare that the research work reported in this dissertation is my own, except where otherwise indicated and acknowledged. It is submitted for the degree of Masters of Management in Finance and Investment at the University of the Witwatersrand, Johannesburg. This thesis has not, either in whole or in part, been submitted for a degree or diploma to any other universities.

Signature of candidate: Date

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1 Chapter 1. Introduction

1.1 Theoretical background

The financial crisis of 2007-2008 has made it clear that liquidity and illiquidity play a pivotal role in the functioning of financial markets.The term liquidity has been employed differently in empirical research and is definied as the ease of transactions. In the most recent decades, shcholars such as Fabre and Frino (2004),Seppi (2001) and Chordia et al. (2000) have investigated the determinants and common factors that affect liquidity .Other scholars study how liquidity of specific stocks behave when industry liquidity change. This phenomenon is often referred to as commonality in liquidity (Fernandez-Amador et al,2013).On the other hand, how liquidity is priced in assets has also been a trending research in the past years.

When it comes to asset valuation, liquidity is referred to as the ability of converting an asset into cash with minimised transaction costs. Empirical studies have addressed the pricing of liquidity in asset prices, examples are Amihud and Mendelson (1986), Datar et al. (1998), Butler et al.(2005) and many other scholars.The aim of this study is to investigate the determinants of illiqudity in the South African banking industry. We compare the results using Roll(1984) illiquidity and Goyenko et al.(2009) in studying the behaviour of illiquidity in the South African banking industry. The comparison steps from the fact that Goyenko illiquidity measure is an extension of Roll(1984) illiquidity measure.

1.2 Objective of the studity

The objective of this study is to investigate illiquidity behaviour in the South African banking industry .The difference between this study and the previous studies is that we considered banks as listed comapanies on stock exchange and study lqiudity from trading perspective while other studies consider liquidity from credits and loans perspective and use accounting ratios to proxy liquidity. One of the closest study to ours in South Africa is the study conducted by kumbirai and Webb (2010), but still the objective of their study is bank performance.Outside South Africa, Singh and Sharma(2016) use similar factors. Kumbirai and Webb (2010) study the performance of the South African major commercial banks based on financial ratios and find that liquidity slow down during the financial crisis. We study how illiquidity behaves in the South African banking industry using listed commercial banks as opposed to the dominance of banks' performance in the South African literature.Other emprical evidence related to banking performance category are Okeahalam(2006) and Ncube(2009).

1.3 Significance of the study

South Africa has one of the most developed and equiped financial system in Africa.The banking system is dominated by private and commercial banks while the top banks are known to be Standard bank, First National Bank, Absa Bank, Nedbank and Capitec bank. There are many other private banks in South Africa that are listed on exchanges but not frequetly traded as compared to the above cited banks.The question is how illiquidity of listed commercial banks on the stock exchange behave with respect to firms' specific factors and macroeocnomics factors? The theory underlying the idea in this study is that, banks are often referred to as providers of liquidity. That is by acting as best intermediaries between surplus units (households) and deficit units (firms).While accounting ratios dominate how liquidity is measured in the banking industry, we argue that if the internal stiuation of the bank reflects the economic fundamental as argued by Chen et al.(2012).

One can therefore derive illiquidity measures using asset prices of the banks and study the factors that influence these illiquidity measure. This study therefore becomes significant because it documents on the factors that influence illiquidity in the banking sector using metrics different from accounting ratios.By documenting on the determinants of illiquidity in the South African banking sector not only informs policy makers on how asset prices of listed banks react to these factors but also informs investors and traders on secuirty selection and portfolio formation.

1.4 Problem statement

The gap identified in this study is that, studies on the determinants of illiquidity from trading or stock exchange perspective has not been deeply investigated in the South African banking industry.This study therefore intends to close this gap by using the illiquidity measures of roll(1984) and Goyenko et al.(2009) to reach the objective set in this paper. Empirical evidence similar to this study is provided by Yeh et al.(2014) in Taiwan.

