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UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

THE SIZE AND LIQUIDITY PREMIUM ON THE JSE

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Abstract

This research paper is undertaken to test the size premium and liquidity premium on the JSE between January 2000 and December 2018. Previous research has found mixed results as to whether excess returns can be obtained by investing in portfolios consisting of small size, defined as market capitalisation, stocks compared to large capitalisation stocks. A liquidity premium has also been suggested on the JSE due to similarities between small capitalisation and illiquid stocks. In this paper, five portfolios based on size and liquidity are rebalanced semi-annually and annually and one, six- and twelve-month average monthly holding period returns are calculated. A dual sort is also done, rebalanced annually, to measure the average monthly holding period returns for three liquidity portfolios within three size portfolios. Prior research has suggested that small size stocks outperform large capitalisation stocks while other have a suggested a reversal of this over time. This paper finds no significant size effect or liquidity effect. Both illiquid and small size portfolio returns are significantly different to the market, proxied by the JSE All-share index. The dual sort finds that the best returns are generated in the mid capitalisation-high liquidity portfolios and lowest returns in the small capitalisation-high liquidity portfolios.

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The size and liquidity premium on the JSE

INTRODUCTION

The search for excess return, otherwise known as alpha, by market participants has been the root cause for the plethora of research done on stock market efficiencies and inefficiencies. Market efficiency is founded on the premise that information is fully reflected in the markets, whether it being historic, public or insider information. According to Fama (1970), one of the requirements for a fully efficient market is that there should be readily accessible market information available at all times for enough investors. In an efficient market profits can only be earned by bearing more risk subject to transaction costs. Fama (1970), stated that the argument for inefficient markets arises once an investor can make better predictions based on the information available in market prices.

Over the years researchers and investors have identified variables that have proven to have some sort of explanatory power for asset returns including size (market capitalisation), book-to-market equity, leverage and price-earnings ratios (Fama and French, 1992).

Stock Market Anomalies

Basu (1977) examined the relationship between price-earning (P/E) ratios and the stock performance. According to Basu (1977) shares with historically low P/E ratios tend to outperform growth shares with high P/E ratios. This is attributed to the fact that shares with low P/E ratios are undervalued in comparison to overvalued growth shares. Banz (1981) found that small capitalisation shares outperform large capitalisation shares as they consistently produce larger risk-adjusted returns. Amihud and Mendelson (1986) studied the bid-ask spread as proxy for levels of liquidity and find that asset returns are an increasing function of the spread and higher spreads are more common for less liquid shares. Rozeff and Kinney Jr. (1976) seminal work on the equal-weighted index of the New York stock

exchange between 1904 and 1974 found an average return on shares of 3.5% in the month of January, and 0.5% in the other months. This anomaly is known as the January effect. These anomalies are only some of the significant anomalies which have questioned the efficiency of capital markets.

This study will specifically consider the size effect and whether smaller market capitalisation firms have higher risk-adjusted share returns when compared to larger firms. The size effect can simply be explained as the excess risk-adjusted return an investor obtains from investing in smaller size shares. This phenomenon is based on the negative relationship identified between share size and return. Banz (1981) was the first to document this anomaly and many researches since then have expanded this topic only to find mixed results. The mixed result is a key reason as to why this has become one of the more significant and studied variables in cross-sectional stock return studies. Differences in sample size, restrictions in sample selection, sample biases, sample selection periods and locations have all had a part to play when studying the size premium.

Thus far most of the literature with data samples prior to the 1980s have found a significant size effect. Schwert (1983) stated that the size effect may just be a stock market anomaly similar to the weekend effect. The alternative answer is that the size premium is only prevalent for the really small stocks due to information asymmetry, as investor know very little about them and would not be buying them. Thirdly Fama and French (1992, 1995) hypothesised that small capitalisation shares are riskier than large capitalisation shares, as a possible explanation for the size effect, suggesting that investors obtain a premium due to the higher risk of holding smaller assets.

The second aim of this study is to shed light on the impact liquidity has on share returns on the JSE. It will further consider the relationship between the size effect and liquidity with the aim of identifying whether they have predictive power on share performance. The inclusion of liquidity to this study is due to the suggestion of a correlation between size and liquidity by (Bailey and Gilbert, 2007). In the study there is a suggestion that small capitalisation shares are more illiquid than large capitalisation shares and encourages further research into separating the effects of size and liquidity.

Liquidity is defined as the impact of market participants buy/sell actions (or volumes traded) on the price of assets traded on an exchange over a specified time period (Bailey and Gilbert, 2007). Bailey and Gilbert (2007) found that previous research ignored liquidity as they assumed closing prices throughout their trading. The difficulty in measuring liquidity arises as it consists of three different dimensions, namely; price, time and volume (Bailey and Gilbert, 2007). Bailey and Gilbert (2007) proposed the following measures of liquidity; (i) bid-ask spread, which is the difference between the price offered by buyers and the price asked by sellers for an asset, (ii) volatility ratio, defined as the comparison of short term volatility to long term volatility, focusing on price dimension volume of trade, (iii) liquidity ratio, the volume of trade divided by the absolute percentage change in price.

This paper will measure liquidity as per Amihud (2002) ILLIQ, which is defined as the daily ratio of absolute stock return to its ZAR volume. This method of calculating liquidity factors in all three-dimension mentioned above making it a suitable measure of liquidity.

This paper will attempt to find the size effect on the Johannesburg Stock Exchange (JSE), using different sample sizes and methodology compared to previous literature. In the further sections we will look to critically analyse the size premium and test whether it has disappeared over time. The addition of liquidity will provide great value to researchers should there be systematic higher or lower share returns on a share based on the share's liquidity levels. Specifically, this research paper has three key objectives.

1. To identify whether there is a size effect on the JSE.
2. To identify whether there is a liquidity effect on the JSE.
3. To identify the relationship between levels of liquidity and share returns on the JSE.

The rest of the paper is structured as follows: First a literature review on the history of the size premium, an international overview of the size premium and lastly findings in South African literature. The second part reviews levels of liquidity between large and small capitalisation shares as well as the impact levels of liquidity has had on historical share returns. This is followed by the data and sampling to be applied in the study, then a breakdown of the Methodology. The findings are then thoroughly reviewed in the empirical analysis section. Then finally the paper is concluded and suggestions for future research is provided.

LITERATURE REVIEW

Market Efficiency

The evidence of anomalies in stock markets such as the size premium, January effect and book-to-market raises questions on the hypothesised efficiency of markets. Fama (1970) explains an efficient market as one which fully reflects all available information. The efficient market hypothesis(EMH) is broken up into different information subsets.

The *weak-form* subset assumes that stock prices fully reflect all historical information of the security. This information includes all past prices, rates of returns and trading volume data. Under these conditions market participants should gain little or no value from trading rules which rely on past return data.

The *semi strong-form* theory states, all publicly available information is reflected in the markets which include conditions falling under the weak-form hypothesis. This subset assumes stock price adjusts to all publicly available information including security specific information such as earnings, price-to-earnings ratios, dividend yield, stock splits. Macroeconomic events and announcements would also be reflected in current prices after being made public. Market participants should therefore not be able find excess risk adjusted returns after information has been made public.

The *strong-form* describes a completely efficient market scenario, that includes both the weak-form and semi strong-form EMH. It assumes a perfect market where all information, including insider information, is cost-free and available to everyone at the same time. This means that stock prices always trade at fair value and market participants would only be able to achieve excess returns if they take on more risk.

In accordance with the EMH, market participants will only be able to achieve returns in excess of the risk-free rate, should they take on more systematic risk, measured as market beta, as all other risks would be diversified away. This statement supports the capital asset pricing model (“CAPM” hereafter) developed by Sharpe (1964), Treynor (1962), Lintner (1965a, b) and Mossin (1966), which is dependent on a shares market beta to determine its

expected return. This model enables investors to derive the required rate of return for any risky asset.

The CAPM assume efficient markets and the risk return relationship is linear implying that the more risk borne, the higher the expected return. For many years this model has been used to calculate the expected returns of assets or potential investments. There has been a number of critiques of this model as it is seen by many researchers as a simplistic way of measuring stock returns. The testability of the CAPM is questioned by Roll (1977), due to the inability to correctly measure the market portfolio.

The CAPM assumes efficient markets where (i) there are no transaction costs, (ii) all available information is freely available to all investors, and (iii) all investors agree on the implications of current information for the current price and distributions of future prices of each security (Fama E. F., 1970). The formula for CAPM is represented below;

$$E(R)_{(i)} = R_{(f)} + \beta_i \left[R_{(m)} - R_{(f)}\right] \quad (1)$$

Where:

$E(R)_{(i)}$ = Expected return of the asset

$R_{(f)}$ = Risk free rate (the rate received when investing in a risk-free asset i.e. US treasury bonds)

β_i = Beta of the security

$$\beta_i = \frac{\sigma^2 im}{\sigma_m{}^2}$$

$R_{(m)}$ = Expected market return

This model has been seen as a simplistic way of understanding stock returns, given that it is a two-parameter model. Further criticism stems from the number assumptions required for the CAPM to hold. The number of assumptions, which are extensions of the Markowitz (1952) assumptions, required for the CAPM to hold has led researchers to develop more complex pricing models such the Arbitrage Pricing Theory (APT) model of Ross (1976). The APT is applauded as it requires less and more relaxed assumptions as well as incorporating different dimensions of risk (Reilly and Brown, 2012). The strength of the APT model lies in its ability to derive the required rate of return using multiple risk factors that are able to impact

the returns of all assets, such as gross domestic product (GDP) growth, changes in interest rates and inflation rates. And unlike the CAPM, there is no requirement that the market portfolio be mean variance efficient (Roll and Ross, 1980)

The Arbitrage pricing model of Ross (1976) is represented below;

$$R_{i,t} = \lambda_0 + \sum_{j=1}^{n} \lambda_{j,t}\beta_{i,j} + \varepsilon_{i,t} \quad (2)$$

Where:

$R_{i,t}$= Actual return on security *j* at time period t

λ_0 = The expected return on an asset with zero systematic risk

$\lambda_{j,t}$ = The risk premium related to the *j*th common factor

$\beta_{i,j}$ = Factor betas/loadings; these represent the pricing relationship between the risk premium and asset, or how responsive the asset is to the risk premium

$\varepsilon_{i,t}$ = a zero mean random error term which has a unique effect on the asset but is completely diversifiable in a large portfolio.

