Are Momentum Strategies Profitable for Large Asset Managers on the JSE Securities Exchange?

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Abstract

This study tests for the existence of the momentum effect on the JSE Securities Exchange using the methodology of Jegadeesh and Titman (1993). A new, long term, survivorship bias corrected dataset for the period 1976 – 2009 is used. We extend this approach by using the liquidity cap approach introduced by Bailey and Gilbert (2007) to control for liquidity constraints. Sadka (2003) showed that the momentum effect on the New York Stock Exchange is most concentrated in the least liquid shares. Controlling for liquidity is thus vital to establish the economic validity of the momentum effect for large investment managers operating in a very concentrated market such as the JSE. The positive results and the size of the observed effects are consistent with some of the previous studies in both South African and other countries, but the study provides two key additional insights: firstly, the size of the momentum effect is very sensitive to the treatment of the returns to delisted firms; and secondly, these profits are shown to increase as the more illiquid shares are excluded from the analysis, contrary to Sadka's (2003) findings. This analysis suggests that while the momentum effect may well be source of sustainable abnormal investment returns, practitioners should be aware of challenges relating to the implementation of investment strategies based on this effect.

1. Introduction

The effectiveness of momentum trading strategies to produce consistent abnormal returns (the momentum effect) on the New York Stock Exchange (NYSE) and American Stock Exchange (AMEX) was first formally presented by Jegadeesh and Titman (1993). Their study showed that investment strategies based on the performance of shares relative to a market index over the short- to medium-term (three to twelve months) consistently outperform the market in a way that is not consistent with concept of market efficiency. They showed that portfolios comprised of shares which have performed well in the past will tend to outperform portfolios comprised of those which have performed poorly in the recent past (at least for the short- to medium-term i.e. for holding periods up to a year). Therefore, in order to profit from momentum strategies, an investor would buy and hold the past winner shares and short sell the past loser shares (Jegadeesh and Titman, 1993).

Evidence for the momentum effect in South Africa was initially identified in the industrial sector of the JSE Securities Exchange (the JSE) by Fraser and Page (2000). This result was confirmed shortly afterwards by Van Rensburg (2001). Van Rensburg and Robertson (2003) then investigated momentum effects in all sectors of the JSE Securities Exchange and found that after excluding thinly-traded and non-traded shares, no significant price momentum measures were present. It is important to note that the momentum analysis was only a tangential part of the research conducted in all of these papers. The first in-depth analysis of momentum on the JSE Securities Exchange was performed by Boshoff (2009). This paper is unpublished and used a different methodology to the one adopted in this paper. Subsequent to this, the first published analysis of intraday momentum effects on the JSE Securities Exchange was performed by Venter (2009). This paper adds to the body of literature on the momentum effect in South Africa firstly

by using a new, long term dataset that is corrected for survivorship bias. It also uses a portfolio construction methodology that has not been used in the South African context before. Finally, it tests for the economic validity of the momentum effect by using a new methodology for adjusting for levels of liquidity in the portfolio creation process.

Liquidity plays a major role in any investment strategy, as the profitability thereof relies heavily on the ability to trade necessary positions at as close to the observed price as possible. The analysis of liquidity and its relation to momentum strategies has not received much attention in literature. Sadka (2003) introduces the first substantial analysis of momentum and liquidity and examines the effects that both liquidity risk and the level of liquidity have on momentum on the NYSE.

The limited existence of thinly traded shares, found more commonly on the stock exchanges of developing nations, may explain why few attempts have been made to include liquidity in research that has been performed on the momentum effect in international studies. The JSE Securities Exchange, although ranked amongst the world's most sophisticated bourses, is also subject to having thinly-traded shares on its exchange.

Van Rensburg and Robertson (2003), in their study of momentum, accounted for this low level of liquidity amongst the shares on the JSE Securities Exchange. Their adjustment involved the exclusion of shares from their analysis that did not meet a required liquidity estimate defined by the turnover ratio[1]. Boshoff (2009) applied a similar methodology but also examined how momentum profits differ as cut-off values for the turnover ratio were increased at discrete intervals. Although this method would show the relationship between liquidity and momentum, the turnover ratio provides no reference as to what these liquidity levels represent in monetary

[1] The turnover ratio for a share is calculated by dividing the average daily trading volume of the share over the month by the number of outstanding shares at the beginning of the month (Van Rensburg and Robertson, 2003).

terms. In other words, it's not clear how these liquidity constraints relate to the size of a portfolio under management.

Bailey and Gilbert (2007), although focusing on mean reversion, provide a solution to the problem in the form of their "liquidity cap" measure. This "liquidity cap" measure allows us to view the effects of liquidity in terms of a Rand-sized portfolio which has to be allocated to a predefined number of shares in the market (Bailey and Gilbert, 2007). Therefore, by changing the size of the portfolio to be traded on the market, one is able to view how liquidity affects certain investment strategies, from an asset manager's point of view (Bailey and Gilbert, 2007).

The purpose of this study is therefore to test for the presence of momentum on the JSE over the period 31 January 1976 to 31 April 2009, as established in different (and shorter) sample periods by Fraser and Page (2000), Van Rensburg (2001) and Boshoff (2009). Once this has been established, the effect that liquidity has on momentum strategies will be examined. The results of such will provide evidence as to whether large asset managers can profit from momentum strategies.

The remainder of this paper is divided into five sections. Section 2 consists of a literature review outlining the relevant literature on momentum. Section 3 specifies the methodology used in the analysis. The results are shown in Section 4 and Section 5 and Section 6 consists of the conclusion of the study.

2. Liquidity and momentum strategies

Liquidity, as mentioned in the introduction, is an avenue of momentum research which has not received a great deal of attention in research on the momentum effect. With papers such as Rouwenhorst (1999) and Jegadeesh and Titman (2001) briefly touching on certain aspects of

liquidity and its relation to momentum, Sadka (2003) introduces the first detailed analysis. This general lack of liquidity research is surprising, considering that a momentum strategy is hugely reliant on the liquidity of the shares in which it is trading. This is a great concern in South Africa's relatively illiquid market – the JSE.

Most studies which have taken liquidity into account in their analysis of momentum, have done so by first excluding a portion of shares, based on a liquidity estimate, and then evaluating the momentum profits obtained by the remaining pool of shares. The bulk of the momentum research performed on the JSE Securities Exchange has incorporated some element of liquidity in their analysis. Van Rensburg (2001) and Van Rensburg and Robertson (2003) both screen their data for thinly-traded shares, excluding those shares which had not traded at least once every month over the course of their analysis. Boshoff (2009) applies the turnover ratio to the JSE Securities Exchange, excluding shares which do not meet the required turnover estimate. He then goes one step further and examines the resultant momentum profits achieved after increasing the turnover ratio at discrete intervals and found that momentum strategies earned greater profits amongst the more liquid shares (Boshoff, 2009).

Jegadeesh and Titman (2001) exclude stocks with a price below $5 from their analysis. The main reason for this exclusion was to counter the major price fluctuations which are characteristic of small firms. The momentum profits achieved, however, did not differ greatly whether these low-priced shares were included or not and provides evidence that momentum profits should be achievable in the more liquid shares. (Jegadeesh and Titman, 2001)

Using a share's turnover ratio as a proxy for liquidity, Rouwenhorst (1999) investigates whether there is a cross-sectional relationship between certain share characteristics and liquidity in emerging markets. After examining 20 emerging markets and 1750 different stocks,

Rouwenhorst (1999) found there to be a positive relationship between momentum and liquidity. The strength or size of the relationship, however, is not specified. (Rouwenhorst, 1999)

Sadka (2003) differentiates between two aspects of liquidity that a share possesses and investigates the relationship between these liquidity aspects and momentum. The "liquidity level" of a share can be explained as the overall ability of an investor to trade in that share (Sadka, 2003). Estimates of the liquidity level are based on a share's previous trading history (examples being the turnover ratio mentioned above, a share's bid ask spread and trading volume). The second aspect of liquidity investigated by Sadka (2003) is the "liquidity risk" of a share. Liquidity risk is priced into a share and can be explained as the risk incurred or premium associated with investing in a share with a low level of liquidity.