1.5 Contribution of the study

The contribution of this study is twofowld: first, as compared to studies such as Amihud and Mendelson (1986), Datar et al.(1998) and and Chordia et al.(2000) , this study first computes illiquidity based on Roll(1984) illiquidity measure and the extension of Goyenko et al.(2009).Second we provide empirical analysis using the computed illiquidity measures to see whehther factors that influence these illiquidity measaures lead to different conclusion.The essence here is that

the illiquidity measures are theoretically derived as comapared to commonly used meaures or accounting ratios.The remaining of this study is structured as follows: chapter (2) presents a literature review while chapter(3) illustrates the methodological approach and describes the data used.Chapter (4) presents the empirical results while Chapter (5) presents conclusion and recommendations.

2 Chapter 2. Literature review

The first section of this chapter presents an overview of the firms specific factors and liquidity while the second section reviews the relationship between liquidity and macroeconomic variables

2.1 Firms' specific factors and liquidity

Since the tight loans stiuation created by the financial crisis of 2007-2008, liquidity has become a major economic variable that requires careful attention from policy makers and investors. As argued by Acharya and Pedersen(2005), liquidity becomes a source of risk when its a lot. The role of liquidity has been extensively documented from both theoretical and empirical point of views. Empirical investigations have provided different results with respect to firms' specific factors that drive liquidity in the banking industry. The study by Vadova(2011) finds that banks liquidity in Czech Republic are driven by capital adequacy, nonperforming loans and interest rates on interbank transactions. Furthermore, he finds that business cycles, inflation and financial crises have negative impact on liquidity.If we assume that these result hold , in the case of illiquidity variables, on would therefore expect a positive impact of inflaction, business cycles and crises on illiquidity variables.

Moussa(2015) on the other hand finds that capital to total asset ratio, the growth rate of GDP and inflation significantly influence liquidity while firms size and financial costs and deposits do not. The difference between these studies and this study is that, they use accounting ratios to measure liquidty while this study extracts the illiquidity measure from the prices of the listed banks.The literature that speak to our approach o measuring illiquidity variables can found in Amihud and Medelson (1986) and Amihud(2002). Accooding to these studies liqiudity and stock returns are related. In the same line, Pastor and Stambbaugh(2003) shows that aggregate liquidity influences stock returns while Datar et al.(1998) argue that less liquid assets require higher return that more liquid assets.The Johannesburg Stock Exchange report (2014),shows that liquidity is low in the African markets.The barriers to increasing liquidity are attributed to the lack of retail investors and limited short selling.

Studies that address the role of liquidity in the African economies are Choi and Cook (2004) and Ngirande (2014), these scholars find that constraints on the financial institutions balnace sheet is a barrier to increasing liquidity.Stock exchanges in the African economy are small in size while institutional enforcement is also weak (Odera, 2012).The relationship between liquidity and returns is also investigated by Spiegel and Wang(2005) where they establish that liquidity and returns move in opposite direction.Yau and Ze-To(2016) and Bekaert et

al. (2007) pointed out that liquidity plays a crucial role in the determination of equity returns.In emerging economies, Jun et al.(2003) find that liquidity and stock returns are positively correlated.In the the banking industry, Chen et al.(2014) argue that overaccumaltion of short-term debts by financial institutions make them more vulnerable to liquidity shocks.

Empirical evidence is provided by Shin (2009) on how a new form of bank runs is particulary driven by problems related to liquidity.Lartey et al.(2013) using time series analysis find that, between the period 2005-2010 in Ghana, the relationship between listed banks' profitability and liquidity has been deteriorating while Nimer et al.(2015) find that return on banks' assets is influenced by liquidity through quick ratios.Further, Delechat et al.(2012) and Singh and Sharma(2016) show that, bank size negatively affects liquidity in the banking sector.When it comes to the effect of banks' debts on banks' liquidity,Dinger(2009) and Moussa(2015) documents opposit empirical results.While Dinger(2009) finds that when deposits on short term debts increases , banks' liquidity decreases, Moussa.(2015) finds no signifcant effect of deposit on liquidity in the banking sector.

2.2 Liquidity and macroeocnomic variables

The literature has provided empirical documentation on different macroeocnomics factors affecting liquidity. Amongst those factors are the gross domestic product (GDP), the inflation rate, interest rate, money supply,yield spread, unemployment and many others.Starting from moneraty policy variables, interest rates and the money supply have been interpreted as common drivers of liquidity and illiquidity.In fact,common factors that drive industry and stock specific liquidities are often refered to as "commonality in liquidity".Recent research on the relationship between monetary policy and liquidity has been documented by Amador et al.(2013).They find that interest rates and money supply are common drivers of the relationship between firms' specific liquidity and industry liquidity.The same study in options market is conducted by Cao and Wei (2009) and Chu(2015).