Both the CAPM and APT are similar in that they apply a linear relationship between risk and return. The CAPM is simpler as it has a single market risk factor whereas APT has the option of applying several risk factors.

The Size Premium

Banz (1981) was amongst the first papers to have identified the negative relationship between small capitalisation firms and share returns, now known as the size effect. The paper found that smaller firms tend to have higher risk adjusted returns than larger firms which is now known as the size premium or the size effect. This finding raises more questions than answers as it is possible that these excess returns may just be due to one or more factors which is proxied and correlated to size. Nonetheless this finding adds to the tons of literature that exposes the simplicity of the CAPM.

The CAPM finds a linear relationship between the expected returns of a security and its' market risk. This model has been looked at as the foundation of asset pricing, whereas the size effect was identified as an additional variable used to further explain the make-up of share returns.

Banz (1981) sample includes all common stocks quoted on the NYSE for at least five years between 1926 and 1975 obtained from the Centre for research in Security Prices (CRSP). This data is sorted into size, measured by market capitalisation, and beta portfolios which is used to calculate the average risk adjusted returns for the different portfolios. Banz (1981) applied monthly mean residual returns of the portfolios to the Three Factor Model and a Two Factor Model. The Two-Factor Model adds the size variable to the CAPM whereas the three-factor model adds the variables size and value to the CAPM. The addition of these variables are adjustments made to the CAPM to find more accurate returns. According to the linearity assumptions of the CAPM, the relationship between size and return should be randomly distributed around zero. Banz (1981) highlighted non-linearity by illustrating a significant positive relationship between smaller firms and higher risk adjusted returns. Most importantly it is to note that the effect is only significant for very small firms in the smaller beta portfolios.

Similarly, Reinganum (1981) found the size effect in the US markets, by calculating the mean abnormal returns for stocks sorted into 10 size, measured as market capitalisation, portfolios, obtained between 1962 through to 1975 from the CRSP. According to Reinganum (1981) investors can systematically obtain abnormal risk adjusted returns, as high as 12%, for at least two years by simply forming small size portfolios, which is consistent to the findings of Banz (1981) who found an annual size premium of 19.8%. In trying to understand the size premium Banz (1981) suggested it could be due to information asymmetry meaning investors are solely getting a premium due to higher required rates for shares with less available information.

Keim (1983) attributed the size effect anomaly to what is now known as the January Effect, which is the seasonal high stock returns observed in the month of January. The possible explanation to the January effect is tax-loss selling and the Information Hypothesis. Brown, Keim, Kleidon & Marsh (1983) found abnormally high trading volumes, at year-ends, for

shares which have had significant price declines in the previous 12 months. The significant price declines are attributed to the eagerness of realizing capital loses before the tax year. Small stocks are then sold due their typically high variances which results in the decline in prices which is subsequently followed by investors purchasing the small firms at a discount post Financial year end realizing these higher returns as the small stocks return to their equilibrium. Another possible explanation is the information hypothesis explained by Rozeff & Kinney Jr. (1976), where it states that, as January represents a financial year end where new information such as financial statements gets released into the market, the gradual dissemination of this new information will have a greater impact on smaller firms.

In a month-to-month study of the persistence of the size effect between the periods 1963-1979, on the NYSE and AMEX, Keim (1983) found more than fifty percent of the annual abnormal returns for shares to be attributable to share performance in the month of January. Although the size effect fails to explain the January effect, there is significant evidence of larger risk adjusted returns for smaller firms in the month of January.

Blume and Stambaugh (1983) found a smaller size effect on the New York Stock Exchange. The Blume and Stambaugh (1983) findings are in line with Keim (1983) as the majority of the size effect is attributed to excess return found in January. According to Blume and Stambaugh (1983) the size effect averages roughly 0.6 percent per day in January and about zero for the remainder of the year. This equates to an annualized average of 0.05 percent per day which is half as large as the 0.1 percent per day found by Reinganum (1981) and Keim (1983). The difference does not raise the question of whether there is a size premium but more to the degree at which the size premium can be overstated based on the biases in computed the returns.

Blume & Stambaugh (1983) identified an upward bias in daily returns when using closing prices to calculate expected return. Closing prices have a bid-ask effect and is therefore not the true price of a stock. The Bid-ask effect is a property of closing prices in which the last recorded transaction reflects a public market order on only one side (Blume and Stambaugh, 1983). An example given would be a market buy/sell order being matched off by a limit sell/buy order which results in the trading price being greater/lower than the true price. The study found that the true price should be the average of the bid and ask price and a buy and hold method should be used as opposed to the rebalancing method used by Keim (1983)

and Reinganum (1981). The Buy and Hold strategy invests an equal amount in each security at a given/initial time, but no further transactions are performed during the period, whereas the Rebalanced portfolio takes the arithmetic average of individual returns periodically. This means that the portfolio is rebalanced and takes on the average bid-ask bias for individual returns in each period (Blume and Stambaugh, 1983). Those changes would prove to eliminate some computing errors and give a better measure of the size effect. This method would also do well as it will separate small size premiums from liquidity premiums.

Chen (1983) found using the APT model developed by Ross (1976), that size effect has a linear relationship with macro-economic factors. This relationship is developed on the grounds that idiosyncratic risk can be diversified away in a portfolio, and therefore it is the assets' sensitivity to macro-economic forces that drives expected return. Using the APT model Chen (1983) concluded that there isn't a significant size effect in his sample as the average returns between size portfolios do not differ much when adjusting for the macro-economic factors. Chan, Chen, & Hsieh (1983) built on the multifactor model of Chen (1983) and found that the analysis of the size effect using a multi-factor framework explains most of the abnormal average returns for small firms. The study found that market betas fail to capture risks such as; the state of the economy, business expansions and contractions, the growth rate of industrial production, and finally the impact of inflation and interest rates. These factors were seen in Chan, Chen, & Hsieh (1983) to have great explanatory power for average returns.

Roll (1981) and Schwert (1983), stated that beta calculation is often mis-specified due to the low trade volumes of small cap stocks. The infrequency of trade for smaller firms means that small size firms have smaller betas than the more frequently traded larger firms, therefore understated betas, due to a downward bias of risk caused by thin trading, can be the cause of the size effect (Roll, 1981 and Schwert, 1983). This highlights the importance of accounting for the infrequency of trade when calculating betas. Dimson (1979) and Scholes and Williams (1977) provided beta measures which make adjustments for thin trading and non-synchronous trading, which is prevalent amongst small size stocks. Keim (1983) used the Scholes-Williams beta, the Dimson beta, as well as the OLS regression beta which brings robustness to results of the study. After adjusting for thin trading, Keim (1983) found a significant negative relationship between small size and excess returns, concluding that thin trading is not the reason for the size premium.

Stoll and Whaley (1983) extended the evidence of the size effect anomaly on the NYSE and AMEX by looking at the size premium net transaction costs. The aim of Stoll and Whaley (1983) was to study the difference between gross abnormal risk adjusted returns and net abnormal risk adjusted returns, by accounting for transaction costs in the form of bid-ask spreads. According to Stoll & Whaley (1983) the size effect should be a lot less when taking transaction cost into consideration, and even more so for small size stocks. This is due to the proportionally higher spread put up by market makers as compensation for infrequent trade and risk, other costs would include investigating and monitoring costs. The results show that the small size effect is only significant for longer holding periods of three months to a year whereas it is negative for the shorter holding periods due to bid-ask spreads. This finding is similar to Schultz (1983) which found that small firms earn greater adjusted returns for longer holding periods. Although this is similar to Stoll and Whaley (1983) the paper does challenge the conclusion that transaction costs and the use of gross adjusted returns, instead of net adjusted returns, is reason for the small size effect.

Amihud and Mendelson (1986) found a direct relationship between returns and bid-ask spread, although failing to explain whether or not transaction costs is the reason for the small size premium. The Model developed by Amihud and Mendelson (1986) required that investors be compensated for holding stocks with larger bid-ask spreads. With small size stocks being found to be relatively illiquid, and illiquid stocks found to have greater bid-ask spread's, then in principal according to the Amihud and Mendelson (1986) model, small size firms should have greater net returns in the long run. Amihud and Mendelson (1986) found this not to be the case, the size effect failed to explain the return-spread relationship, as the sum of the results for evidence of a size effect is insignificant. In conclusion size effect may only be a consequence of a spread effect (Amihud and Mendelson,1986). These findings were refuted by Eleswarapu and Reinganum (1993) who, by modifying the portfolio formation technique, increased the number of firms in their analysis by 45% more than Amihud and Mendelson (1986). The difference in the portfolio formation led to the view that the Amihud and Mendelson (1986) results can be attributed to the omission of very small stocks. Eleswarapu and Reinganum (1993) found that even when adjusting for transaction costs (bid-ask spreads) there is still a significant size effect. The study looks at the liquidity premium, which states that firms with lower liquidity would have greater returns. There is

significant evidence that this anomaly only holds true in the month of January, which is a similar finding to Keim (1983).