Sadka (2003) finds that both of these aspects of liquidity are strongly related to momentum. The analysis of the liquidity level of the shares within a momentum strategy showed that the shares contained in the portfolios of the extreme buys and sells were the least liquid. Liquidity could thus be viewed as a possible "limit to arbitrage" with regard to the execution of momentum strategies. Liquidity risk was found to account for roughly half of the momentum effects in the market (Sadka, 2003).

Liquidity level proxies are often based on the average trading volume of shares, examples being the "turnover ratio" used by Rouwenhorst (1999) and Boshoff (2009) mentioned above. The "liquidity cap" measure introduced by Bailey and Gilbert (2007), which is the liquidity level proxy used in this study, is also based on average trading volume. Reviews of past literature with respect to the relationships between momentum and trading volume will therefore provide useful insight into some of the results obtained in the result section of this study.

Lee and Swaminathan (2000) use a Jegadeesh and Titman (1993) -style momentum analysis on NYSE and AMEX stocks over the period of January 1965 to December 1995. Each of the resultant decile portfolios formed, however, were further sorted into three more portfolios based on their past trading volume over the formation period (Lee and Swaminathan, 2000). Amongst the most important of their findings, is the fact that momentum strategies earn higher profits among the high volume stocks than they do among the low volume stocks. Splitting the profits up into their respective return-volume portfolios, Lee and Swaminathan (2001) also found that the length of return continuation was greatest in the high volume loser shares and the low volume winner shares. A loser (winner) share is a share which has performed poorly (well) in the past.

Chan, Hameed and Tong (2000) confirm the positive relationship found between momentum profits and trading volume on stocks from 17 countries across the world, including emerging market countries such as Thailand, Indonesia and Malaysia.

This paper extends the body of work referred to above by applying an alternative measure of liquidity in the South African market.

3. Methodology

3.1 Data

All shares that have been listed on the JSE Securities Exchange over the period 31 January 1976 to 30 April 2009 are included in this analysis. This includes shares which have subsequently delisted, in order to avoid the survivorship bias problem identified by Gilbert and Strugnell (2008). The monthly prices, dividend yields and trading volumes of the above-mentioned set of shares are collected using I-Net Bridge. To dampen the effect that dividend

yield's of delisting companies can have on momentum strategies, dividend yields are capped at 50 per cent[2]. Shares which are lacking the necessary data are excluded from the analysis, leaving a total of 1543 shares for analysis. The 2008 Reweighted Consumer Price Index (CPI) is also collected from I-Net Bridge over the same period. The reweighting of JSE All Share Index, make it necessary to collect two sets of data, namely the CI01 (the JSE/Actuaries All Share Index) and the J203T (the FTSE/JSE All Share Total Return Index). The CI01 as well its dividend yield is collected from I-Net Bridge over the period 31 January 1976 to 30 June 1996. Its successor, the J203T is collected using McGregor BFA over the period 30 June 1995 to 30 April 2009. The overlap in the data collected for the J203T and CI01 is due to the fact that at least 13 months of J203T data is needed, before a 12 month return can be generated using the J203T data.

3.2 Trading Strategy

Although the analysis conducted in this paper is empirical in nature, special attention is given to ensure that the methods used in the analysis, are as practical as possible. Accordingly, the decile approach, implemented by Jegadeesh and Titman (1993), is used to perform the analysis of momentum strategies. This approach requires trades in 20 percent (top and bottom ten percent) of the listed shares on the market at each time point and is favoured due to its practicality over approaches such as the Conrad and Kaul (1998)[3] approach which requires trades in all listed shares on the market.

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[2] Dividend yields are calculated using historical dividends. As a company nears delisting its price tends to collapse towards zero which causes the dividend yield to balloon to unrealistic levels. The use of an equal weighting scheme in the construction of the portfolios used in this study led to severely biased results for the portfolios which include these shares. We have uses of the cap of 50% on dividend yields to avoid this problem.

[3] The Conrad and Kaul (1998) approach includes all listed shares at each time point in its zero-cost momentum strategy. Shares which have outperformed (underperformed) an equally-weighted market index over the formation

The approach calls for two periods, a formation period and a holding period (Jegadeesh and Titman, 1993). Shares are first ranked in ascending order based on their formation period returns (Jegadeesh and Titman, 1993). The formation periods of sizes 1,3,6,9 and 12 months are used in this analysis.

After ranking the shares they are then divided into deciles, the top decile portfolio consisting of the past loser shares and the bottom decile portfolio consisting of the past winner shares (Jegadeesh and Titman, 1993). Shares within each decile are equally-weighted (Jegadeesh and Titman, 1993). The bottom decile (past winner shares) are then bought while the top decile or past loser shares are then short sold, forming a zero-cost strategy which is held for the length of the holding period (Jegadeesh and Titman, 1993). Holding periods are chosen to be the same length as the formation period, 1, 3, 6, 9 and 12 months respectively.

The formation and holding period lengths are chosen to be consistent with previous momentum research on the JSE Securities exchange performed by Fraser and Page (2000), Van Rensburg (2001) and Van Rensburg and Robertson (2003). This gives a total of 25 strategies. Jegadeesh and Titman (1993) skip a week between the formation and holding period returns to allow for "bid-ask spread, price pressure, and lagged reaction effects" (Jegadeesh and Titman, 1993:68). Due to data constraints, a month is skipped between formation and holding period returns in this analysis. Holding periods are overlapping given the relatively limited number of data points in the sample period. This unfortunately eliminates the possibility of tests for statistical significance of the differences between returns as these test assume independence of samples.

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period are bought (short sold). These positions are held for the duration of the holding period (Conrad and Kaul, 1998).

3.3 Returns and delisting of shares

The return for a share over a given period is calculated as a monthly average return. It is very important to note that we do not have any information on the returns to shareholders following the delisting of a share. This can range for 0%, if the share price at the delisting represents the payout to the shareholders at that point in time, to -100% if the company goes into bankruptcy and the shareholders do not receive any payment for their shares. While we might expect the price of the share to have declined to (almost) zero by the time the share delists, we can't necessarily infer that this is the case. Moreover, the loss in the final period will still be 100% if the shareholders do not receive any compensation - even if the price is 1 cent.

We have modelled both situations in this study, but it is important to note that a negative 100 per cent return (Method 1 below) will most likely understate the compensation received however a zero per cent return (Method 2 below) will most likely overstate the compensation received.

To capture this difference, two different methods (Method 1 and Method 2) are used to convert an "i" month return into a monthly average return. Both methods use Equation 1 - they only differ by the return it is assumed they produce when a share delists.

$$Ri = \left(\left(\frac{Pi}{P0} \right)^{\frac{1}{i}} - 1 \right) * K + \left(\frac{\left(\sum_{J=0}^{i} DYj \right)}{(i+1)} \right) / 12$$

If a share delists between time 0 and time "i", Method 1 would produce a negative 100 per cent return, while Method 2 would produce a zero per cent return. Both methods would leave the return achieved through the dividend yield unchanged for this final period. This methodology is used for the returns calculated in formation and holding periods.

The large number of shares that delist over the analysis period is motivation for the inclusion of Methods 1 and 2. Recording a negative 100 per cent return (using Method 1) is more representative of the compensation received by a shareholder when a share delists due to its going bankrupt. However, when a large number of shares in a portfolio delist at the same time, their combined returns can overpower the returns achieved by those shares which remain listed, and more importantly, overpower changes in the returns achieved by momentum strategies at higher liquidity levels (as demonstrated in the analysis section of this paper). Method 2, on the other hand, emphasises (relative to Method 1) the results of the pool of shares that do not delist during their respective holding periods. Large amounts of delisting shares will compress the returns achieved by the winner and loser portfolios around the zero mark instead of pushing them below zero as would occur with Method 1.

3.4 Abnormal Returns

ALSI returns are subtracted from the returns generated by the zero-cost momentum strategies in order to ascertain whether the returns achieved are abnormal. ALSI returns are calculated using the CI01 until June 1996, thereafter the J203T is used. Two equally-weighted market indices (EWI1 and EWI2) are also calculated by taking the equally weighted returns on all listed shares at each time point (Bailey and Gilbert, 2007). EWI1 returns are calculated using Method 1's version of Equation 1 and EWI2 returns are calculated using Method 2's version. EWI1 and EWI2 are calculated using the same data as the formation and holding periods above and are used to provide insight into the movements of the winner and loser portfolios of the momentum strategies over the period under analysis.