The empirical results of Amador et al.(2013) are similar to Cao and Wei(2009) and Chu (2015) and Chen and Phuong(2014).They all find that contractionary monetary policy has a negative impact on liquidity.Further, The study of Florackis et al.(2014) confirms the above cited results on the relationship between central bank policy variables and liquidity.Other studies in the same line are Chordia et al.(2004) and Lee et al.(2016).Using bond market, Goyenko and Ukhov (2009) show that the market of stock exchange and debt market are connected through monetary policy variables.At the macroecocnomic level, Galariotis and Giouvris (2015) use a general equilibrium model to gauge how liquidity

affects macroeconomics variables while Levine and Schmukler (2006) investigate how globalization affect liqudity.

The gross domemstic product has been found to have a positive impact on liquidity, empirical evidence can be found in Choon et al.(2013) and Dinger(2009). Further, the impact of unemployment rate on banks liquidity is studied by Munteanu(2012) and is documented to be negative while Horvath et al(2014) found a positive relationship.On the other hand,Moussa(2015) and Bhati et al.(2015) document that the effect of inflation rate on banks' liquidity is negative while Tseganesh (2012) establishes a positive relationship between inflation and bank's liquidity.The following section presents the methodological approach for empirical investigation.

3 Chapter 3. Model and data

Based on the literature, we selected two illiquidity measures, this chapter presents the theoretical derivation of these illiquidity variables and further presents the sources of the data we used for empirical investigation.

3.1 Model

We First present the theoretical derivation of Roll (1984) illiquidity measure which is followed by Goyenko et al.(2009) extension. In the remaining of this paper we refer to Roll(1984) as Roll illiquidity and Goyenko te al.(2009) illiquidity as Goyenko's illiquidity.Basic economic principles state that the market prices are determined by the force of supply and demand.In a situation when supply is greater than demand for a security, Chen(2012) argues that the differential between the liquid price and the illiquid price can be used to proxy liquidity discount or liquidity premium depending of the specification. The distinction between Chen(2012) and this study is that liquidity is linked to credit risk in Chen(2012) while this model focuses Roll's and Goyenko's illiquidity measures which we beleive bear equilibrium charasteritics as described in Chen(2012).Starting from Roll (1984) formulation, let us assume that the market fundamental value is represented by a variable V_t which is unobservable.The unobservable market fundamental evolves according to the following equation:

$$V_t = V_{t-1} + \epsilon_t \tag{1}$$

The error component in Eq.(1), captures uncorrelated public information shocks.Further, let us denote by P_t, the observable market price of the security under consideration.The fundamental value $V_t$of the asset is linked to the observable asset prices through the following equation:

$$P_t = V_t + \frac{S}{2}E_t \tag{2}$$

The variable E_t captures the buy/sell indicators or as described in Chen(2012) as demand and supply forces.The varibale S is the effective spread .If we make V_t the subject of the formula in Eq.(2), take it backward and apply the first difference, we obtain the following equation:

$$\Delta P_t = \frac{S}{2}\Delta E_t + \epsilon_t \tag{3}$$

From Eq.(3) above, Roll (1984) demonstrates that:

$$S = 2\sqrt{-cov\left(\Delta P_t, \Delta P_{t-1}\right)} \tag{4}$$

The specification in Eq.(4), assumes that the covariance term is negative $cov\left(\Delta P_t, \Delta P_{t-1}\right) < 0$.Based on Eq.(4), a proxy can be constructed for Roll(1984) price impact. The proxy is the Roll spread divided by the average daily rand trading volume.We now move to presenting the extended Amihud illiquidity proxy as developed by Goyenko et al.(2009). The Amihud (2002) illiquidity measure is first presented in the following equation.

$$d_t = average\left(\frac{\mid r_t \mid}{tv_t}\right) \tag{5}$$

In Eq.(5), the variable $d_t$is illiquidity, r_t stands for returns on security i at time t while tv_t is the rand trading volume of the security.Following Goyenko et al.(2009) and Holden(2009), the extended Roll (1984) half spread in Eq.(3) and Eq.(4) is illustrated as Follows:

$$\Delta P_t = \frac{1}{2} S_t \Delta E_t - \frac{1}{2}\left(1-\gamma\right) S_{t-1} \Delta E_{t-1} + \epsilon_t \tag{6}$$