Possible explanations for the size premium

Van Dijk (2011) reviewed the size effect over the years. The study provides a great summary of the developments of the size effect from Banz (1981) to the literature of the early 2000s. From the summary there is overwhelming results that the size effect is real, although many studies after the early 1980s argue that there has been a reversal and the size effect is no more. The majority of the studies will argue differently, with discrepancies being attributed to risk measures, flaws in pricing tests, errors in methodology and more. Van Dijk (2011) encourages further studies into the size effect, looking at the relationship between size and liquidity, and being able to account for factors that can improve some of the evidence on the size effect. Furthermore, transaction costs can also be seen as a strong factor as discussed by Stoll and Whaley (1983). The study argues that size effect could possibly be explained on a behavioural basis as investor bias can lead to mispricing's that result in a size effect.

According to Van Dijk (2011) international studies into the size effect can shed some light on certain concerns from US studies. The size effect in different countries could be impacted by variables such as trading mechanisms, market efficiencies and type of investors. This may help alleviate any data mining concerns due to different markets and time periods.

Van Dijk (2011) reviews 30 years of research to find possible explanations for the size effect, and provides a comprehensive insight into the history of the size effect and its contradictions in more recent literature. It states that the size effect has not disappeared. The explanations presented include risk, liquidity, investment behaviour and lastly that these finding may be caused be a statistical fluke. Van Dijk (2011) suggests that future research should be focused on the relationship between size and firm level investment decisions, liquidity and behavioural causes along with looking at the January effect in different geographies.

Risk as an explanation for the size effect is founded on the notion that the higher returns found on smaller stocks is a form of compensation for distress risk and that the size effect is only prevalent within the highest default risk percentile.

Berk et al. (1999), (as cited in Van Dijk, 2011) developed a model where size is related to economically interpretable characteristics of the firm, such as current assets and the level of risk of the asset. The model looks at how different variables of a firm affects the systematic risk of a firm and it then reproduces cross-sectional and time series behaviours previously documented for stock returns. This model has been able to reproduce findings which are quantitatively similar to Fama and French (1992). Firm level variables incorporated into the test for small size could therefore add significant input to the study.

The interaction between firm size and liquidity factors, as many asset pricing models have found that stock returns depend not only on transaction costs but also liquidity risk. Previous studies on this topic include Amihud & Mendelson (1986) and Eleswarapu & Reinganum (1993). According to Van Dijk (2011) liquidity explains the cross section of stock returns, although changes in market liquidity account for a minor-part of the time-series variation in these returns.

Behavioural causes such as investor overconfidence and the role it plays in creating the relationship between size and future returns. Chan & Chen (1991) found that small firms are firms that have performed badly in the past and according to Lakonishok, Shleifer and Vishny (1994), stocks that have done badly in the past tend to be undervalued which will lead to over-performance of returns in the future as the stock climbs back towards equilibrium. Information asymmetry has also been considered under behavioural causes.

Lastly Van Dijk (2011) looks into the possibility that these findings may simply be a statistical fluke driven by data mining as most authors use similar data samples and periods. Survivorship bias such as the omission of defaulted stocks and seasonality such as January effect may also be other statistical factors that influence the findings on size effect tests.

As previously mentioned, recent literature has documented a reversal of the size premium. If true that small firms may be under-priced the reversal of the size premium could be attributed to investors buying more small stocks which would increase the price of these small firm stocks and reduce the expected return.

Jiang & Yamada (2011) looked into intensified demand for larger stocks in Japan between 1975-2006 from international investors. The paper found a reversal of the size effect, using company-level ownership data. The increase in demand for large Japanese stocks causes price pressure which leads to higher returns for large Japanese firms and causes the reversal of the size premium. This provides interesting insight as fundamentals or risk associated with small and large shares were not the cause of this shift in the size effect in this instance.

Evidence from South African Literature

In earlier studies of the size effect on the JSE, de Villiers, Lowings, Pettit, and Affleck-Graves (1986) found no evidence of a significant size effect. Using three different measures of size, namely market capitalization, asset base and trade volume, the paper finds large capitalization stocks provide superior returns on the JSE. The data included ranges from 1976 – 1980, comprises of only industrial stocks and omits resource sector stocks, as at the time resource stocks were heavily correlated with gold prices. In comparison to other literature the sample is small and not very diversified which could be the reason for the findings. The selection criteria result in great survivorship bias, as stocks without a 6-year trading period and low liquidity firms, all previously shown to be characteristics of small cap stocks, were omitted. Other than the statistical reason, de Villiers et al. (1986) highlighted that the JSE has high levels of cross holding, a lot of institutional investors and low levels of liquidity, with the last two also mentioned as possible factors by Robins, Sandler and Durand (1999).

Similarly, to de Villiers, Lowings, Pettit and Affleck-Graves (1986), Page and Palmer (1991) failed to find a size effect using company data from 1978 to 1988. A possible explanation to these findings, similar to de Villiers et al (1986) is low trading volumes and survivorship bias. Page and Palmer (1991) excluded shares that ceased to trade over the period, which has been seen as an error especially when looking for a small size premium as small cap stocks have higher risk of default and are the most likely to cease trading. The study sheds further light on the importance of using liquidity filters, it finds high levels of thin trading on the JSE. Robins, Sandler, and Durand (1999) also fail to find a size effect on the JSE concluding that the size effect is mostly prevalent in the 10% smallest decile of listed stocks, therefore the

failure to find size effect in this paper was due to the portfolio construction of 50% lowest/highest market capitalisation.

Van Rensburg and Robertson (2003) was amongst the first studies to have found a significant size effect on the JSE. As prior to 1996 most of the research omitted the very small stocks due to liquidity constraints which ultimately led to survivorship bias and as per Robins, Sandler and Durand (1999) the size effect is found in the 10% smallest decile. Van Rensburg and Robertson (2003) used the periods 1990 to 2000 and apply the two-way sort procedure sorted by size and price to earnings, similar to Fama and French (1992), to create twenty-five groups of stocks. The size effect is found be significant across both the one-way (size only) and the two-way portfolio sorts. The smallest portfolio amongst the one-way sort portfolios' average monthly return is 2.5% higher than the largest portfolio over the ten-year period, statistically significant at the ninety-five percent confidence level. In the two-way sort portfolio, the difference is bigger at 3.99% for the smallest size portfolio with the lowest price/earnings ratio. Auret and Sinclaire (2006) also found a significant size premium and agree with Van Rensburg and Robertson (2003) that size together with price-to-earnings have significant explanatory power for share returns. What helped these studies, with data sets post 1996, is that liquidity more than doubled after 1996 and despite the selection bias introduced by liquidity filters, the size effect was still significant.

Basiewicz and Auret (2009) tested the size effect with a much bigger data set than the previous South African papers. Similarly, to Van Rensburg and Robertson (2003) there is a significant size effect found on the JSE. Their findings are consistent with Eleswarapu and Reinganum (1993) who stated that the size effect is more prevalent to very small size stocks. In comparing the results between the two different filters applied, the equal-weighted portfolios with price restrictions of 200 cents obtained as much as 3.14% less returns than portfolios with no price restrictions for similar levels of liquidity, measured as trading costs (Basiewicz & Auret, 2009). Consistent with previous literature the size effect was less prevalent for value-weighted portfolios. The study found that the price restrictions have a much bigger impact on the returns than liquidity restrictions. Further finding no clear pattern on how liquidity affects returns for the different size portfolios, although it concluded that the size effect may only reflect a premium for illiquidity.

Auret and Cline (2011) failed to find a significant size effect when using returns and risk adjusted returns calculated by the Treynor Ratio. It does find an insignificant size effect when using the Sharpe Ratio. The authors suggest implementing a liquidity filter and transactions cost as done so by Basiewicz and Auret (2009) to the study as it may result in a different outcome. Different time periods and databases has also been seen as a possible reason for not finding a size effect. Auret & Cline (2011) tested two different sub-periods (1988-1995; 1996-2006) as studies with datasets prior to 1996 find no size premium (de Villiers, Lowings, Pettit and Affleck-Graves (1986), Page and Palmer (1991) and Robins, Sandler and Durand (1999)) whereas (Van Rensburg and Robertson (2003), Auret & Sinclaire (2006) and Basiewicz & Auret (2009)) studies with datasets post 1996 finds a significant size effect. Auret & Cline (2011) found small size firms did outperform large firms post 1996 but not prior to 1996, although these finding were not statistically significant.

Strugnell, Gilbert, & Kruger (2011) have a data set (1994-2007) similar to the second dataset from Auret & Cline (2011). For comparative purposes on the basis that the size effect is depended on the period tested, we should expect to see similar findings. This is not the case as Strugnell, Gilbert, & Kruger (2011) found a significant holding period return of 10.81% per annum. Although they concluded that the size premium for the smallest quintiles are reducing over time. This further concludes that absence or presence of size premium may just be a result of the data set, filters applied (selection bias) or/and methodological issues.

Muller & Ward (2013) conducted a study spanning from 1985 to 2011, using both share price data and company financial statements, fails to find a significant size premium. The first criticism is that it excludes the one percent of the smallest listed companies on the JSE on the basis that they hold no relevance to institutional investors, this could possibly explain why there is no size premium found as mentioned in Eleswarapu and Reinganum (1993) and Robins, Sandler and Durand (1999). The portfolio sorts are extensive, despite excluding the very small stock. Muller and Ward (2003) formed 30 different size portfolios with 10 equally weighted shares each and find no significant pattern for size premium. The study sorts the top 280 listed shares on the JSE into 5 size portfolios and graphs the portfolios returns over 27 years. The size premium is only significant from 1989 to 1999 and then disappears which concurs with previous arguments that the size has disappeared in recent times, although inconsistent with studies on the JSE which find no size effect prior to 1996.