3.5 The Liquidity Cap Measure

In order to establish the relationship between momentum and liquidity, the liquidity cap measure developed by Bailey and Gilbert (2007) is used. Simply put, the liquidity cap is dividing line whereby shares which do not meet the particular liquidity level defined by the liquidity cap are excluded from further analysis (Bailey and Gilbert, 2007). Intuitively the liquidity cap is set by taking into account the size of the portfolio that is being invested using the strategy, and the historical level of turnover of individual shares. By increasing the size of the liquidity cap at discrete intervals and analysing the momentum profits obtained at each interval, the relationship between momentum and the level of liquidity can be tested.

The advantage that the liquidity cap measure has over other liquidity proxies is that the size of the liquidity estimate is directly related to a portfolio size in monetary terms and hence shows the relationship between momentum and liquidity from the asset manager's point of view (Bailey and Gilbert, 2007). The liquidity cap measure screens the shares before the formulation period has taken place, hence only including shares of a required liquidity level into the momentum strategy analysis.

There are two sides to the liquidity cap measure for a given share, the first being the liquidity cap estimate. This is calculated by multiplying the share's average trading volume over the last 12 months by its current share price and dividing by two (Bailey and Gilbert, 2007). The second is the figure that the liquidity cap is compared to. This is derived from an amount of money that has to be invested into each of the decile portfolios making up the momentum strategy, we will call this amount of money the "liquidity portfolio" (Bailey and Gilbert, 2007). Due to the decile portfolios being equally weighted, the amount invested into each share will be

the same. For example, if you have a liquidity portfolio of R1000 and each portfolio comprises 10 shares, you will have an investment of R100 into each share.

Shares are screened (or excluded) if their liquidity cap estimate is below the amount that needs to be invested into the particular share (Bailey and Gilbert, 2007). In essence, the liquidity cap screens shares which do not have the level of liquidity to meet an investment of X amount, where X represents the liquidity portfolio size divided by the number of shares in the decile portfolio. The liquidity portfolio sizes are R0, R10 million, R100 million, R1 billion and R10 billion (Bailey and Gilbert, 2007). Bailey and Gilbert (2007) also include liquidity portfolios of size R100 000 and R1 million. These, however, are found to exclude a very minimal number of shares and thus are not included in this analysis. The liquidity portfolio sizes are discounted according to the CPI in all months prior to June 2008 when the index was reweighted (Bailey and Gilbert, 2007). All 25 momentum strategies are run at each liquidity portfolio size. This amounts to 125 strategies that were tested and will be reported here.

3.6 Changes to the Liquidity Cap required for this study

Additional changes have to be made to the liquidity cap measure for its use in this study, as a different portfolio construction methodology is used by Bailey and Gilbert (2007). The major difference is the choice of portfolio size. Bailey and Gilbert (2007) used fixed portfolio sizes as opposed to the decile approach approach adopted in this paper which calls for portfolio sizes of 10 per cent of the total listed shares at each time point. The portfolio sizes using this approach therefore change as shares list and delist from the market. The liquidity cap measure is, therefore, altered to better suit the decile approach. Instead of using a fixed number of shares every month, a moving average of the previous 12-month total listed shares is taken and 10 per cent of this figure is used as the number of shares to be divided into each liquidity portfolio.

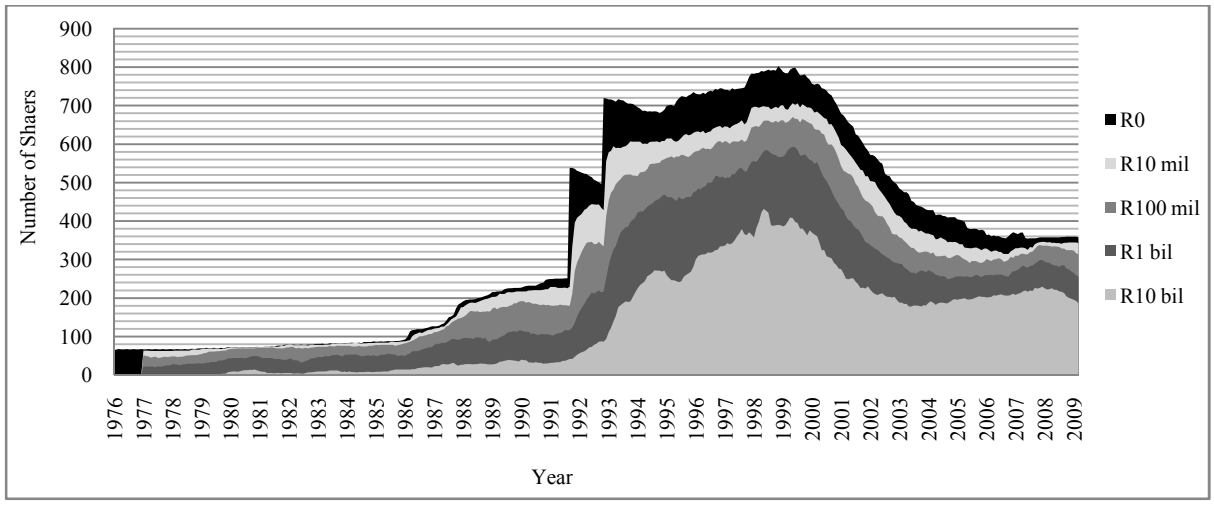
The problem with using the moving average approach, however, is that the Rand investment into each share will not be consistent over the entire period for a given liquidity portfolio size. It will be larger for periods when there are fewer shares listed. Therefore, the analysis may favour the momentum returns achieved by shares in periods when there are more stocks listed.

A further problem with the decile approach when used in conjunction with the liquidity cap measure, is that the liquidity cap measure requires the number of shares in a portfolio to be known prior to screening the shares. With the decile approach, the actual number of shares in the portfolio will only be known once the screening of the shares has taken place (it will take 10 per cent of the shares once they have been screened by the liquidity cap). Thus, the original number of shares in a portfolio at each time point, calculated as above, is used for all liquidity portfolio sizes, even though the actual amount of shares in the decile portfolio may be fewer. This means that the Rand value of the resultant decile portfolios formed will not be equal to the liquidity portfolio sizes and will deviate further from these amounts as the liquidity portfolios increase in size and exclude more shares. The amount invested into each share, however, will increase in relation to the liquidity portfolio sizes. Therefore, portfolio sizes will not be reported according to their liquidity portfolio size. Instead, they will be reported as the number of shares in the decile portfolio multiplied by the Rand investment into each share. This reverse-engineered amount will be a prudent estimate of the decile portfolio sizes, as shares would have been screened at a higher liquidity level.

4. Results

Before the results of the trading strategies can be analysed, it is first necessary to report on the results of the liquidity cap measure with special attention given to the problems reported in the Methodology discussed above. Figure 1 shows the number of shares which are included in the analysis at each of the liquidity portfolio sizes.

Figure 1. The number of shares included for analysis at each liquidity portfolio size.



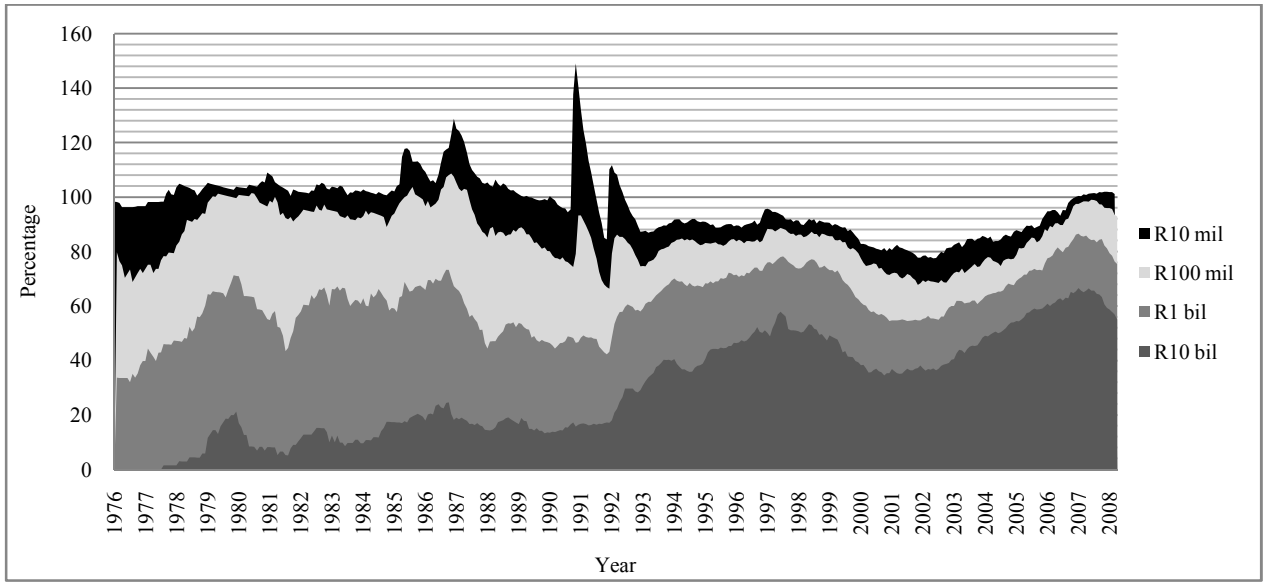
The liquidity portfolio of size R0 represents the original data set. The number of listed shares starts out at 65 in January 1976 and reaches a maximum of 803 in February 1999 before declining to 358 in April 2009.The massive change in listed shares is an initial cause of concern using a moving average approach to the liquidity cap measure as mentioned in the methodology.