In Eq.(6) the proportion $(1-\gamma)$ stands for the proportion of half spread attributed to the proccessing of orders.Dividing Eq.(6) by P_{t-1} yields:

$$\frac{\Delta P_t}{P_{t-1}} = \frac{\frac{1}{2} S_t \Delta E_t - \frac{1}{2}\left(1-\gamma\right) S_{t-1} \Delta E_{t-1}}{P_{t-1}} + \frac{\epsilon_t}{P_{t-1}} \tag{7}$$

The left hand side of Eq.(7) is the stock return $\left(\frac{\Delta P_t}{P_{t-1}} = r_t\right)$, we can therefore substitute Eq.(7) into Eq.(5) to obtain the following extended Amihud illiquidity measure:

$$d_t = average\left(\frac{\mid \frac{\frac{1}{2} S_t \Delta E_t - \frac{1}{2}(1-\gamma) S_{t-1} \Delta E_{t-1}}{P_{t-1}} \mid}{tv_t}\right) + average\left(\frac{\frac{\epsilon_t}{P_{t-1}}}{tv_t}\right) \tag{8}$$

The mean of the second term on the right hand side of Eq(8) is zero by assumption,it is the non liquid component of the retrun in Eq.(7). It is also

defined in Goyenko et al.(2009) to capture public information. Furthermore, it is an uncorrelated error term and is independent of the liquid compoenent of returns. We may therefore rewrite Eq.(8) as follows

$$d_t = average\left(\frac{|\ \frac{\frac{1}{2}S_t\Delta E_t - \frac{1}{2}(1-\gamma)S_{t-1}\Delta E_{t-1}}{P_{t-1}}\ |}{tv_t}\right) \tag{9}$$

Eq.(9) is the extended Amihud impact meaure as presented in Goyenko et al.(2009).The problem with Eq.(9) is that, the numerator of the illiquidity measure in Eq.(9) $\frac{1}{2}S_t\Delta E_t - \frac{1}{2}(1-\gamma)S_{t-1}\Delta E_{t-1}$ is unobservable but can be proxied using full spread . We therefore construct the illiquidity meaure in Eq.(9) using full spread. The particularity of Eq.(9) is that, Roll (1984) impact measure is a special case or is nested in Eq.(9). One may therefore obtain Roll Eq.(3) by assuming that $\gamma = 0$. The first objective of this study is to investigate how illiquidity behaves in the South African banking sector.The two measures of illiquidity are the ones presented in Eq.(4) and Eq(9). We compute these illiquidity meaures for the major commercial banks in South Africa.Those are Standard Bank (SB), Absa bank (AB), NedBank(NB),Capitec Bank(CB) and Bidvest Bank(BB).The first National Bank (FNB) is not included because of incomplete date issues. These meaures are computed for the period 2007-2017.

Second using panel data analysis, we investigate how firms' specific charateristics affects the illiquidity meaures.Let us denote the illiquidity measures by d_{it}^j where $j = Roll, Goyenko$ and follows Yeh et al.(2014) to specify the panel regression model as presented in Eq.(8) below. The definitions of the variables in Eq.(10) are presented in table 3.1 that follows.

$$d_{it}^j = \beta_i + \alpha_1 x_{it} + \alpha_2 y_{it} + \alpha_3 z_{it} + \alpha_4 w_{it} + \alpha_5 gr_t + \alpha_6 \pi_t + \varepsilon_{it} \tag{10}$$

Table 3.1 Variables' definition

Variables	Definition
x_{it}	Returns on equity
y_{it}	Total debt to asset ratio
z_{it}	Total cash to asset ratio
w_{it}	Log of market capitalization
gr_t	The growth rate of GDP
π_t	The inflation rate

The panel regression model as in Eq.(10) states that illiquidity is a function of firms specific variables such as the return on equilty x_{it}, the debt to assets ratio y_{it}, the cash to asset ratio z_{it}, the firm size w_{it} (this is proxied using market

capitalization) and macroeocnomic variables such as the growth rate of GDP gr_t and the inflation rate π_t in the economy, the variable $\varepsilon_{it}$is the error term. The coefficient β_i is the fixed effect parameter.The model is estimated for the period 2007-2017 . In total,four regression results are presented.