Page and Auret (2014), conducted a study on testing cash-flow beta, and cash flow-based fundamentals, finds excess returns of 0.2% per month between small size shares and their larger counterparts. Despite this size effect being insignificant, the study does very importantly highlight that returns are multi-dimensional and cannot be simplified by the implications of the CAPM. Page and Auret (2014), take a different approach as it applies return on equity as opposed to share returns as it looks to find the size and value premium.

Page, Britten, and Auret (2016) studied the persistence of anomalies on the JSE, further looking into the multi-dimensional nature of share returns. The variables in this study include size, value and momentum. According to Page et al (2016) the size effect has largely dissipated on the JSE. The findings on size were sorted with a price and liquidity filter, both of which failed to show any pattern for the size effect. Only two out of nine zero-cost strategies' returns were significant and only at the ten percent level of significance. Similarly, Muller and Ward (2013), and Auret and Cline (2011) failed to find a size effect on the JSE.

In more recent literature Vermeulen (2016) found an insignificant negative correlation between size and return. The multiple regression applied includes variables such as; leverage, book-to-market ratio, earnings yield, dividend pay-out, earnings growth, return on equity, earnings per share and asset growth. The sample included all companies listed on the JSE between 1994 and 2013, and after sorting for the set parameters was reduced to 115 companies. One of the significant parameters of this study is that the companies selected must have survived the full 20-year period which creates a survivorship bias.

Literature on liquidity

Amihud and Mendelson (1986), was amongst the early papers to have document the relationship between liquidity and returns as well as explain the role of liquidity, which was calculated as the cost of immediate execution, in asset pricing. Liquidity, the cost of immediate execution, is measured by the bid/ask spread, where the least liquid stocks would have the greatest bid/ask spread. Amihud and Mendelson (1986), tested the period 1961-1980 on the NYSE. The paper presents a model of the return-spread relation and ultimately finds that risk adjusted returns increase with spread. This finding persists when introducing

size as an explanatory variable in the regression equation. With expected returns also being negatively related to size, indicating that size and liquidity are independent variables.

Another similarity between the size effect and liquidity premium is seasonality. Eleswarapu and Reinganum (1993) performs a cross-sectional regression between monthly returns, betas and the relative bid-ask spread. In contrast with Amihud and Mendelson (1986), Eleswarapu and Reinganum (1993) designed the empirical tests to explore possible monthly seasonality and find that the liquidity premium is more pronounced during the month of January. This January effect on liquidity is found on the NYSE between 1961-1990, similar period to Amihud and Mendelson (1986). Considering why the size effect and liquidity premium are both significant in the month of January, Eleswarapu and Reinganum (1993) suggested that this could give insight as to whether size is just a proxy for liquidity.

In a comprehensive study on the liquidity premium on the NYSE between 1964-1997 Amihud (2002) found a positive relationship between illiquidity and returns, stating that higher realised illiquidity raises expected illiquidity, lowers stock prices and increases expected returns. The study also found a negative relationship between size and illiquidity and further suggesting that variation over time in the size effect could be explained by changes in market liquidity. Amihud (2002) measured liquidity as the daily ratio of absolute stock return to its dollar volume averaged over some period. The liquidity proxy positively impacts a security's excess return, leading to suggestions that a stocks excess return is partially represented by an illiquidity premium. In a more recent study, Amihud, Hameed, Kang, & Zhang (2015) measured the illiquidity premium as the differential return between the most and least liquid(IML) stock quintile portfolios and find that the average monthly IML is 0.80% (0.49%) for an equally return-weighted (value-weighted) portfolio.

This study will look to emulate Amihud (2002) ILLIQ liquidity measure shown below;

$$Illiq_{im} = \frac{1}{D_{im}} \sum_{t=1}^{D_{im}} \frac{R_{imd}}{Vol_{imd}} \tag{3}$$

Where;

D_{im} = Days data is available for stock i in month m
R_{imd} = Return on the day for stock i in month m
Vol_{imd} = Volume on the day for stock i in month m

Other measures of liquidity include the measure described in Liu (2006). Liu (2006) develops a measure that finds liquidity to be highly correlated with bid-ask spread, turnover and return-to-volume measures. This liquidity measure incorporates four dimensions of liquidity namely trading quantity, trading speed, trading cost and price impact. The findings by Liu (2006) based on this measure is a monthly illiquidity premium of 0.682% on the NYSE between 1963-2003, which is similar to that found by Amihud, Hameed, Kang, and Zhang (2015). Liu (2006) found that the properties of illiquid stocks are small capitalisation, value and low turnover stocks with large bid-asks spreads and large absolute return-to-volume ratios. In addition to that, the study highlighted multiple similar properties between illiquid stocks and small capitalisation stocks, such as asymmetric information and positive relationship with default and distress risk.

On the JSE liquidity is critically reviewed in De Villiers (1996). De Villiers (1996) stated that liquidity and market turnover, which is found to be low on the JSE, are linked but not synonymous. There is a positive relationship between the two meaning that an increase in market turnover would result in an increase in liquidity. De Villiers (1996) found evidence of a liquidity premium on the JSE but does point to the difficulty in finding the correct measure of liquidity due to its' multiple dimensions, namely volume, price and time. There is significant ground to further consider the relationship between liquidity and returns as suggested in Amihud and Mendelson (1986). The possibility of an illiquidity premium on JSE could play a big part in a size effect study on the JSE due to similarities in characteristics of small size stocks and illiquid stocks, mentioned above, which has led to suggestions that size may just be a proxy for liquidity. Another reason this study could be important is that small size stocks tend to be highly illiquid (Bailey & Gilbert, 2007).

Bailey and Gilbert (2007) tested the relationship between liquidity and mean reversion, by applying a liquidity cap, 50% trading days per month, to the sample. By applying this liquidity cap, it is found that small capitalisation stocks were mostly omitted due to the high correlation between liquidity and size. Although Bailey and Gilbert (2007) does not test what

the liquidity premium is, they do find that there is arbitrage opportunities for investors who look to trade in illiquid stocks, as liquidity does have explanatory power in explaining stock returns.

Not all agree as Reisinger and Van Heerden (2014) found that liquidity is not significant in explaining excess stock returns on the JSE. Reisinger and Van Heerden (2014), unlike Bailey and Gilbert (2007) and De Villiers (1996), performed empirical studies on liquidity on the JSE using five measures of liquidity; Bid-ask spread, turnover, price impact and two zero return measures. Survivorship bias is removed as all shares listed or delisted on the ALSI between 2003-2011 were included. Reisinger & Van Heerden (2014) initially applied an APT style approach and finds that size, value and momentum are significant in explaining returns but does not find liquidity to be significant. The same is found when the liquidity factors are applied to the CAPM and Fama-French model.

Besides the liquidity-return relationship another important factor to consider is its' relationship with risk and the implications it has to the measures of risk. The fact that small firm stocks are subject to less frequent trading implies that risk measures derived from returns over short intervals will tend to underestimate the true risk of such shares (Roll, 1981). Roll (1981) found that thin trading (illiquidity) results in higher autocorrelation of returns for small shares and because of this the ratio of the variance of returns on an equally-weighted index to that of a value-weighted index increases as the holding period increases.

Page, Britten and Auret (2015) applied the conventional CAPM approach to calculate beta. In order to minimise the downward bias arising from illiquidity a modified version of Liu (2006) zero daily trade filter (ZDT) is applied. Liu (2006) described liquidity as the ability to trade large quantities quickly at low cost with little price impact. Page, Britten and Auret (2015) applied this method to split the sample into portfolio sorts based on their level of liquidity, at which point the differences between the betas at each level of liquidity can be tested for statistical significance. This will be further discussed in the methodology section.

The studies mentioned above further raise the question of whether CAPM is mis-specified by implying a simple linear relationship between risk and return. This study looks to include size and liquidity as additional variables to address the simplicity of implying a linear

relationship between risk and return. The implications of this study for asset pricing is whether to consider that there is as size effect when creating a portfolio, and if true, does it speak to the efficiency of the South African markets as well as test the CAPM. Although majority of the recent literature have insignificant or no size effect on the JSE there are still inconsistencies that arise subject to time periods and methodological differences the inclusion of liquidity and thin trading can further shed light on this phenomenon.

HYPOTHESES

Test of size effect

H_{0a} : Small capitalisation stock portfolios obtain average returns equal to large capitalisation stocks on the JSE.

H_{1a} : Small capitalisation stock portfolios do not obtain average returns equal to large capitalisation stocks on the JSE.

Test of liquidity effect

H_{0b} : Illiquid stock portfolios obtain average returns equal to liquid stocks on the JSE.

H_{1b} : Illiquid stock portfolios do not obtain average returns that are equal to liquid stocks on the JSE.

Test of whether liquidity effect explain size effect

H_{0c} : Small illiquid stock portfolios obtain average returns equal to large liquid stocks on the JSE.

H_{1c} **:** Small illiquid stock portfolios do not obtain average returns equal to large liquid stocks on the JSE.

Test of whether small capitalisation stocks outperform the market

H_{od} : Small capitalisation stock portfolios obtain average returns equal to the average returns of the JSE market index.

H_{1d} : Small capitalisation stock portfolios do not obtain average returns equal to the JSE market index.

Test of whether illiquid stocks outperform the market

H_{oe} : Illiquid stock portfolios obtain average returns equal to the JSE market index average returns.

