MOMENTUM AND LIQUIDITY ON THE JOHANNESBURG STOCK EXCHANGE

Daniel Page
University of the Witwatersrand
Associate Lecturer
moshe.page@wits.ac.za

James Britten
University of the Witwatersrand
Lecturer
james.britten@wits.ac.za

Christo J Auret
University of the Witwatersrand
Professor
Private Bag X3, Wits, 2050, Johannesburg
christo.auret@wits.ac.za

Abstract

Short-term price momentum has become a globally popular topic of research, with a plethora of international evidence proving its profitability. This paper investigates short and medium term momentum strategies on the Johannesburg Stock Exchange (JSE) over the period January 1995 to December 2010. The study further considers the interaction between momentum and liquidity, proxied by turnover. We find that there is a significant momentum effect on the JSE over the sample period, yet the magnitude of profits declines in the latter half of the sample. When combining liquidity with momentum, the high and intermediate liquidity momentum strategies achieve consistently significant average excess returns, yet the low liquidity momentum results are largely inconsistent and insignificant. The findings of this paper are in line with the behavioural decomposition of the momentum effect, as there is evidence of both a short-term momentum effect and the beginnings of a longer-term reversal.

Key Words: Momentum, JSE, Liquidity
JEL Classifications: G12, G17, C15

1. Introduction

The study of momentum and long-term reversal in share returns has become a popular topic in financial economics and adds to the growing body of evidence discrediting the theory of efficient markets and the CAPM. Studies of short-term momentum and long-term contrarian strategies have been conducted internationally and both anomalies have been found to be profitable over differing time horizons. Momentum can be loosely defined as the excess return achieved by investing in previous winners and simultaneously selling previous losers, using a holding period between one and twelve months. This study aims to identify whether pure momentum profits are achievable on a cross-section of shares on the Johannesburg Stock Exchange (JSE) and whether liquidity, proxied by turnover, has an effect on momentum profits.

2. Literature Review

2.1 International Evidence of short-term momentum

In their seminal paper, Jegadeesh and Titman (1993) explored the profitability of short-term momentum strategies on a cross-section of US shares and found that strategies that invest in previous winning shares and sell previous losing shares achieve profits of about one percent per month. Rouwenhorst (1999) conducted a similar study on European markets and found evidence of the momentum effect, consistent with Jegadeesh and Titman (1993). A number of studies have identified momentum in the returns of assets other than equities. Stevenson (2002) applied momentum strategies to real estate securities and found that previous winners outperform previous losers over the short-term. Taylor (1998) found the presence of short and medium term momentum profits in commodity prices.

There have been a number of studies that have attempted to explain the existence of the momentum anomaly, with a clear distinction emerging between two conflicting hypotheses. Barberis, Shleifer and Vishny (1998) and Hong and Stein (1998) present behavioural models that attempt to explain the momentum anomaly by attributing momentum profits to biases in the way that investors interpret and act on information. The behavioural approach assumes that short-term momentum profits are a delayed overreaction to positive (negative) news or historical return, resulting in an upward (downward) buying (selling) pressure on previous winner (loser) shares. A risk based explanation was most notably expounded by Conrad and Kaul (1998). The authors argued that short-term momentum profits can be wholly attributed to the cross-sectional variations in mean returns, implying that stocks with high (low) unconditional expected rates of return in adjacent time periods are expected to have high (low) realized rates of returns in both periods. The evidence thus far is more in favour of the behavioural model as the presence of both short-term momentum and long term reversal is consistent with the under reaction/ overreaction hypothesis. Demir, Muthuswamy and Walter (2002) conducted an in-depth analysis of momentum on a cross-section of Australian equities. The authors considered the interaction between size, liquidity and momentum and found that momentum profits are not explained by cross-sectional differences in the liquidity or size of shares. Fraser and Page (2000) tested dividend yield, book to market and twelve month historical momentum on a cross-section of monthly share returns of stocks listed on the JSE. The authors found that momentum and value, proxied by book to market, were independently significant determinants of the cross-sectional variations in share returns. Venter (2009) conducted a study on intra-day high volume trading and found that ranking shares on their previous returns (measured over very short time periods) was too crude a measure to exploit. Griffin, Ji and Martin (2005) conducted a study of both price and earnings momentum on 40 markets across the world (Including South Africa). The authors found that both earnings and price momentum were present on the Johannesburg stock exchange. More recently, Hoffman (2012) found that there is a weak but persistent time-series correlation between the twelve month historical portfolio returns and future returns on the JSE, implying short-term momentum.