3.2 Data

The data we employ in this study is obtained from Bloomberg and the Reserve Bank of South Africa (RBSA)'s online database.Data on firms' specific charateristics are obtained from Bloomberg. Those are return on equilty x_{it}, the debt to asset ratio y_{it}, the cash to asset ratio z_{it}, the firm size w_{it} as proxied by market capitalization. The macroeocnomic variables such as the growth rate of the gross domestic product gr_t and the inflation rate π_t in the economy are obtained from the SARB's online database. For the computation of monthly illiquidity meaures, daily data is used and the data period is 2007-2017.Yearly data is used for the panel regression analysis.The descriptive statistics of the data and the correlation tables are presented in the first subsection of the empirical results analysis.

4 Chapter 4.Empirical results

4.1 Descriptive analysis

This section presents the descriptive analysis of the data.There are two illiquidity meaures, Roll's illiquidity measure and Goyenko extension of Amihud (2002) illiquidity meaure.The Roll's illiquidity measure is only computed for banks with negative covariance $cov\left(\Delta P_t, \Delta P_{t-1}\right)$, this is because the spread is undefined when the covariance is positive. After computing Roll's spread, we find that the covariance between change in price and change in lag price is negative for only Standard Bank, Absa Bank and Bidvest Bank.This implies that the cross section of the first panel regression analysis (regression related to Roll's illiquidity measure) comprises Standard Bank, Absa Bank and Bidvest Bank.The second panel regression analysis (regression related to Goyenko's illiquidity measure) uses the whole cross section which is comprised of Standard Bank, Nedbank, Absa Bank, Capitec Bank and Bidvest Bank.The descriptive statistics of Roll's illiquidity is presented in table 4.1 below:

Table:4.1 descriptive of Roll's illiquidity measure

	Standard Bank	Absa Bank	Bidvest Bank
$Mean$	0.58	0.49	1.50
$Median$	0.57	0.46	1.46
Max	0.99	1.03	2.58
Min	0.20	0.04	0.40
$Std.Dev.$	0.16	0.19	0.42
$Skewness$	0.35	0.48	0.15
$Kurtosis$	2.78	3.40	2.84
Obs	144	144	144

The mean value of the Roll price impact for Standard Bank is 0.58,0.49 for Absa Bank while the mean value for Bidvest bank is 1.50.In table 4.1, we observe that Bidvest has the highest mean and median values as well as the highest standard deviation.The following table 4.2 presents the illiquidity measure of Goyenko et al.(2009).

Table:4.2 descriptive of Goyenko's illiquidity measure

	Standard	Absa	NedBank	Capitec	Bidvest
$Mean$	0.04	0.19	0.38	9.95	0.13
$Median$	0.02	0.11	0.23	4.53	0.08
Max	0.63	1.61	6.34	79.21	1.48
Min	0.00	0.00	-0.67	-26.49	0.00
$Std.Dev.$	0.06	0.22	0.62	14.55	0.17
$Skewness$	6.47	2.57	6.53	2.13	3.96
$Kurtosis$	62.11	13.59	6.72	8.50	28.23
Obs	144	144	144	144	144

For the illiquidity variable of Goyenko et al.(2009),Capitec has the highest mean value of 9.95 and the highest standard deviation while Standard Bank, Absa Bank, NedBank and Bidvest Bank have the mean value of 0.04,0.19,0.38 and 0.13 respectively.The minimum value is negative for Nedbank and Capitec Bank while the minimum value is zero for the remaining banks.We present graphical illustration of both illiquidity measures in appendix A of this paper.We compute the correlation between the variables that are included in the regression model.There are two correlation tables, the first presents correlattion when Roll's illiquidity is taken into consideration while the second presents correlation analysis when Goyenko's illiquidity measure is taken into consideration.The illiquidity measure of Roll is positively correlated with return on equity, debt to asset ratio,cash to asset ratio, the growth rate of GDP but negatively correlated with inflation rate and market capitalization.The negative correlation between market capitalzation and the illiqidity measure means that illquidity decreases with market capitalization, this result is supported by Singh and Sharma(2016).