H_{1e} : Illiquid stock portfolios do not obtain average returns equal to the JSE market index.

IMPORTANCE / BENEFITS OF THE STUDY

Research done on the size premium in South Africa has led to mixed results due to factors such as; different samples, methodological errors and period applied. This study adds to previous research by having a bigger and more recent data set as well as correcting for potential survivorship and selection bias, and methodological errors. The last decade has been a period of expansion, post the global crisis, which might bring about interesting results on the size premium. The second benefit of the study is the inclusion of liquidity to the study. Many researchers have suggested that size may just be a proxy for liquidity. This study looks to identify whether there is a liquidity premium on the JSE and to identify the significance of having size in conjunction with liquidity portfolios. This is an important addition to research as volumes among smaller stocks are quite low globally, and JSE itself is quite illiquid and small compared to global indices.

DATA AND SAMPLING

An important factor to consider once the source of data has been selected is whether adjustments applied could lead to survivorship bias. Survivorship bias is a sampling bias which can occur when a sample of historical stock market omits stocks who have delisted or liquidated. The bias would prove even more crucial to small firm data as small firms have the higher probability of going into liquidation or delisting. This exclusion of delisted stocks has the ability to distort current performance studies based on time series. The main source comes from researchers not recognizing it and adjusting for it in their methodology. Gilbert and Strugnell (2010) study on the JSE find that research that excludes delisted stocks will

be subject to survivorship bias although it may not always materially affect the outcome of the study.

Van Rensburg and Robertson (2003) used BARRA organisation's full data set of monthly stock returns from 1990-2000. BARRA Organisation's data set includes delisted companies, which helps to avoid survivorship bias. Auret and Sinclaire (2006) used a similar data set which could partly explain why they found similar results for the size premium. Basiewicz and Auret (2009) obtained a large part of data from I-Net Bridge(I-Net), The Bureau of Financial Analysis/McGregor's database (BFA) and Bloomberg Professional service. According to Basiewicz and Auret (2009) I-Net has better coverage of older firms and BFA has better coverage of newer firms. Both Van Rensburg and Robertson (2003) and Basiewicz and Auret (2009) stated that post 1994 information on Market Capitalisation was not easily supplied. Muller and Ward (2013) used JSE listed stocks from 1985 to 2011 with financial statements from I-net and find that the size effect is only prevalent if the smallest 1% of firm by market capitalisation are included.

Bloomberg is used to obtain all historical daily prices, trading volumes and market capitalisation. Bloomberg database provided historical share data across the entire cross-section of stocks listed between January 2000 – December 2018. This period has available data for 434 stocks' Market capitalisation and Price, and 390 stocks' volume.

In order to tackle any survivorship bias that could be faced by omitting delisted stocks, this study includes delisted stocks. Strugnell, Gilbert and Kruger (2011) made adjustments to the returns in the month of delisting due to the data sample not being able to provide actual returns. According to Strugnell, Gilbert and Kruger (2011) it is incorrect to assume that by delisting investors lose 100% of their return, as in a case of mergers investors possibly gain returns for selling the stocks at a premium. Therefore, Strugnell, Gilbert and Kruger (2011) applied minus 100% for delisting and 50% for comparative purposes. The findings are economically insignificant, but a bias remains. In the case of delisting the probability of bankruptcy being the cause is inversely related to the firm size Strugnell, Gilbert and Kruger (2011). The data sample from Van Rensburg and Robertson (2003), provided by the BARRA organisation, included actual monthly returns thus removing the need to make assumptions and adjustments for delisting. This paper has obtained share price data and would therefore

be required to make adjustments. In order to avoid bias of either applying minus 100% or minus 50% this paper will apply zero percent return in the presence of delisting.

METHODOLOGY

From the daily share price data returns are calculated as lognormal returns shown in the equation below;

$$Log\ returns = Ln\frac{P_1}{P_0} \tag{4}$$

Where;

P_1= Current month stock price

P_0= Previous month stock price

Portfolio returns are calculated by the rebalanced returns method, defined as geometrically compounded returns with periodic portfolio rebalancing, with the portfolios being rebalanced semi-annually in order to find the six-month holding period return and annually for the twelve-month holding period return.

This methodology is adopted as Roll (1983) found that the buy-and-hold method (geometric returns) provides the most realistic investment experience, as it gives an unbiased estimate of the holding period return on a realistic portfolio. The bias is due to a serial dependency that is prevalent amongst securities that have non-synchronous trading, which is typically thinly traded stocks and as previously mentioned is a characteristic of small stocks. Scholes and Williams (1977) highlighted the economic errors arising from non-synchronous data, which is more severe on daily share data. Therefore, when using daily share data, arithmetic and rebalanced portfolio returns are exaggerated as there is positive serial dependence in play. As a result, the best way to alleviate these errors would be to apply geometric returns and use monthly return data, this would result in a less significant firm size premium (Strugnell, Gilbert, & Kruger, 2011).

Liquidity

Two measure of liquidity were considered to sort the sample into portfolios, namely Amihud (2002) ILLIQ and Liu (2006) Zero daily trade (ZDT) filter.

The ILLIQ is measured as the daily ratio of stock return to its ZAR volume shown in equation 3. Amihud (2002) finds this to be a rough measure of price impact as it measures the daily price response associated with one ZAR of trading. The motive behind using this measure is its ability to work over long periods of time, which is highly beneficial in time-series studies. According to Amihud (2002) liquidity measures such a bid-ask spreads require transaction-by-transaction information, this becomes impractical when testing large samples over long periods of time. The ILLIQ measure will be split into quintiles where we will use the illiquid minus liquid (IML) approach to calculate the illiquidity premium. By applying this to a two-way portfolio sorts we can identify whether the size effect is a result of a stocks' level of liquidity. Amihud (2002) found that the illiquidity effects are stronger for small firms' stocks, suggesting that variations over time in the size are related to changes in market liquidity over time.

The Liu (2006) zero daily trade (ZDT) filter adopted by Page, Britten and Auret (2015), proposes a liquidity measure as the standardized turnover-adjusted number of zero daily trading volumes over the prior 12 months. Liu (2006) finds that the least the liquid decile outperforms the most liquid decile by, on average, 0.682% per month when using a 12-month holding period. Page, Britten and Auret (2015) limit the amount of zero trade days to 50 and find reduction of almost half their sample. The ZDT acts as a great filter when trying to eliminate stocks with very little liquidity. For the purposes of this study stocks with all levels of liquidity are required, this allows the study to clearly identify at what levels of liquidity are there a positive liquidity premium. Therefore, the ZDT will not be applied.

Portfolio Sorts

For the one-way portfolio sorts, the data is split into quintiles, revised semi-annually and annually for comparative purposes, based on size and liquidity respectively. Size is obtained as the market capitalisation of the stock and liquidity is taken as ILLIQ, shown in equation 3. Stocks with available size/liquidity values at the rebalancing dates are sorted and split

into quintiles to create the five different portfolios for size and liquidity. Secondly a similar approach to Van Rensburg and Robertson (2003) and Strugnell, Gilbert and Kruger (2011) is applied where a two-way portfolio is formed to test the effects of liquidity within each size portfolio. Firstly the data set is split into terciles, small/medium/large, based on size and then splitting each size portfolio into terciles, low/mid/high, based on their level of liquidity, to form a set of nine portfolios rebalanced semi-annually and annually. Terciles, instead of quintiles, are used for the two-way sort in order to have enough observation in each portfolio. If the data was to be initially split into quintiles and each quintile into further five portfolios, it would result in noisy portfolio returns, due to very little observations which would potentially skew the outcome in the presence of any extreme outliers.

Portfolio returns are used as dependant variables in the initial univariate and bivariate tests. The market is proxied by the JSE all-share index for hypothesises D and E to test the level of significance between the difference of means across the portfolios using a two-tailed test. The two-tailed approach is applied as it provides neutrality as this paper aims to identify the direction, positive or negative, to which the differences in means between the portfolio and market proxy.

Regressions

This study applies time-series regression for size and liquidity portfolios respectively regressed against the market proxy.

The following regressions are performed;

$$Reg_{size} : E_{Rt} = \alpha + \beta_{Jse} + \varepsilon \quad (5)$$

$$Reg_{liquidity} : E_{Rt} = \alpha + \beta_{Jse} + \varepsilon \quad (6)$$

The market proxy to be applied to this study, when calculating the market beta, is the JSE All-Share Index. Despite the arguments on market proxies raised in Roll (1997), the JSE ALL-Share Index is the most widely used market proxy in South African studies. It is important to note, as found in Strugnell, Gilbert and Kruger (2011) and Van Rensburg and Robertson (2003), that the use of this market proxy potentially explains a reduction in the statistical power of the market model beta.

Empirical Analysis: Size and liquidity effects

In this section the results are shown for the one-way portfolio and two-way portfolio sorts. The one-way portfolio sort on size is formed using market capitalisation. The portfolios are divided into five equal weighted quintiles rebalanced semi-annually and annually both Van Rensburg and Robertson (2003) and Strugnell, Gilbert and Kruger (2011), used monthly rebalancing and similarly equal weighted portfolios as opposed to value weighted portfolios. The rebalancing is done to ensure that the portfolios are correctly represented by their respective properties. Transaction costs and dividend yield were not accounted for in this study. Stocks with no market capitalisation data on the rebalancing date were omitted. To avoid survivorship bias, there was no requirement that stocks had to trade for the whole six-month period. Stocks that delisted during the period were assigned 0% return for that month.