Figure 1 shows that in general, the decrease in number of shares included in the analysis at higher liquidity levels is not proportionately greater for periods when there are less listed shares. In fact, the drop in shares due to the R10 million and R100 million liquidity portfolios seems proportionately greater for the shares between 1992 and 2003, where the largest number of listed shares lie. The R10 billion liquidity portfolio on the other hand, although excluding a large amount of shares over the 1992 to 2003 period, does exclude all shares from the analysis over a

few disjointed periods prior to 1992. The R10 billion portfolio will therefore favour the more recent returns achieved in the momentum strategies.

The reverse-engineered portfolio sizes, calculated by multiplying the Rand investment into each share, for a given liquidity portfolio size, by the number of shares in the decile portfolio, is shown in Figure 2. The four major peaks at the R10 million and R100 million liquidity portfolio sizes correspond to periods where there was a large increase in the number of shares listed on the JSE Securities Exchange, shown in Figure 1.

Figure 2. The reverse-engineered portfolio sizes[4]



4.1 Momentum Strategies

The results from the momentum strategies at the liquidity portfolio of size R0 (i.e. before any share exclusions due to liquidity have taken place) are shown in Table 1.

Strategy 12-12 (12 month formation period and 12 month holding period) of Method 1 is the only strategy to achieve positive returns. Positive returns are achieved in the 12-9, 9-12 and 12-12 strategies with respect to Method 1 and in the 9-3 strategy with respect to Method 2. A

[4] The amounts are expressed as a percentage of the liquidity portfolio sizes for scaling purposes.

distinct difference between the returns achieved by Method 1 and Method 2 is that the returns for Method 1 increase with both an increase in the length of the formation period and with an increase in the length of the holding period. Method 2, on the other hand, follows a more convex shape with respect to increases in both the formation and holding periods, reaching maximums at 12-1, 9-3, 9-6, 6-9 and 6-12 respectively. This convex shape is more intuitive, as one would expect the start of a mean reversion type of return reversal to occur at longer holding periods.

Table 1. The annualised abnormal, zero-cost, momentum returns achieved using Method 1 and Method 2

Abnormal Returns		Method 1				
		Holding Period				
		1	3	6	9	12
Formation Period	1	-0.305	-0.299	-0.265	-0.207	-0.187
	3	-0.222	-0.223	-0.160	-0.052	-0.008
	6	-0.205	-0.200	-0.177	-0.073	-0.055
	9	-0.214	-0.204	-0.111	-0.006	0.057
	12	-0.188	-0.180	-0.061	0.053	0.130

Abnormal Returns		Method 2				
		Holding Period				
		1	3	6	9	12
Formation Period	1	-0.296	-0.256	-0.208	-0.165	-0.154
	3	-0.163	-0.084	-0.045	0.003	-0.011
	6	-0.131	-0.055	-0.023	-0.004	-0.033
	9	-0.14	-0.061	-0.036	-0.042	-0.066
	12	-0.142	-0.084	-0.077	-0.078	-0.09

The general lack of abnormal profits achieved by momentum strategies in this analysis are similar to those achieved by the more recent momentum studies performed on the JSE Securities Exchange. Boshoff (2009) examined the period from 31 December 1979 to 31 October 2007 while Van Rensburg and Robertson (2003) examined the 10 year period from July 1990 to June 2000. Both find zero significant momentum profits. Contradictory to this, Fraser and Page (2000) and Van Rensburg (2001) found there to be significant momentum profits over the periods January 1973 to October 1997 and February 1983 to March 1999, on industrial shares of the JSE Securities Exchange only. Despite the differences in the data used to conduct these studies, the discrepancies in results achieved are also likely to stem from the different methodologies used in the studies as well. Boshoff (2009) used the Conrad and Kaul (1998) approach and looked at

various formation (3, 6, 9 and 12 months) and holding periods (1, 3, 6, 9 and 12 months). Fraser and Page (2000) and Van Rensburg (2001) used a Jegadeesh and Titman (1993) style methodology with various formation periods (12 months and 1, 3, 6, 12 and 24 months) and only a one month holding period. Instead of the decile approach, they used five equally-weighted and three equally-weighted portfolios, respectively. Although the one-month holding period returns in this study are significant, they are negative and totally contradictory to that of Fraser and Page (2000) and Van Rensburg (2001).

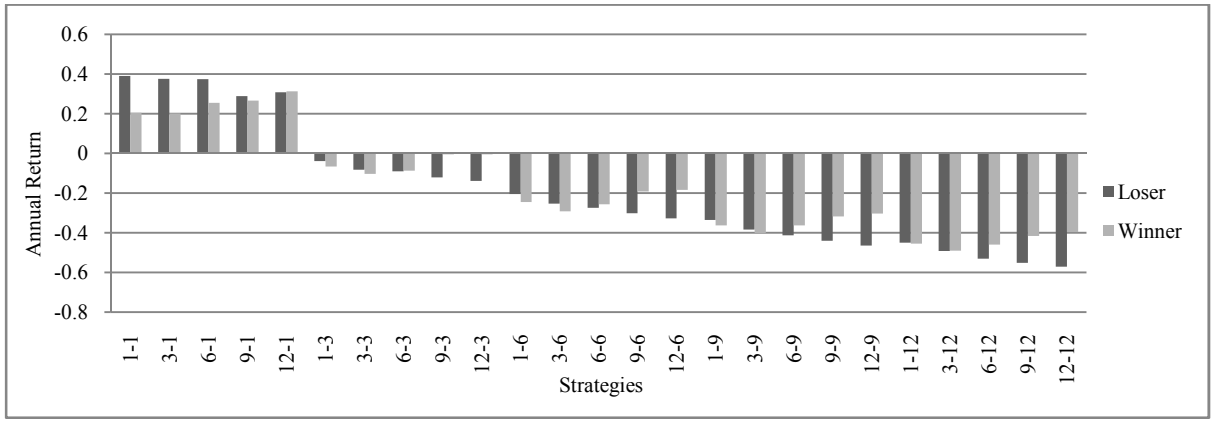
The composition of each of the zero-cost momentum strategy returns are broken down into their relevant winner and loser portfolios in Figure 3. There are two major points that can be drawn from Figure 3, the first being that the zero-cost momentum returns achieved by Method 1 are due to the losers outperforming the winners. The second point being that the returns achieved by the winner and loser portfolios are largely negative and are clearly greatly affected by the negative 100 per cent return achieved by a delisting share.

Looking at the dynamics of the individual strategies, it can be seen that the loser portfolio's returns decrease with an increase in both the formation and holding periods. This can be explained by the fact that shares which have experienced longer periods of negative returns may be more likely to delist in the future. Consequently, a share forming part of the loser portfolio after a longer formation period may have an increased chance of delisting. The decreased return achieved at longer holding periods can be explained by the notion that the longer a share is held, the greater the chance there is of it delisting while it's in your possession. This notion is even more pronounced in the context of this analysis due to the overlapping nature of holding periods as specified in the methodology.