Table 4.3 Correlation table with Roll's illiquidity

	d_{it}^{Roll}	x_{it}	y_{it}	z_{it}	w_{it}	gr_t	π_t
d_{it}^{Roll}	1						
x_{it}	0.28	1					
y_{it}	0.03	-0.03	1				
z_{it}	0.86	0.30	0.08	1			
w_{it}	-0.63	-0.63	-0.41	-0.61	1		
gr_t	0.05	0.74	-0.14	0.03	-0.31	1	
π_t	-0.11	0.44	0.16	-0.17	-0.21	0.31	1

The positive correlation between return on equity and illiquidity implies that higher return are required by investors in order to buy illiquid assets. In order words, investors require a premium on illiquid assets.When it comes to debt to asset ratio, as total debt increase, this signal the health of the company and illiquidity incerases. Further, we observe that the market is negatively correlated with debt to asset ratio as well as cash to asset ratio.Table 4.4 below presents the correlation results when Goyenko's illiquidity meaure is used.The exact same

sign relationship that is observed with Roll's illiquidity measure is also observed with Goyenko's illiquidity measure.

Table 4.4 Correlation table with Goyenko's illiquidity

	d_{it}^{Goy}	x_{it}	y_{it}	z_{it}	w_{it}	gr_t	π_t
d_{it}^{Goy}	1						
x_{it}	0.54	1					
y_{it}	0.46	0.45	1				
z_{it}	0.74	0.62	0.44	1			
w_{it}	−0.75	−0.66	−0.52	−0.73	1		
gr_t	0.05	0.40	−0.07	−0.18	−0.08	1	
π_t	−0.11	0.39	−0.06	−0.14	−0.12	0.42	1

We see that illiquidity is positively correlated with return on equity, debt to assets ratio, cash to assets ratio, the growth rate of GDP but negatively correlated with market capitalization and the inflation rate.The same correlation results with both illiquidity measures shows the quality of the measures.We now move onto to presenting the empirical analysis in the following chapter.

4.2 Empirical results

This section presents the empirical results and the results that are presented, follow the number of illiquidity variables we have.We first present emperical results related to Roll's illiquidity variable and secondly the empirical results related to Goyenko et al.(2009) illiquidity measure.The dependent variables are the illiquidity variables.The independent variables are returns on equity x_{it}, the debt to assets ratio y_{it}, the cash to asset ratio z_{it}, the firm size w_{it} (this is proxied using log of market capitalization).The maceoconomic variables are the growth rate of gr_{it} and the inflation rate π_t. We first run the regression analysis without the macroeocnomic variables and test for multicolinearity and heteroscedasticity.Considering Roll's illiquidity as the dependent variable, the panel regression result is presented in table 4.5 below.

Table 4.5: Regression results with Roll's illiquidity

Panel A	$d_{it}^{Roll} = \beta_i + \alpha_1 x_{it} + \alpha_2 y_{it} + \alpha_3 z_{it} + \alpha_4 w_{it}$	
	Cofficients	t-statistics
α_1	-0.02	1.70
α_2	-0.01	1.98
α_3	0.12^{***}	6.06
α_4	-0.39^{**}	2.64
Prob > chi2		0.0214
R^2		0.79
Panel B	$d_{it}^{Roll} = \beta_i + \alpha_1 x_{it} + \alpha_2 y_{it} + \alpha_3 z_{it} + \alpha_4 w_{it} + \alpha_5 gr_{it} + \alpha_6 \pi_t$	
	Cofficients	t-statistics
α_1	-0.03	1.52
α_2	-0.01	1.98
α_3	0.12^{***}	5.70
α_4	-0.39^{**}	2.59
α_5	2.02	0.32
α_6	4.44	0.62
Prob > chi2		0.0233
R^2		0.79

*** is significance at 1%,** is significance at 5%, * is significance at 10%

The first panel (panel A) of table 4.5 shows the panel result estimates without the macroeocnomics variables.The regression result shows that total cash to asset ratio is significant at 1% while market capitalization which is used to proxy the size of the firm is negative and significant at 5%. The second panel (Panel B) presents the results of the panel regression analysis with macroeconomic variables included.We find that both cash to assets ratio and market capitalization are still significant at 1% and 5% respectively.The model fit the data well with an R-square R^2 of 0.79 for the model with macroeocnomic variable and the model without macroeocnomic variables.In order to check whether for residuals diagnostic tests, we use the Breush Pagan test to test for heteroscedasticity and find that the probability of Chi-square is less than 5% meaning the variance of the residuals are not constant and the results presented in table 4.5 above suffer heteroscedasiticity.