The liquidity sorting process follows a similar approach. The stocks used in the liquidity portfolios are required to have traded at least once in the previous month in order to have been included in the one-way portfolio sort. The dual sort follows a slightly different approach. The stocks which meet the liquidity requirements for the previous month and have market capitalisation data available on the first day on each year are sorted into terciles by size then each tercile into liquidity terciles, equally weighted and rebalanced annually. Monthly returns are then obtained for one, six and twelve month holding periods to provide the time series data used.

The average returns for each period are shown below where P1 represents the small capitalisation portfolio and P5 the large capitalisation portfolio. The statistical significance is calculated in each table where differences of average means are calculated as per below. The graphs showing the P-values can be found in the appendix section.

* Significant at the 10% level

** Significant at the 5% level

*** Significant at the 1% level

Firm size effects

The results below show the one, six and twelve month holding period average returns across the five size portfolios. The mean returns show no evidence of a significant size premium across all portfolios. The null hypothesis of equal means is rejected across the extreme quintiles(P1-P5) for all three holding periods. The evidence shows that small capitalisation stocks underperform compared to large capitalisation stocks on the JSE for the one- and six-month holding periods on the extreme small and large quintiles. These findings are different to the findings of Van Rensburg and Robertson (2003) and Strugnell, Gilbert and Kruger (2011) who found a positive size premium. This further raises suggestions that the size effect has disappeared over time as Page, Britten, and Auret (2016) and Vermeulen (2016) have also found no evidence of a statistically significant size premium on the JSE.

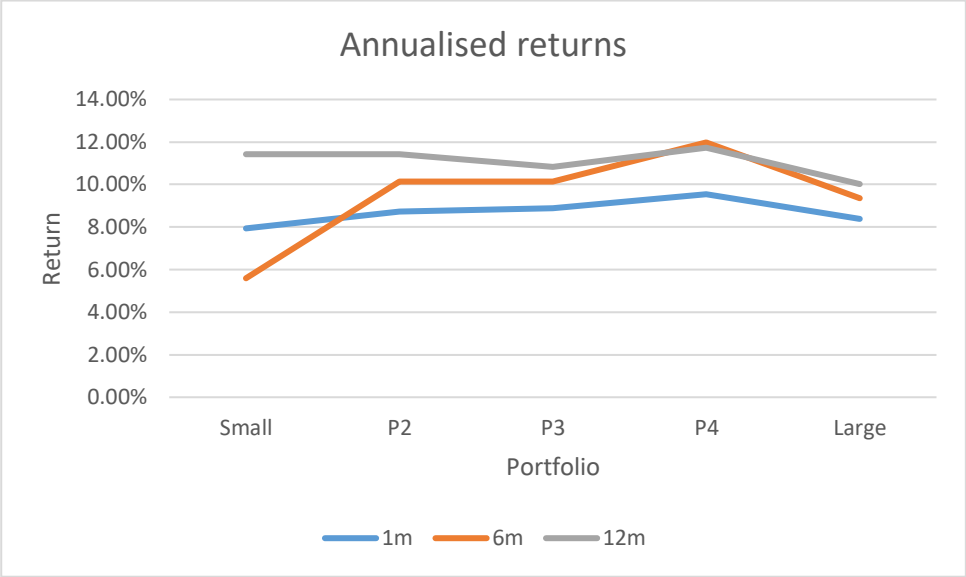
Table 1 shows the average annualised returns across the different periods and the differences between the smallest and largest quintiles as well as the difference between some of the quintiles in between. The P-values are shown in Table 1.2 in the appendix. Unlike previous studies such as Strugnell, Gilbert and Kruger (2011) this study fails to find a statistically significant size premium even when the smallest portfolio is measured against the rest, although small capitalisation portfolio does outperform the large capitalisation stock for the twelve month holding period. Auret and Cline (2011) too found a negative size premium on the JSE. Another striking finding is that the small size portfolio has negative average returns over the sample period. Figure 1 graphs these portfolio returns and shows a somewhat flat line between the quintiles, along with the fact that none of the differences between the portfolios have turned out to be significant leads to the suggestion that size premium has not reversed over time but no longer exists.

Table 1: Annualised average returns for portfolios formed on size

	Holding period		
Portfolio	1m	6m	12m
Small	7,94%	5,59%	11,41%
P2	8,74%	10,14%	11,42%
P3	8,89%	10,16%	10,83%
P4	9,55%	11,98%	11,73%

Large	8,38%	9,37%	10,02%
Difference between portfolio			
P1-P5	-0,44%	-3,78%	1,39%
P1-P2	-0,81%	-4,54%	-0,01%
P2-P5	0,36%	0,77%	1,39%

Figure 1: Average returns for portfolios formed on size



In explaining abnormal returns Chen (1983) and Chan, Chen, & Hsieh (1985) stated that the size effect maybe driven by the additional risk of small size stocks. According to these studies small size shares have higher average returns due to the underlying risk of factors such bankruptcy costs. The flat lines in Figure 2, shows that the risk across the different size portfolios only differ slightly which is similar to Strugnell, Gilbert and Kruger (2011). This suggests that the size premium is not a proxy for risk. In this case the slightly higher risk borne by the small size portfolios does not result in significantly higher returns. This is a contradiction to the mean-variance relationship of the CAPM which suggest that higher risk would result in higher return.

Table 2: The standard deviation of annualised monthly returns

	Holding period		
Portfolio	1m	6m	12m
Small	15,12%	21,03%	27,39%

P2	13,36%	20,51%	23,90%
P3	13,42%	17,72%	19,84%
P4	14,70%	18,18%	20,81%
Large	15,52%	18,18%	18,66%

Figure 2: The standard deviation of annualised monthly

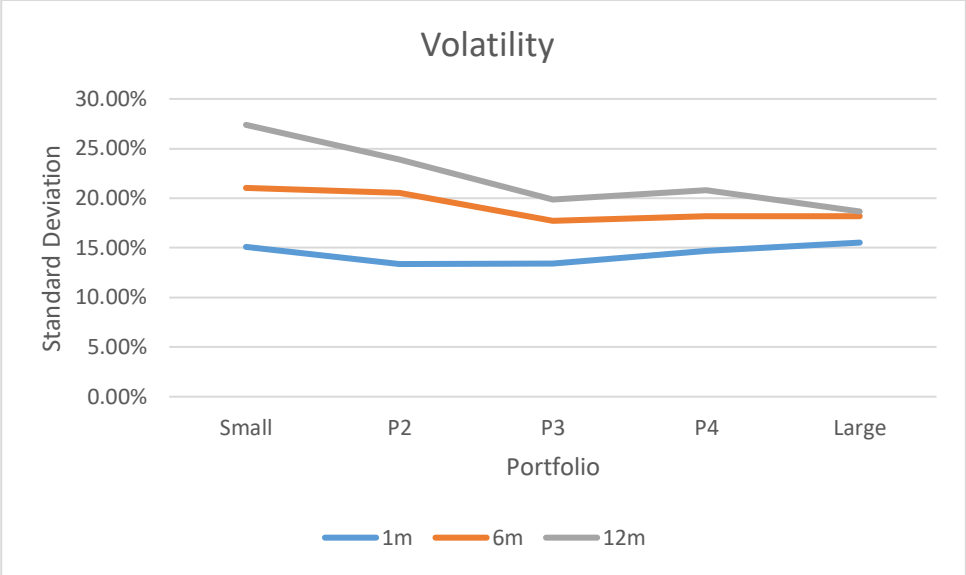
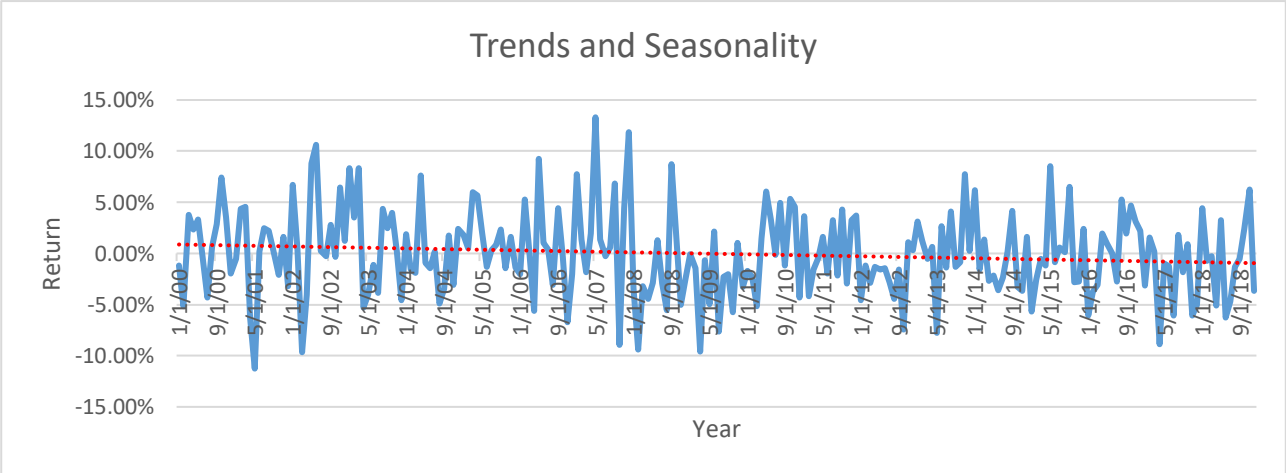


Figure 3 below shows very little seasonality and with a slight downward trend over time which has also been documented in Strugnell, Gilbert and Kruger (2011). In terms of the suggestions that the size premium has reduced over time, by looking at the trendline it is evident that small capitalisation shares dominance over large capitalisation shares over period is in fact decreasing.