2.2 Momentum and liquidity

The literature and findings on the effects of (il)liquidity on momentum profits is mixed. Chan, Hameed and Tong (1999) applied momentum strategies to entire

equity indices and found that there is a persistent momentum effect on the global equity market. Interestingly, the authors found that return continuation is more pronounced post an increased level of trading volume over the previous period. Their findings point to the possibility that returns of momentum strategies are in some way related to the liquidity of the underlying market. Sadka (2006) emphasized the need to consider liquidity as the exploitation of momentum profits would require a high level of portfolio turnover and transaction costs. The author found that variations in liquidity help explain a component of the excess profits earned by both price and earnings momentum strategies and that both strategies seemed to perform better when there were positive liquidity shocks and underperformed when there were negative liquidity shocks.

Korajczyk and Sadka (2004) found that typical momentum strategies are less likely to be profitable for large investment funds; however, considerable potential profits may be achieved if one considers liquidity-conscious portfolio construction. Pastor and Stambaugh (2003) found that the addition of a liquidity spread explains half of the excess returns achieved from momentum portfolios. Lee and Swaminathan (2000) found that the momentum premium was much higher among high-volume stocks, consistent with the findings of Sadka (2006). The authors hypothesized that trading volume serves as an indicator of demand for a stock, implying that there is a contemporaneous and structural connection between overreaction and high trading volumes. Chen, Ibbotson and Hu (2010) considered liquidity as an investment style and found that portfolios constructed of low liquid shares (proxied by turnover) outperformed their highly liquid counterparts. The authors considered the effects of combining liquidity and momentum strategies and found that the high momentum - low liquidity portfolios achieved the highest returns over the sample period, implying that investors are compensated for liquidity risk even when engaging in momentum strategies.

3. Data

Our data is sourced from the Findata@Wits, consisting of information on every share listed on the JSE over the period January 1990 till December 2012. In order to limit survivorship bias, firms that expire over the sample period are labelled extinct within the analysis. Cash shells, Investment Trusts, Property trusts and exchange traded funds are excluded from the sample. In order for a share to be included in the sample, at least 12 months' worth of return, price, number of shares and volume data is required. The application of the filters leaves a total

1353 companies over the sample period. The data employed in this study are a cross-section of monthly returns, prices, volumes and number of shares in issue of all shares listed on the Johannesburg Stock Exchange over the period January 1995 to December 2010. Monthly returns are calculated arithmetically and are adjusted for dividends as well as any corporate action that would affect a share-holders return[1]. Monthly turnover values are calculated as the volume of a share in a particular month scaled by the number of shares in issue.

4. Methodology

4.1 Momentum Sort

The initial momentum sort involves classifying shares based on a historical sorting period (estimation period), where the sorting period considered is defined by *h* months (*h* = 3, 6 ,9 ,12 months) . At each portfolio formation date, quartile breakpoints are inserted and shares are classified into one of five portfolios, namely: Very High (VH), High (H), Medium (M), Low (L) and Very Low (VL). In order for a share to be considered, it requires at least *h* months of historical return prior to the portfolio formation date and must have a price of a 50c or higher. Shares are then held in the portfolio for *f* months (*f* = 3, 6 ,9 ,12 months) post portfolio formation. Equally-weighted portfolio returns are calculated over the holding period *f*. More formally, the average portfolio return can be described by:

$$\bar{R}_{h,f} = \sum_{t=1}^{n} \frac{R_{h,ft}}{n}$$

Where $R_{h,ft}$ is the total return of the shares at month *t* (within the post sort holding period *f*) of a portfolio sorted on the historical *h* month return. For each month, the Very High portfolio return is subtracted from the Very Low portfolio return, analogous to being long the extreme winner portfolio and simultaneously shorting the extreme loser portfolio (WML). Formally, the average excess return of the winner minus loser portfolio can be described as:

[1] This would include share buy backs, rights offers, unbundling's etc

$$\overline{WML}_{h,f} = \sum_{t=1}^{n} \frac{VHR_{h,ft} - VLR_{h,ft}}{n}$$

Where $\overline{WML}_{h,f}$ is the average excess return earned by the extreme winning portfolio over the entire sample period using an estimation period of *h* months and a holding period of *f* months. The result is sixteen $\overline{WML}_{h,f}$ portfolios. We examine all possible three month, six month, nine month and twelve month estimation and holding period intervals. This entails that a six month ;six month (6;6) strategy at time period 0 (formation month) has within it the historical 6 month estimation period and will be held for 6 months. At the next portfolio formation (month 6), the previous holding period returns will become the portfolio estimation period returns. The significance of the various WML portfolios are examined using two-sample paired t-tests.

4.2 Momentum and Liquidity Sort

In order to determine the effect of liquidity on momentum profit, shares are sorted independently and simultaneously based on pre-ranking historical return *h* (*h* = 3, 6, 9 and 12 months) and the historical average turnover over the past twelve months defined by *l*. Monthly turnovers are calculated by scaling the volume traded of a share scaled by the number of shares in issue in a given month. Chen, Ibbotson and Hu (2010) state that turnover is an appropriate proxy of liquidity as volume alone favours large capitalization stocks, while turnover is size neutral implying that both large and small capitalization shares can have high turnovers. High turnover stocks tend to have lower bid-ask spreads, higher trading volume relative to the size of the company, and low price impact per rand traded. At each portfolio formation date, two portfolio breakpoints are inserted based at the 33rd and 66th percentile of average turnovers over the previous twelve months. Shares are then assigned into one of three portfolios namely high volume (HV), medium volume (MV) and low volume (LV).

Portfolio returns are calculated using the following formula:

$$\overline{WML}_{h,f(l)} = \sum_{t=1}^{n} \frac{VHR_{h,ft(l)} - VLR_{h,ft(l)}}{n}$$

Where $\overline{WML}_{h,f(l)}$ is the average monthly WML return based on the historical estimation period *h*, the post-formation holding period *f* and the liquidity group *l*. Once again, we examine all possible three month, six month, nine month and twelve month permutations based on *h*, *f* and l^2. The significance of the various WML liquidity sorted portfolios are examined using two-sample paired t-tests. The reason for only defining three volume portfolios is that at the first portfolio sort there are 544 firms that meet all requirements for inclusion, yet at the end of the sample period, the number drops to 326 firms (approximately 40% drop in acceptable firms). In order to ensure that each portfolio has at least 15 shares, a four way liquidity split was not plausible. It should be noted that the exclusion of penny stocks (defined as any share with a price less than 50c) is applied in order to reduce the effect of bid-ask bounce and the relationship between stocks with low price and trading costs as documented by Bhardwaj and Brooks (1992). The price filter may negatively bias the liquidity sort as it potentially removes the possibility of the experiments detecting a pure liquidity premium.

5. Results

5.1 Momentum Sort

Table 1 presents the results of the univariate momentum sort where the excess average monthly returns (WML) are given for each sorting period *h* and holding period *f*.

Table 1: Univariate Momentum sort over the entire sample period (h =3, 6, 9, 12 months and f =3, 6, 9, 12 months)

Winner – Loser (WML)	Holding Period (*f*)			
Sorting Period (*h*)	3 months	6 months	9 months	12 months
3 months	0.012350 **0.002*****	0.018309 **0.000*****	0.018595 **0.000*****	0.008819 **0.025****
6 months	0.019994 **0.000*****	0.019921 **0.000*****	0.021190 **0.000*****	0.016546 **0.000*****
9 months	0.020218 **0.000*****	0.020268 **0.000*****	0.016040 **0.000*****	0.018193 **0.000*****
12 months	0.018778	0.019164	0.013056	0.012155

[2] It should be noted that portfolio construction was automated using VBA and resulted in 8000 lines of code!