Table 4.6 Multicolinearity test results with Roll illiquidity

Variables(A)	vif	$\frac{1}{vif}$	Variables(B)	vif	$\frac{1}{vif}$
x_{it}	2.14	0.46	x_{it}	4.71	0.21
y_{it}	1.62	0.62	y_{it}	1.69	0.59
z_{it}	1.85	0.54	z_{it}	2.17	0.46
w_{it}	3.97	0.25	w_{it}	3.99	0.25
gr_{it}	-	-	gr_{it}	2.56	0.39
π_t	-	-	π_t	1.56	0.64
$mean$	2.40		$mean$	2.78	

Further,In order to test for multicollinearity in the data,we compute the variance inflation factor as presented in table 4.6. The table shows that vif of every single variable is less than 10. This implies that the data does not suffer from multicollinearity.To correct for heteroscedasticity, we run the robust version of the results presented in table 4.5 and present the robust results in table 4.7 below.The robust results did not changge much as compared to the resutls with heteroscedasicity.Both cash to asset ratio and market capitlaization are still significant at 1% and 5% respectively while debt to asset ratio became significant at 1% as well.

Table 4.7 Robust regression results with Roll's illiquidity

Panel A	$d_{it}^{Roll} = \beta_i + \alpha_1 x_{it} + \alpha_2 y_{it} + \alpha_3 z_{it} + \alpha_4 w_{it}$	
	Cofficients	t-statistics
α_1	-0.02	1.46
α_2	-0.01^{***}	2.89
α_3	0.12^{***}	5.08
α_4	-0.39^{**}	2.61
R^2	0.79	
Panel B	$d_{it}^{Roll} = \beta_i + \alpha_1 x_{it} + \alpha_2 y_{it} + \alpha_3 z_{it} + \alpha_4 w_{it} + \alpha_5 gr_{it} + \alpha_6 \pi_t$	
	Cofficients	t-statistics
α_1	-0.02	1.35
α_2	-0.01^{***}	3.07
α_3	0.12^{***}	5.87
α_4	-0.39^{**}	2.62
α_5	2.02	0.51
α_6	4.44	0.74
R^2	0.79	

*** is significance at 1%,** is significance at 5%, * is significance at 10%

The second part of the emprical results presents the panel regression analysis using Goyenko et al.(2009) illiquidity measure.The results are also presented in the same fashion as above.The first panel (Panel A) presents the regression results without macroeocnomic variables while the second panel (Panel B) presented the regression results with macroeocnomic variables included.We find that cash to assets ratio and market capitalization are significant at 1% level of significance.When the macroeocnomic variables are included, cash to asset ratio became weakly significant at 10% while market capitalization is still significant at 1% level of significance.

Table 4.8 Regression results with Goyenko et al.(2009) illiquidity

Panel A	$d_{it}^{Goy} = \beta_i + \alpha_1 x_{it} + \alpha_2 y_{it} + \alpha_3 z_{it} + \alpha_4 w_{it}$	
	Cofficients	t-statistics
α_1	-0.02	0.29
α_2	0.02	0.64
α_3	0.12^{***}	3.29
α_4	-1.67^{***}	2.95
Prob > chi2		0.0000
R^2		0.65
Panel B	$d_{it}^{Goy} = \beta_i + \alpha_1 x_{it} + \alpha_2 y_{it} + \alpha_3 z_{it} + \alpha_4 w_{it} + \alpha_5 gr_{it} + \alpha_6 \pi_t$	
	Cofficients	t-statistics
α_1	0.04	0.38
α_2	0.01	0.32
α_3	0.15^{*}	1.79
α_4	-0.39^{***}	3.07
α_5	0.01	0.04
α_6	-0.67	1.23
Prob > chi2		0.0000
R^2		0.65

*** is significance at 1%,** is significance at 5%, * is significance at 10%

The model fit well the data with an r-square of 0.65.We also perform dignostic tests, both heteroscedasticity and multicollinearity tests.We find evidence of heteroscedasticity as the probability of Chi-square is less than 5% for the results presented in panel A and panel B of table 4.8.The multicollinearity test results as presented in table 4.9 below show that the variance inflation factor (vif) is less than 10 for every single variable included in the models.This too implies no multicollienarity in the data.