Figure 3: Seasonality and trends of the size premium



Liquidity effects

Table 3 and figure 4 shows the average monthly returns across equal weighted portfolios formed on liquidity with semi-annual rebalancing. The findings below show little evidence of a liquidity premium. Contrary to previous literature namely Amihud (2002) and Amihud, Hameed, Kang, & Zhang (2015), there is no systematic excess return obtained by investing in low liquid stocks. Only two of nine observations show a positive liquidity on JSE albeit being insignificant at all levels. The null hypothesis of equal means across the extreme quintiles is rejected.

Figure 4 illustrates that highly liquid stocks do not outperform the low liquid stocks. Although portfolios that fall in between the extreme portfolios underperform.

Table 3: Average annualised portfolio returns for stocks formed on Liquidity

	Holding period		
Portfolio	1m	6m	12m
Low	10,32%	9,71%	14,35%
P2	7,69%	10,01%	10,47%
P3	7,01%	8,72%	8,90%
P4	9,24%	10,07%	10,59%
High	13,03%	14,01%	14,98%
Difference between portfolio			
P1-P5	-2,71%	-4,30%	-0,63%
P1-P2	2,63%	-0,31%	3,87%
P2-P5	-5,34%	-4,00%	-4,50%

Figure 4: Average annualised portfolio returns for stocks formed on liquidity

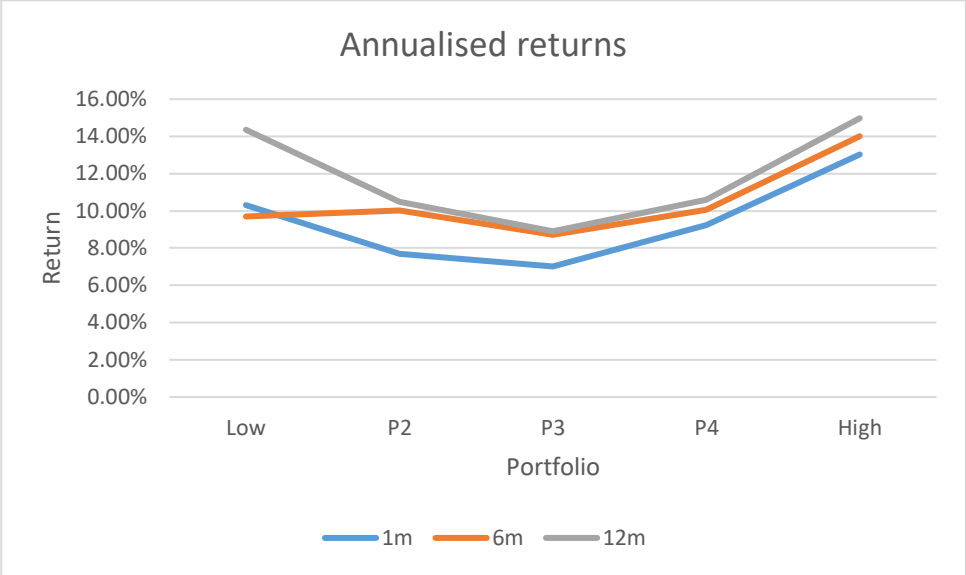
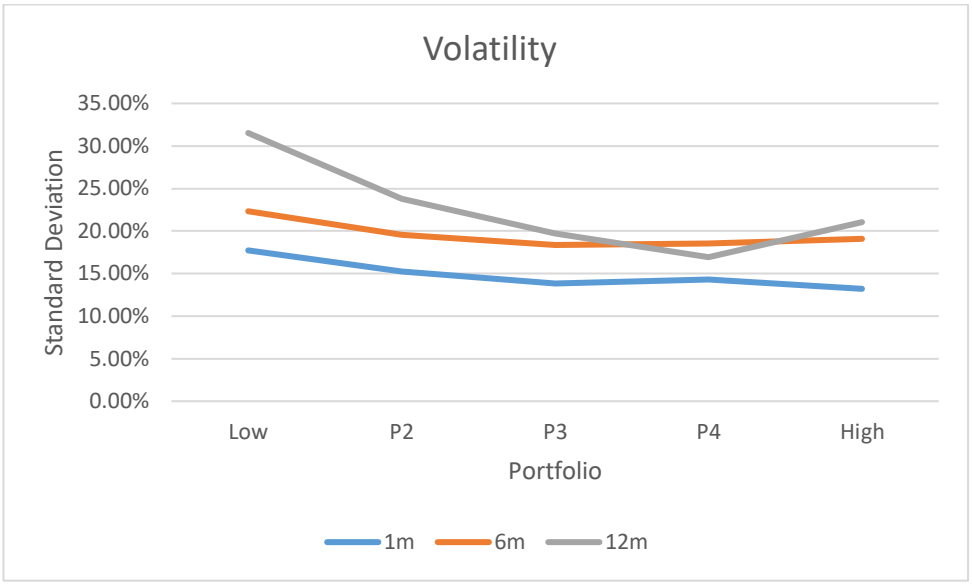


Table 4 and Figure 5 below shows that low liquidity stocks bear slightly more risk than high liquidity stocks as seen by the similar standard deviation across all portfolios.

Table 4: Standard deviation of portfolio returns formed on Liquidity

	Holding period		
Portfolio	1m	6m	12m
Low	17,72%	22,32%	31,52%
P2	15,26%	19,57%	23,80%
P3	13,80%	18,36%	19,75%
P4	14,31%	18,51%	16,93%
High	13,20%	19,11%	21,01%

Figure 5: Standard deviation of annualised portfolio returns for the annually rebalanced Liquidity portfolios



Two-way analysis: size and liquidity

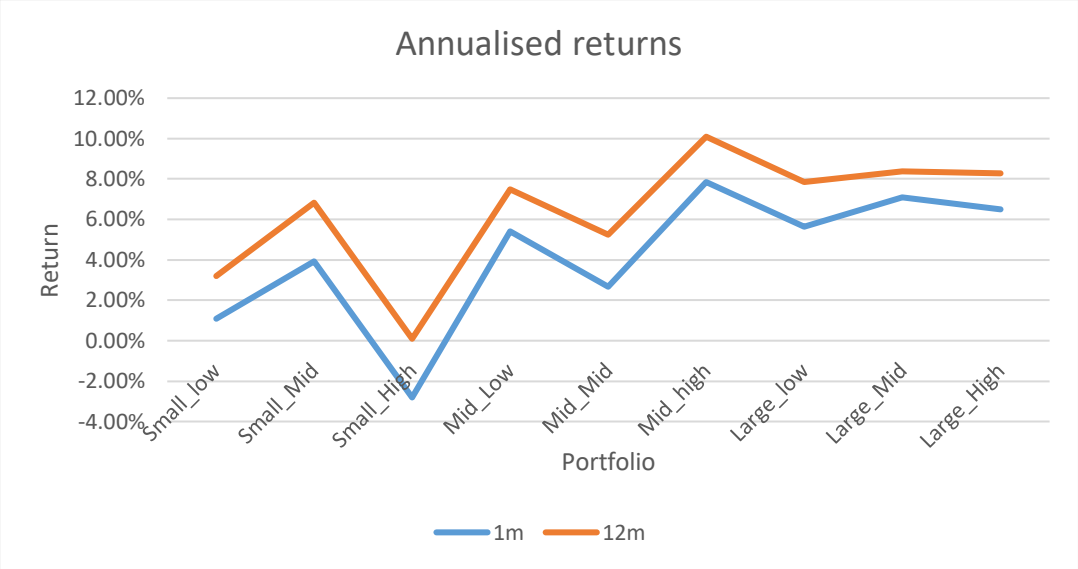
The results below show how liquidity portfolios perform within their respective size portfolios. Table 5 and figure 6 show that small capitalisation stocks with high liquidity have negative returns while the best performing portfolio is the mid capitalisation with high liquidity portfolio. From the below we can reject the null hypothesis of equal means across the extreme portfolios (small_low and Large_high) with none of the holding periods being statistically significant. A similar approach in finding statistical significance is adopted by using the two-tailed t-test. According to the findings below the small capitalisation high liquidity portfolio does not outperform the large capitalisation high liquidity portfolio, once again finding insignificant differences between portfolios.

Table 5: average returns for liquidity within size portfolios

	Holding period	
Portfolio	1m	12m
Small_low	1,10%	3,20%
Small_Mid	3,93%	6,84%
Small_High	-2,81%	0,09%
Mid_Low	5,41%	7,48%