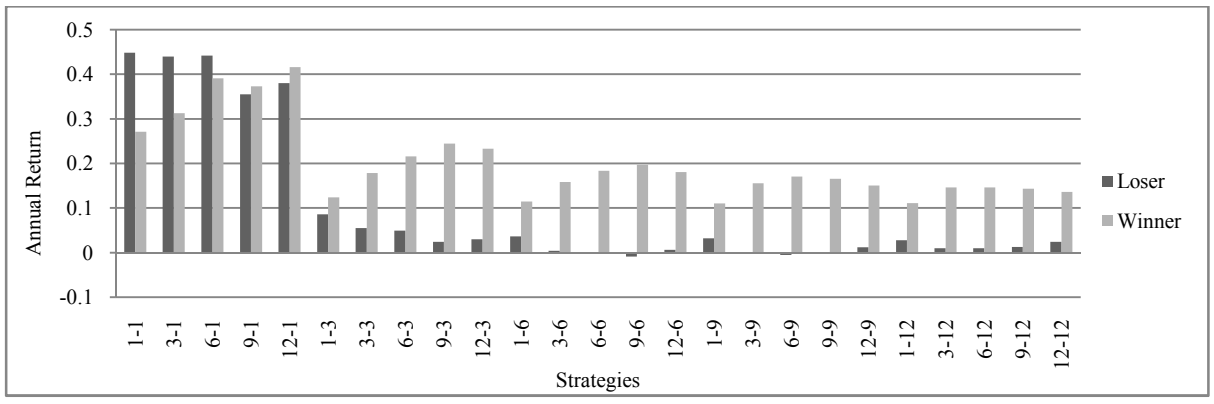
The winner portfolio's returns decrease with an increase in holding period but follow a more concave shape with respect to increases in the formation period. In general, they reach a minimum at formation periods of length 3. A similar explanation to that of the loser returns above can be applied here except that shares which have experienced longer periods of positive returns may be less likely to delist in the future. Therefore, a share forming a part of the winner portfolio after a longer formation period may have a decreased chance of delisting.

Figure 3. The winner-loser contribution to momentum profits at the R0 liquidity level

Method 1

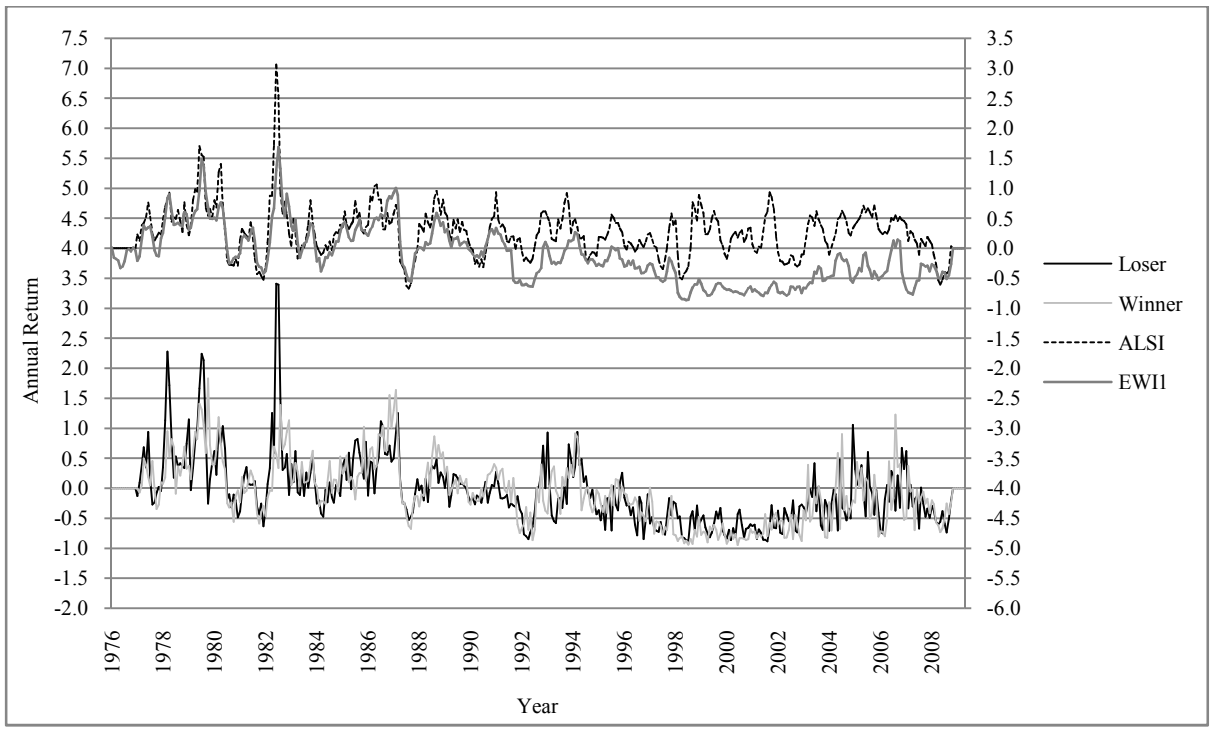


Method 2



The winner-loser composition of Method 1 paints a very different picture to that of Method 2. Firstly, the returns achieved by both the winner and loser portfolios are largely positive, and secondly, the zero-cost momentum returns achieved are due to the winners outperforming the losers. The difference between the compositions of Method 1 and Method 2, shown in Figure 3, highlight the effect that delisting shares have on the returns generated by the winner and loser portfolios within a momentum strategy.

Figure 4. The 6-month returns achieved by winner and loser portfolios, using Method 1



Referring to figure 4, it appears that the returns achieved by the EWI1 portfolio track those of the ALSI quite closely for the first half of the period under analysis. However, the returns deviate in the remainder of the period, with the greatest deviation occurring in the period post 1998. This can be attributed to the large number of share delistings which took place over that period, illustrated in Figure 1. The winner and loser portfolios tend to track the EWI1 portfolio

quite closely, especially over the second half of the period under analysis. This again confirms that both the winners and losers are largely affected by delisting shares. The winner portfolio appears to dominate the loser portfolio across most of the period.

Table 2 The abnormal, zero-cost momentum profits achieved for all liquidity portfolios using Method 1 and Method 2

Method 1

	1 Month Holding Period				
Formation Period	**1**	**3**	**6**	**9**	**12**
R0	-0.305	-0.299	-0.265	-0.207	-0.187
R10 mil	-0.297	-0.275	-0.251	-0.184	-0.169
R100 mil	-0.221	-0.181	-0.159	-0.105	-0.088
R1 bil	-0.147	-0.096	-0.033	-0.026	0.006
R10 bil	-0.097	**-0.126**	-0.067	-0.029	-0.078
	3 Month Holding Period				
Formation Period	**1**	**3**	**6**	**9**	**12**
R0	-0.205	-0.200	-0.177	-0.073	-0.055
R10 mil	-0.202	-0.192	-0.176	-0.073	-0.058
R100 mil	-0.180	-0.155	-0.133	-0.059	-0.036
R1 bil	-0.158	-0.132	-0.085	-0.059	-0.042
R10 bil	-0.140	-0.163	-0.138	-0.112	-0.077
	6 Month Holding Period				
Formation Period	**1**	**3**	**6**	**9**	**12**
R0	-0.222	-0.223	-0.160	-0.052	-0.008
R10 mil	-0.221	-0.217	-0.167	-0.066	-0.036
R100 mil	-0.217	-0.209	-0.153	-0.076	-0.032
R1 bil	-0.182	-0.179	-0.136	-0.108	-0.079
R10 bil	-0.196	-0.214	-0.201	-0.159	-0.112
	9 Month Holding Period				
Formation Period	**1**	**3**	**6**	**9**	**12**
R0	-0.214	-0.204	-0.111	-0.006	0.057
R10 mil	-0.217	-0.204	-0.121	-0.027	0.018
R100 mil	-0.214	-0.202	-0.126	-0.049	0.021
R1 bil	-0.195	-0.188	-0.148	-0.108	-0.074
R10 bil	-0.227	-0.233	-0.209	-0.133	-0.100
	12 Month Holding Period				
Formation Period	**1**	**3**	**6**	**9**	**12**
R0	-0.188	-0.180	-0.061	0.053	0.130
R10 mil	-0.201	-0.196	-0.083	0.019	0.070
R100 mil	-0.203	-0.204	-0.093	-0.015	0.058
R1 bil	-0.199	-0.208	-0.140	-0.109	-0.065
R10 bil	-0.216	-0.218	-0.184	-0.122	-0.096