Table 4.9 Multicolinearity test results with Goyenko's illiquidity

Variables (A)	vif	$\frac{1}{vif}$	Variables (B)	vif	$\frac{1}{vif}$
x_{it}	1.96	0.51	x_{it}	4.87	0.20
y_{it}	1.42	0.70	y_{it}	1.62	0.61
z_{it}	2.36	0.42	z_{it}	4.72	0.21
w_{it}	2.73	0.36	w_{it}	2.92	0.34
gr_{it}	-	-	gr_{it}	2.08	0.48
π_t	-	-	π_t	1.84	0.54
$mean$	2.12		$mean$	3.01	

After taking into connsideration the effect of heteroscedasticity, we present a robust result in table 4.10 for Goyenko's illiquidity measure.the results show that debt to assets ratio is weakly significant at 10% while cash to assets ratio

and market capitalizatio are both significan at 1% when the macroeocnomic variables are not included.In the presence of macroeocnomic variables, cash to assets ratio is weakly signficant ta 10% while market capitlaization is still significant at 1% level of significant.The model fit did not improve and remain at 0.65.

Table 4.10 Robust regression results with Goyenko et al.(2009) illiquidity

Panel A	$d_{it}^{Goy} = \beta_i + \alpha_1 x_{it} + \alpha_2 y_{it} + \alpha_3 z_{it} + \alpha_4 w_{it}$	
	Cofficients	t-statistics
α_1	-0.02	0.43
α_2	-0.02^{*}	1.72
α_3	0.18^{***}	3.45
α_4	-1.67^{***}	3.24
R^2	0.65	
Panel B	$d_{it}^{Goy} = \beta_i + \alpha_1 x_{it} + \alpha_2 y_{it} + \alpha_3 z_{it} + \alpha_4 w_{it} + \alpha_5 gr_{it} + \alpha_6 \pi_t$	
	Cofficients	t-statistics
α_1	0.04	0.36
α_2	0.01	0.76
α_3	0.15^{*}	1.89
α_4	-1.81^{***}	3.00
α_5	0.01	0.96
α_6	-0.67	1.00
R^2	0.65	

*** is significance at 1%,** is significance at 5%, * is significance at 10%

As illustrated in the methodology section, the illiquidity measure of Goyenko et al.(2009) is an extension of Amihud (2002) illiquidity measure.Further,the extension is based on Holden(2009) extension of Roll(1984) spread measure.We have also pointed out that Goyenko's illiquidity measure has Roll's illiquidity as a special case.In comparing the results above, we notice that the empirical results based on both illiquidity measures are simillar even though the cross section sample we use for Goyenko's illiquidity results is more than the cross section sample used for Roll's illiquidity.While macroeocnomic variables in both type of analyses did not add much to the results, the results are similar and the variables that influence illiquidity when Roll's illiquidity is considered are the same as the variables that influence illqiuidity when Goyenko's extension is considered.The outcome in this analysis is that Goyenko's extension of Amihud illiquidity did not improve upon the emprical results when Roll's illiquidity is considered, but lead to the same conclusion.

5 Chapter 5 Conlcusion

The main objective of this paper was to investigate the determinants of illiquidity using firms' specific factors and macroeocnomic variables for listed commercial banks on the Johannesburg Stock Exchnage.Based on the literature, we selected Roll's illiquidity measure and Goyenko's illiquidity to complete the study.The illiqiudity measures are related because the second measure is an extension of Amihud (2002) illiquidity measure and Holden(2009). In order to perform the empirical analysis, we follow Yeh et al.(2014) and perform a fixed effect panel regression analysis.The variables included in the regression analysis are firms' specific factors such as returns on equity, total debt to assets ratio, total cash to assets ratio, market size and macroeocnomic variables such as the growth rate of GDP and the inflation rate.

The empirical results shows that total cash to assets ratio and market capitalization are consistent factors that influence illiquidity in the South African banking industry. This result is similar to the one provided in Singh et Sharma (2016) and Yeh et al.(2014).Second, regardless of the illiquidity measure, the empirical results led to the same conclusion where the varibales that are found to be signifcant when Roll's illiquidity is used are also the only variables that are signifcat when Goyenko's illiquidity measure is used.The empirical analysis provided here found no contribution of macroeocnomic variables to illiquidity, we threfore recommend that future studies consider time series analsysis as different results may be found as compared to the ones provided in this document.

6 Reference list

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