	0.000* **	**0.000*** **	**0.004*** **	**0.011*** **
*,**,*** indicate significance at the 10%, 5% and 1% level. The bold numbers indicate the p-values of the two-tailed paired sample t-tests				

The results of the univariate momentum portfolio sort indicate that there is indeed a short to medium term momentum effect on the JSE over the entire sample period. Fifteen of the excess returns are significantly different from zero at the 99% confidence interval, with only the 3;12 portfolio being significant at the 5% level. The highest average monthly excess return is 2.12% and was acheieved by the 6;9 portfolio, while the lowest was the 0.9% achieved by the 3;12 portfolio. The results present some interesting findings. All of the portfolios seem to experience an increase in excess return when moving from h=3 to h=9 (barring portfolio 6;9) and seem to decrease from h=9 to h=12. Similarly, excess returns seem to be increasing from f = 3 to f = 6 but start plateauing and even decreasing at f=9. The results indicate that as both estimation and holding periods increase over nine months, excess returns begin declining, pointing to long-term reversal. In order to examine the consistency of momentum on the JSE, the sample period is split into two independent sub-samples of equal months. The first sub sample spans from 1 January 1995 till 31 December 2001 and the second from 1 January 2002 till December 2010. Tables 2a and 2b present the results of the sub-samples.

Table 2a: Univariate momentum sort over the sub-period January 1995 till December 2002 (h =3, 6, 9, 12 months and f =3, 6, 9, 12 months)

Winner – Loser (WML)	Holding Period (f)			
Estimation Period (h)	3 months	6 months	9 months	12 months
3 months	0.016376 **0.004*** **	0.021286 **0.000*** **	0.025021 **0.000*** **	0.010221 **0.060** **
6 months	0.024265 **0.000*** **	0.025093 **0.000*** **	0.026833 **0.000*** **	0.020490 **0.000*** **
9 months	0.024869 **0.000*** **	0.024149 **0.000*** **	0.022369 **0.000*** **	0.018858 **0.001*** **
12 months	0.022995 **0.000*** **	0.020664 **0.001*** **	0.019752 **0.003*** **	0.008496 **0.191023**
*,**,*** indicate significance at the 10%, 5% and 1% level. The bold numbers indicate the p-values of the two-tailed paired sample t-tests				

Table 2b: Univariate momentum sort over the sub-period January 2002 till December 2010 (h =3, 6, 9, 12 months and f =3, 6, 9, 12 months)

Winner – Loser (WML)	Holding Period (*f*)			
Estimation Period (*h*)	3 months	6 months	9 months	12 months
3 months	0.008323 **0.126408**	0.015332 **0.017*****	0.012169 **0.011*****	0.007417 **0.193361**
6 months	0.015723 **0.004*****	0.014749 **0.019*****	0.015546 **0.001*****	0.012602 **0.013*****
9 months	0.015567 **0.005*****	0.016387 **0.009*****	0.009710 **0.026*****	0.017527 **0.018*****
12 months	0.014561 **0.010*****	0.017665 **0.002*****	0.006360 **0.292968**	0.015813 **0.026*****
*,**,*** indicate significance at the 10%, 5% and 1% level. The bold numbers indicate the p-values of the two-tailed paired sample t-tests				

Tables 2a and 2b summarize the results of the momentum portfolios over the sub-periods. In the initial sub-period, each of the momentum portfolios generate significant excess returns, barring the 12;12 portfolio. Similarly to the results of the entire sample, excess returns seem to be increasing as the estimation period increases from *h*=3 to *h*=6 months, yet monotonically decrease when the estimation period increases from *h*=9 to *h*=12 months. The excess returns increase monotonically as the holding period months increase from *f*=3 to *f*=9 months for the portfolios with estimation periods of *h*=3 and *h*=6 months, while for the portfolios with estimation periods of *h*=9 and *h*=12 months, excess returns decrease monotonically as the holding period increases. The highest excess monthly return over the sub-period was 2.7% and was achieved by the 6;9 portfolio, which was the top performing portfolio over the entire sample (Refer to Table 1). The lowest excess return was achieved by the 12;12 portfolio and was not significantly different from zero.