Method 2

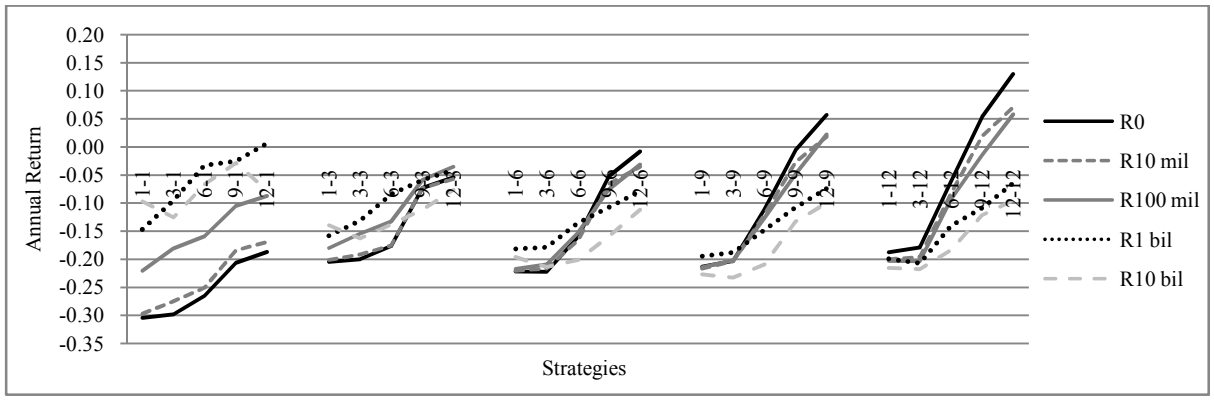
	1 Month Holding Period				
Formation Period	**1**	**3**	**6**	**9**	**12**
R0	-0.296	-0.256	-0.208	-0.165	-0.154
R10 mil	-0.288	-0.235	-0.193	-0.139	-0.135
R100 mil	-0.215	-0.138	-0.093	-0.050	-0.043
R1 bil	-0.138	-0.054	0.042	0.035	0.070
R10bil	-0.091	-0.072	0.019	0.024	-0.012
	3 Month Holding Period				
Formation Period	**1**	**3**	**6**	**9**	**12**
R0	-0.163	-0.084	-0.045	0.003	-0.011
R10 mil	-0.159	-0.076	-0.038	0.010	-0.006
R100 mil	-0.128	-0.026	0.012	0.048	0.027
R1 bil	-0.113	0.000	0.069	0.067	0.051
R10 bil	-0.090	-0.044	0.017	0.027	0.028
	6 Month Holding Period				
Formation Period	**1**	**3**	**6**	**9**	**12**
R0	-0.131	-0.055	-0.023	-0.004	-0.033
R10 mil	-0.127	-0.047	-0.016	-0.008	-0.037
R100 mil	-0.110	-0.027	0.010	0.014	-0.014
R1 bil	-0.088	0.012	0.047	0.036	0.006
R10 bil	-0.089	-0.024	0.014	0.012	0.007
	9 Month Holding Period				
Formation Period	**1**	**3**	**6**	**9**	**12**
R0	-0.14	-0.061	-0.036	-0.042	-0.066
R10 mil	-0.136	-0.056	-0.035	-0.049	-0.073
R100 mil	-0.124	-0.038	-0.016	-0.035	-0.057
R1 bil	-0.109	-0.012	0.002	-0.016	-0.037
R10 bil	-0.104	-0.046	-0.007	-0.011	-0.025
	12 Month Holding Period				
Formation Period	**1**	**3**	**6**	**9**	**12**
R0	-0.142	-0.084	-0.077	-0.078	-0.090
R10 mil	-0.141	-0.087	-0.081	-0.087	-0.100
R100 mil	-0.13	-0.070	-0.060	-0.078	-0.086
R1 bil	-0.122	-0.052	-0.049	-0.063	-0.067
R10 bil	-0.113	-0.071	-0.040	-0.042	-0.057

4.2 Momentum and Liquidity

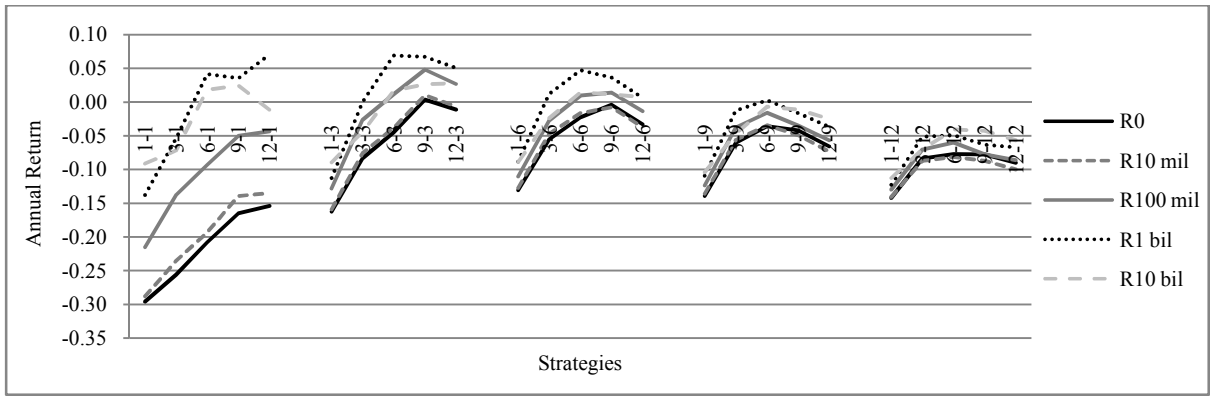
Referring to Table 2, there is only one momentum strategy (strategy 12-12 at the liquidity portfolio size of R0) that achieved positive abnormal returns out of the total of 125 strategies using Method 1. Similarly, Method 2 achieved two (strategies 6-3 and 9-3 at the liquidity portfolio size of R1 billion). The shape of the returns of Method 1 and Method 2, across formation and holding periods at the higher liquidity levels, remain the same as that for the R0 liquidity level mentioned above.

Figure 5 The abnormal returns achieved at the various liquidity portfolio sizes using Method 1 and Method 2.

Method 1



Method 2



Graphs of the abnormal returns achieved by the momentum strategies' at the different liquidity portfolio sizes are displayed in Figure 5. The abnormal returns for the various strategies achieved using Method 1, appear to increase with an increase in liquidity for strategies with shorter formation and holding periods and decrease with an increase in liquidity for strategies with longer formation and holding periods. The change in returns can be explained by the rationale used in the above section. That is, strategies with longer formation and holding periods are found to be more affected by delisting shares, in particular, the loser portfolios. However, the pool of shares available at higher liquidity levels is likely to contain larger capitalisation shares which are less likely to delist (Bailey and Gilbert, 2007). Therefore, the decrease in returns at higher liquidity levels in the longer formation and holding periods may be a direct result of a decrease in the proportion of shares which delist, within the given pool of shares (we will call this argument "Premise 1"). The large effect of Premise 1 may offset and overpower any changes in the return continuation achieved by the remaining listed shares of the momentum strategies.

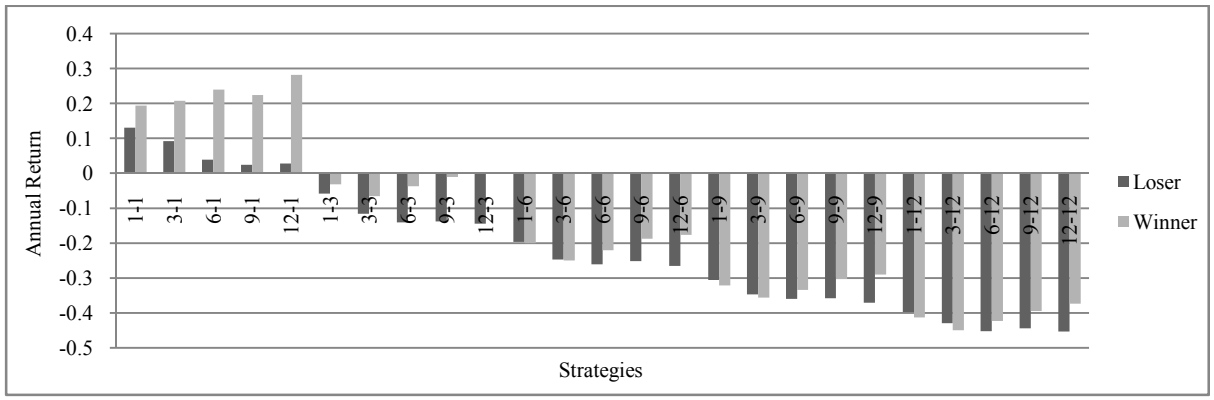
The abnormal returns achieved by Method 2 appear to increase with an increase in liquidity, obtaining a maximum at the R1 billion liquidity portfolio level. The returns achieved at the R10 billion liquidity level tend to be less than those of the R1 billion liquidity level. There are, however, a few exceptions (strategies 6-12, 9-9, 9-12, 12-6, 12-9 and 12-12) and in a similar fashion to Method 1, these occur in the strategies with the longer formation and holding periods. The evidence drawn from the graph of Method 2's returns suggests that the return continuation of the shares which remain listed, increase with an increase in liquidity.