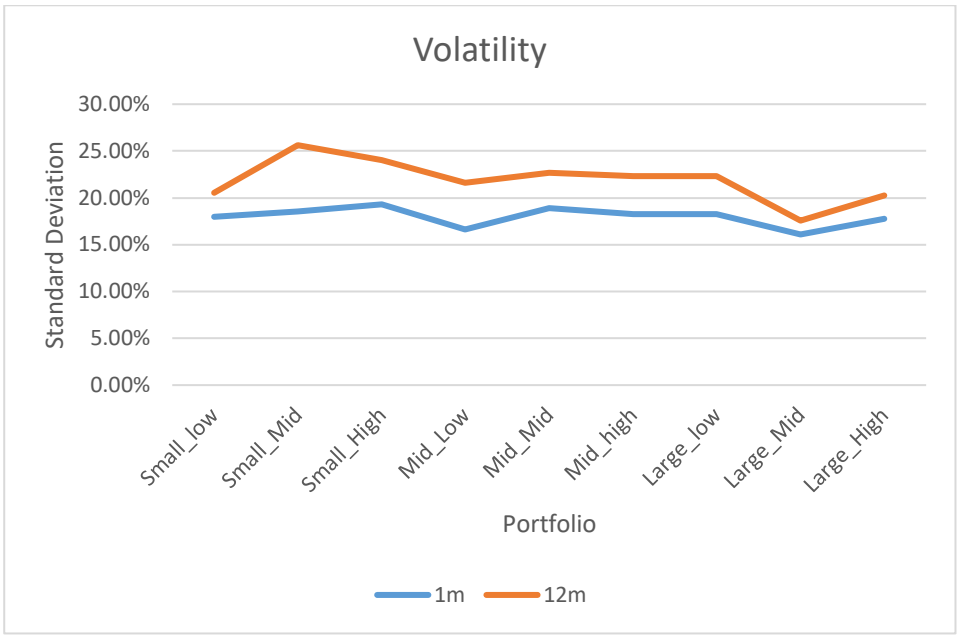
Mid_Mid	2,67%	5,25%
Mid_high	7,85%	10,09%
Large_low	5,65%	7,84%
Large_Mid	7,10%	8,38%
Large_High	6,48%	8,29%
Difference between portfolio		
Small_low-Small_High	3,91%	3,11%
Mid_low-Mid_High	-2,44%	-2,61%
Large_low-Big_High	-0,83%	-0,45%
Small_low-Large_Low	-4,56%	-4,64%
Small_High-Large_High	-9,29%	-8,20%

Figure 6: average returns for liquidity within size portfolios



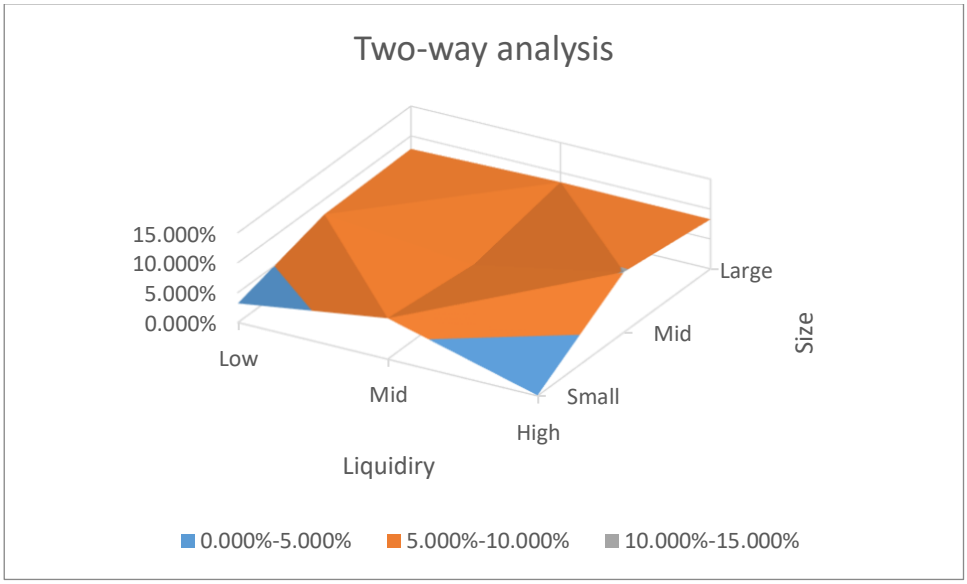
Looking at the risk, proxied by standard deviation, associated we can see that the standard deviation across all quintiles are similar, showing that the portfolio returns are driven by risk factors. Although the fact the that 12 month holding period returns show systematic higher risk and returns does add value towards the mean-variance relationship suggested by the CAPM. As it indirectly implies that investors will obtain higher returns should they bear the higher risk of holding their positions for 12 months.

Figure 7: standard deviation of average returns for liquidity within size portfolios



From this two-way analysis there is further evidence that the size effect has reversed on the JSE as there is no positive excess return to be achieved from investing in small capitalisations stocks instead of large capitalisation stocks. Figure 8 further shows the dominance of the large capitalisation stocks along with the high liquidity stocks.

Figure 8: two-way analysis liquidity within size.



Regressions

Tables 6, 7 and 8 show the regression results for size, liquidity and the dual sort portfolios. This regression identifies whether portfolios constructed based on size, liquidity or both can significantly outperform the market. The market is proxied by the JSE All-share Index and used as the independent variable in the time-series regression. We fail to reject the null hypothesis that suggest equal mean for the three portfolio construction strategies as they do not obtain statistically significant alphas. It is important to note that only one out of nineteen portfolios has a statistically significant alpha meaning the other insignificant alphas could be equal to zero. In addition, only the high liquidity portfolio obtained a statistically significant alpha. The regression also shows high correlation and betas between the large capitalisation portfolio and the market index.

The p-values in the tables below represent alpha, and only finds one significant alpha across all portfolios constructed, which is the high liquidity portfolio. The beta's calculated show a mix of results although it is important to highlight the highest betas are found with the large capitalisation stocks. This still persists across the different liquidity portfolios within the large capitalisation portfolio. It is important to note that we do not obtain any betas above 1 showing the portfolio swings are consistently less that the market swings. R-squared also shows highest values for the large capitalisation portfolios.

Table 6: Regression on size portfolio and the JSE All share index

	Small	P2	P3	P4	Large
Alpha	0,2467%	0,3262%	0,2634%	0,2659%	-0,0169%
Beta	0,48439382	0,463334269	0,55526297	0,61403824	0,85259937
R-Square	0,27386131	0,320856852	0,45701487	0,46584278	0,80510099
P-value	0,32584356	0,129097181	0,17204297	0,20432817	0,89921588

Table 7: Regression on Liquidity portfolios and the JSE All share index

	Low	P2	P3	P4	High
Alpha	0,2334%	0,0756%	0,0715%	0,2409%	0,6179%***
Beta	0,72715749	0,67164726	0,61182613	0,61625639	0,50435082

R Square	0,44937175	0,51719355	0,52446399	0,49489935	0,38944384
P value	0,36223663	0,71400335	0,69970229	0,22439791	0,00232386

Table 8: Regression on liquidity within size portfolios and the JSE All share index

	Alpha	Beta	R square	P value
Small_low	-0,0042314	0,63537642	0,33371681	0,13925628
Small_Mid	-0,0020729	0,65407687	0,33280105	0,48174702
Small_High	-0,007486	0,63206141	0,2861255	0,01909668
Mid_Low	-0,0005981	0,61738359	0,36754088	0,81636612
Mid_Mid	-0,0042974	0,80326519	0,48271639	0,10512801
Mid_high	0,00045655	0,72433428	0,42111532	0,86575375
Large_low	-0,002743	0,90663794	0,6593297	0,18648145
Large_Mid	-0,0009321	0,82397332	0,70018995	0,58682584
Large_High	-0,0021252	0,91130094	0,70208588	0,26091612

Conclusion, implications and suggestions for further research

This paper fails to find a statistically significant size effect on the JSE, confirming the findings of recent literature on the JSE, stating that the premium gained from investing in small capitalisation stock portfolios has decreased over time as illustrated in figure 4. The inclusion of semi-annual rebalancing as opposed to monthly rebalancing used by Van Rensburg and Robertson (2003) and Strugnell, Gilbert and Kruger (2011) who had found a size effect on the JSE brings about a difference to the methodology. The application of 0% for delisted stocks removes the downside bias assumed by delisting, as delisting does not always result in a loss.

There is no statistically significant excess return gained by investing in low liquidity portfolio. The application of the Illiq measure has rarely been used on the JSE, which adds to the novelty of this paper. The standard deviation across the different liquidity portfolios is also very flat. This would need further investigation. The requirement for stocks to have at least traded once in a prior month may have eliminated some very illiquid stocks as sample sizes for the liquidity portfolio were a bit more reduced compared to the size portfolios with liquidity

averaging 15 stocks per portfolio and size 24. The dual sorts provide similar findings to the respective size and liquidity outcomes as the small/low market capitalisation/liquidity portfolios failed to outperform the big/high market capitalisation/liquidity portfolios.

The regression analysis provided great insight as it shows that only one of the portfolio construction methods could significantly outperform the market index. The alphas were found to be very small and insignificant further suggesting that portfolios constructed on size and liquidity cannot be used as strategies which can outperform the market.

The implications of this paper are that investors can no longer gain excess returns by simply investing in small capitalisation shares or illiquid stocks on the JSE. Strategies based solely on market capitalisation and volume will not be able to beat the market.

Further studies should focus on the effects of liquidity as liquidity is still a complex and under researched section on the JSE. Proper liquidity measures must be used, and strict constraints must be loosened in order to avoid methodological errors such as survivorship bias. Measures applied on the JSE must be tailored to suit the characteristics of the JSE as it is still a relatively small and illiquid market. The inclusion of transaction costs could further shed light on the possible reversal of the size premium over time.

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Appendix A

P-Values

Table 1.2: P-values for size effect

	Holding period		
	1m	6m	12m
P1-P5	0,93407814	0,56553917	0,85615835
P1-P2	0,87155794	0,51828004	0,9995169
P2-P5	0,94277819	0,9066817	0,84232364

Table 3.1: P-values for the liquidity effect

	Holding period		
	1m	6m	12m
P1-P5	0,62913073	0,54808826	0,94265983
P1-P2	0,65052262	0,96601768	0,671834
P2-P5	0,29211245	0,54901451	0,54037978

Table 4.1: P-values for the two-way analysis

	Holding period	
	1m	12m
Small_low-Small_High	0,5155303	0,67091165
Mid_low-Mid_High	0,68435191	0,7165376
Large_low-Big_High	0,89294725	0,94789422
Small_low-Large_Low	0,45226538	0,50904867
Small_High-Large_High	0,1294597	0,26340598