The positive relationship between momentum and liquidity found here is consistent with that of Rouwenhorst (1999), who achieves the same results on 20 emerging markets around the globe. More importantly it is consistent with Boshoff (2009), who found a similar relationship to

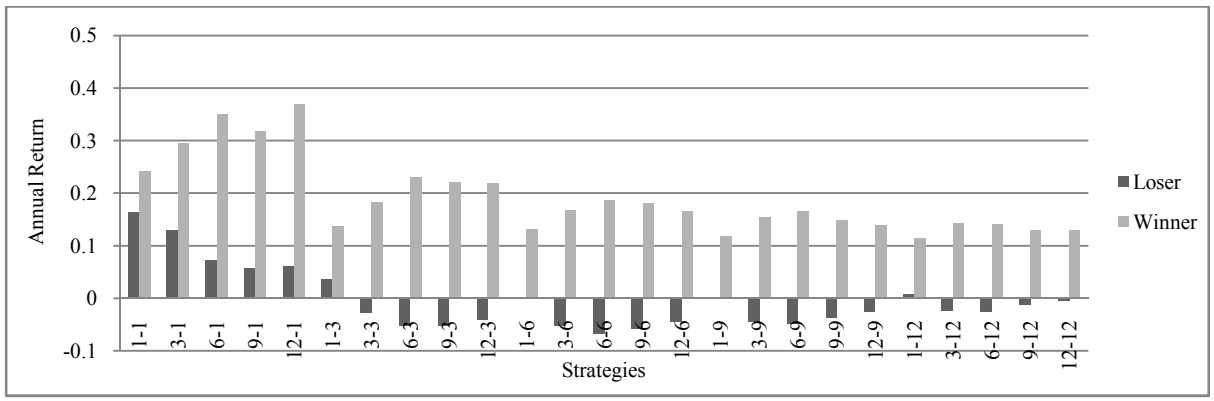
hold on shares on the JSE Securities Exchange over a similar sample period to this study. The decreased returns achieved by the momentum strategies at the R10 billion liquidity portfolio, from the R1 billion liquidity portfolio, provides evidence that there may be a limit to this positive relationship found between momentum and liquidity.

Figure 6. The winner-loser contribution to momentum profits using Method 1 and Method 2 at the R1 billion liquidity level.

Method 1



Method 2



Comparing the magnitude of the returns achieved by the winner and loser portfolios in Figure 6 to those in Figure 3, highlights the fact that the differences in zero-cost momentum returns achieved at the different liquidity levels are largely due to the movements in the loser portfolios. Focussing on the compositions achieved by Method 1, it can be noted that the

decrease in returns achieved at higher liquidity levels by the momentum strategies with longer formation and holding periods, is largely a result of an increase in the losers' returns. This provides further evidence to support Premise 1. The increase in returns for the shorter formation and holding periods are largely a result of a decrease in the loser returns at the higher liquidity level. The winner portfolio returns do increase slightly with the increase in liquidity level. However, as with the loser case, it is hard to speculate whether this is due to a greater return continuation or rather the effects of fewer delisting shares.

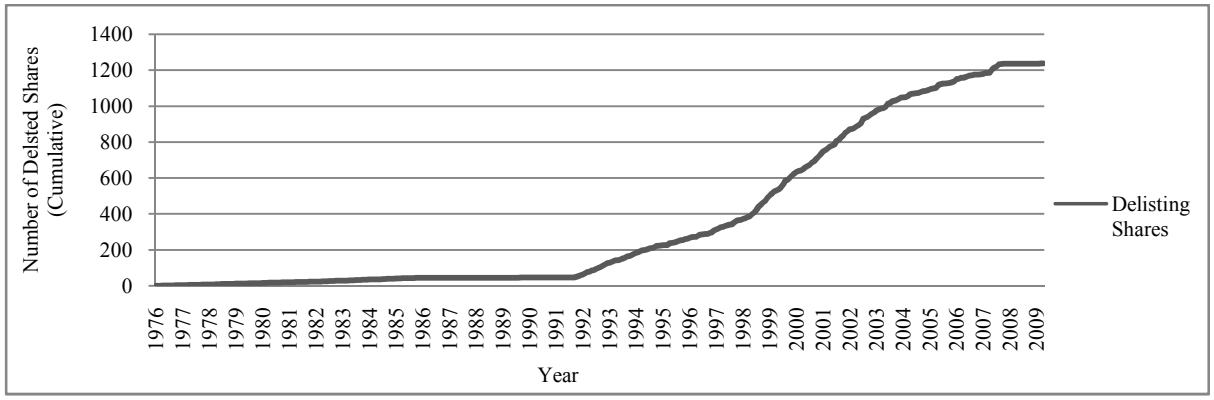
Moving our attention to the composition achieved using Method 2, it can be seen that the losers' change from largely positive in Figure 3 (23 of the 25 strategies are positive) to largely negative in Figure 6 (16 of the 25 strategies are negative). The winner portfolio returns, in general, had a very slight decrease with the increase in the liquidity level. Both of these results cannot be due to a lessened effect of delisting shares (as argued for the change in Method 1's returns) and hence the evidence suggests that among the shares which remain listed, there is a greater return continuation in the losers and a lesser return continuation in the winners at the higher liquidity level.

Noting that according to the liquidity cap measure used in this study, high levels of liquidity in a share imply high levels of past trading volume. Lee and Swaminathan (2000) provide an explanation to this phenomenon. They found that momentum was greatest in the low volume winners and the high volume losers (Lee and Swaminathan, 2000). This explains the greater return continuation achieved by the high liquid losers and the slight decrease in return continuation of the high liquid winners achieved in this study. They also noted a positive relationship between trading volume and momentum which is also consistent with the findings of Table 2 and Figure 5 (Lee and Swaminathan, 2000).

5. Sub-period Analysis

The problems encountered with Method 1 in this analysis have mainly revolved around the overpowering nature of the negative 100 per cent return achieved when a share delists. This figure distorts the returns achieved by momentum strategies greatly, especially during periods where a large amount of shares delist. As mentioned above, shares available for inclusion in momentum strategies at higher liquidity levels would be larger capitalisation shares, which are less likely to delist. Hence it is hard to distinguish whether increases in winner or loser portfolio returns at higher liquidity levels are due to the effect of fewer delisting firms or due to changes in return continuation. A means to counter this problem is to divide the period of the study into sub-periods containing different numbers of delisting shares and examine the momentum returns obtained at different liquidity levels during these periods.

Figure 7. The cumulative number of delisted shares over the entire period of the study



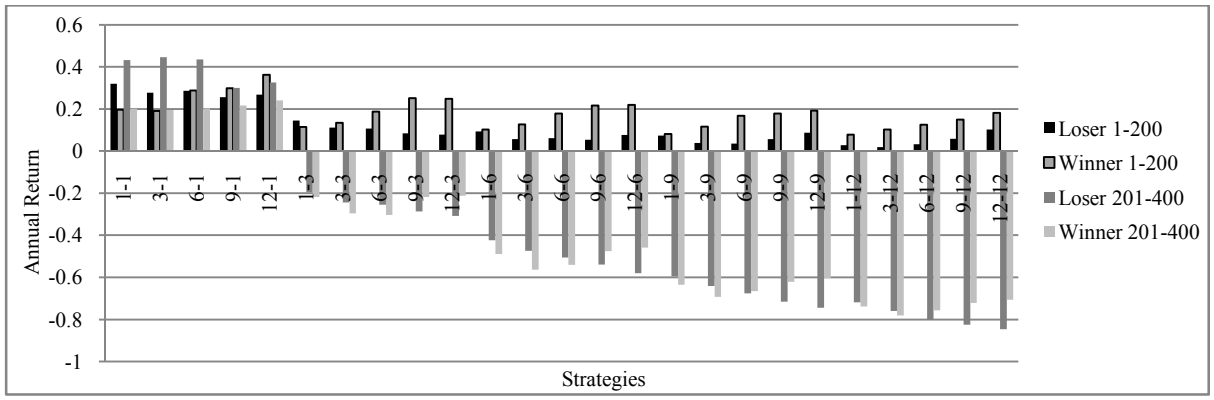
Due to the increase in the slope of the graph in Figure 7 occurring in 1992 (roughly halfway through the original analysis), the sub-period analysis is split into two periods of equal length. The first sub-period runs over the interval, 31 January 1976 to 31 August 1992, while the

second sub-period runs over the interval, 30 September 1992 to 30 April 2009. The first sub-period is characterised by a small number of delisting shares (105 shares) while the second is characterised by a large number of delisting shares (1132 shares).

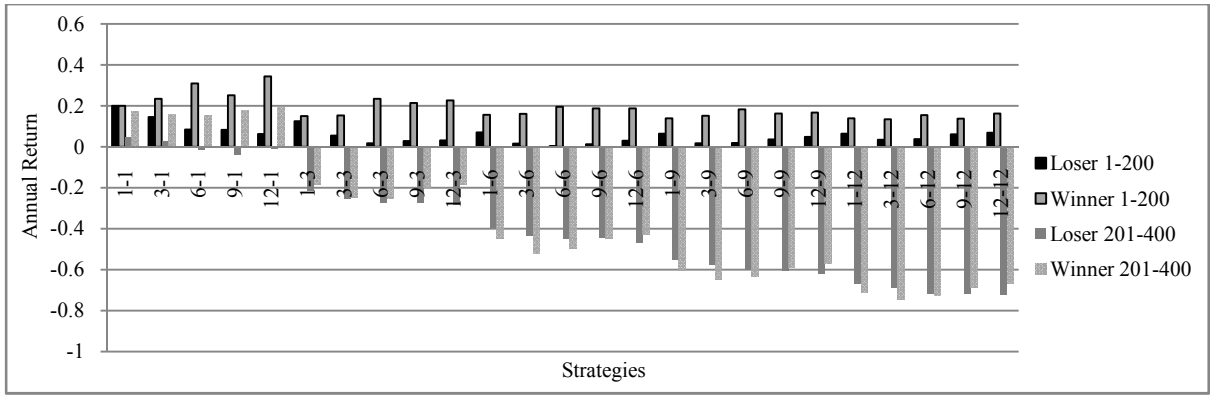
Figure 8 shows the returns achieved by the winner and loser portfolios using Method 1 over the two sub-periods at the R0 and R1 billion liquidity levels.

Figure 8. The returns achieved by the winner and loser portfolios at the R0 and R1 billion liquidity portfolio size in the two sub-periods

R0 Liquidity Portfolio Size



R1 billion Liquidity Portfolio Size



The winner and loser returns achieved at the R0 liquidity level, during the first sub-period are very similar to the composition achieved using Method 2 in Figure 3. The winner and loser returns are positive with the winners outperforming the losers. Similarly the returns achieved by

the winners and losers during the second sub-period are similar to those achieved using Method 1 in Figure 3. The difference in the return profiles achieved by the sub-periods again emphasizes the massive effect that delisting shares have on momentum strategies.

The changes in the return profiles at the R1 billion liquidity level in Figure 8 also showed some similarity to those achieved in Figure 6. Looking at the changes in returns of the second sub-period in isolation, poses the same problem established in the "Momentum and Liquidity" section of the paper outlined above. However, noting that the changes in the returns at the higher liquidity level in the first sub-period, are very similar to those achieved using Method 2 for the entire period of the study, provides further evidence to support the idea that there is a greater return continuation in the listed loser shares at a higher liquidity level. This also suggests, that the lesser proportion of delisting shares at the higher liquidity level, are the main cause of the greater loser returns at the higher liquidity levels using Method 1 (over the entire period of the study). These effects overpower the increase in return continuation of the remaining listed loser shares, thus providing further support for Premise 1.

6. Conclusion

The evidence provided in this analysis, suggests, that among the group of shares which remain listed over their respective holding periods, there is an increase in momentum profits achieved at higher liquidity levels. This is largely attributed to a greater return continuation in the loser shares. These momentum profits are shown to exceed that of the ALSI by up to 6.9 per cent annually, in decile portfolios which averaged well above R0.5 billion. This suggests that momentum profits should be obtainable for large asset managers.

These findings are consistent with that of previous research regarding momentum and liquidity by Rouwenhorst (1999) and Boshoff (2009). They are also consistent with research regarding momentum and trading volume by Lee and Swaminathan (2000) and Chan, Hameed and Tong (2000). However, they contradict the intuitive argument, of larger capitalisation shares being more efficient and less prone to anomalous behaviour.

On the other hand, delisting shares are fundamental stock market characteristics which cannot be ignored. Recording a negative 100 per cent return for a delisting share may more accurately reflect the momentum profits achievable in practice and the returns achieved using this method at higher liquidity levels are shown to decrease in size in strategies with longer formation and holding periods. However, it is recognized that the changes in the returns achieved by winner and loser portfolios at higher liquidity levels using this method are largely due to the effects of proportionately fewer delisting shares at the higher liquidity levels, rather than changes in return continuation of the shares.

It is interesting to note that both methods produced positive abnormal returns. This is especially interesting since the two methods used to record the return achieved by a delisting share represent the bounds, between which, a shareholder would receive compensation. Method 1's returns are largely attributed to the contribution of the losers' returns while Method 2's returns are largely attributed to the contribution of the winners' returns. This is an intuitive result, as Method 1 (Method 2) overstates (understates) the losers' returns and understates (overstates) the winners' returns.

References

Bailey G. and Gilbert E. 2007.The impact of liquidity on mean reversion of share returns of the JSE. *Investment Analysts Journal,* 66:19-30.

Boshoff L. 2009. The Presence of Momentum in the JSE. *University of Stellenbosch Department of Economics.*

Chan K, Hameed A and Tong W. 2000. Profitability of Momentum Strategies in the International Equity Markets. *The Journal of Financial and Quantitative Analysis,* 35(2):153-172.

Conrad J and Kaul G. 1998. An Anatomy of Trading Strategies. *The Review of Financial Studies,* 11(3):489-519.

Fraser E and Page M. (2000). Value and Momentum Strategies: Evidence from the Johannesburg Stock Exchange. *Investment Analysts Journal,* 51(2).

Gilbert E and Strugnell D. 2008. Does Survivorship Bias really matter? An Empirical Investigation into its Effects on the Mean Reversion of Share Returns on the JSE Securities Exchange (1984-2006), *Stellenbosch Economic Working Papers.*

I-Net Bridge. 2009.

Jegadeesh N and Titman S. 1993. Returns to buying winners and selling losers: Implications for stock market efficiency. *The Journal of Finance,* 48(1):65-91.

Jegadeesh N and Titman S. 2001. Profitability of Momentum Strategies: An Evaluation of Alternative Explanations. *The Journal of Finance,* 56(2):699-720.

Lee CMC and Swaminathan B. 2000. Price Momentum and Trading Volume. *The Journal of Finance,* 55(5): 2017-2069.

McGregor BFA. 2009.

Robertson M and Van Rensburg P. (2003). Style Characteristics and the Cross Section of JSE returns. *Investment Analysts Journal,* 57: 7-15.

Rouwenhorst KG. 1999. Local Return Factors and Turnover in Emerging Stock Markets. *The Journal of Finance,* 54(4):1439-1464.

Sadka R. 2003. Momentum, Liquidity Risk, and Limits to Arbitrage. *Northwestern University.*

Van Rensburg P. 2001. A Decomposition of style-based risk on the JSE. *Investment Analysts Journal,* 54: 45-60.

Venter JH. 2009. Intraday momentum and Contrarian effects on the JSE. *Investment Analysts Journal*, 70: 47-60.