Table 2b presents the results of the second sub-sample. The excess returns are notably lower than that of the initial sub-period, with the highest excess average monthly return being 1.77% achieved by the 12;6 portfolio. Furthermore, three of the sixteen portfolios achieved excess average returns that were not significantly

different from zero. Focusing on the variation due to holding periods, the results of the second sub-sample are less consistent than those of the entire sample and the initial sub-sample. For example, consider the estimation periods of h=6 months and h=12 months. Holding the h=6 estimation period constant and allowing for variation in the holding period indicates that moving from f=3 to f=6 results in decrease in the excess return achieved, yet moving from f=6 to f=9 results in an increase. A further difference between the two sub-samples is that the first sub-sample seems to produce the best excess returns in the h,f=6 and h,f=9 range for estimation and holding period, yet the best second sub-samples results are in the h=12 and f=12 range.

5.2 Momentum and Liquidity Sort

The pure univariate momentum results presented above indicate that there is a significant short to medium term momentum effect present on the JSE. The JSE is notoriously illiquid in comparison to more developed markets, with around only one third of shares being classified as liquid and making up 99% of the total market capitalization. The employment of a pure momentum strategy as presented above could be significantly hindered by the trading and liquidity costs associated with rebalancing portfolios. In order to proxy for the effects of liquidity on momentum strategies, shares are independently sorted at each formation date based on their estimation period average return (h) and their historical twelve month average turnover (l). The result is 48 portfolios that represent the excess return achieved using estimation period (h), holding period (f) and liquidity (l). Table 3 presents the results.

Table 3: Bivariate sort based on momentum and liquidity over the sample period Jan 1995 to December 2010 (h =3, 6, 9, 12 months, f =3, 6, 9, 12 months and l = High Liquidity, Medium Liquidity, Low Liquidity)

Winner-Loser (WML)		Holding Period (*f*)			
Estimation Period (*h*)		3 months	6 months	9 months	12 months
High Liquidity	3 months	0.01464 **0.06012***	0.03123 **0.0022*****	0.02483 **0.001*****	0.00712 **0.42961**
	6 months	0.02588 **0.0000*****	0.02958 **0.0000*****	0.03134 **0.000*****	0.02594 **0.000*****
	9 months	0.02381 **0.0002*****	0.02130 **0.0000*****	0.02263 **0.000*****	0.02522 **0.001*****
	12 months	0.01882 **0.002*****	0.02268 **0.0041*****	0.01904 **0.0012*****	0.01817 **0.04892****
Medium Liquidity	3 months	0.01635 **0.0008*****	0.02244 **0.0000*****	0.02060 **0.0000*****	0.01584 **0.0058*****
	6 months	0.02549 **0.0000*****	0.02380 **0.0000*****	0.02439 **0.0000*****	0.01626 **0.0036*****
	9 months	0.02457 **0.0000*****	0.02589 **0.0000*****	0.01599 **0.0019*****	0.01611 **0.0036*****
	12 months	0.02321 **0.0000*****	0.01905 **0.0007*****	0.01529 **0.0061*****	0.01131 **0.0550***
Low Liquidity	3 months	-0.00062 **0.9152**	0.00406 **0.5158**	0.01229 **0.0379****	0.00324 **0.5914**
	6 months	0.01040 **0.0534***	0.01002 **0.1354**	0.00909 **0.1297**	0.00780 **0.1665**
	9 months	0.01396 **0.0164****	0.01620 **0.0343****	0.01297 **0.0339****	0.01286 **0.0394****
	12 months	0.01584 **0.0082*****	0.02034 **0.0448****	0.00943 **0.1940**	0.00759 **0.1716**

*,**,*** indicate significance at the 10%, 5% and 1% level. The bold numbers indicate the p-values of the two-tailed paired sample t-tests

The results presented above seem to indicate that short to intermediate momentum returns are affected by liquidity. Considering the highest liquidity momentum portfolios, 14 of the 16 achieve excess returns that are positive and significantly different from zero. The top performing portfolio is once again 6;9, achieving an excess average monthly return of 3.13% that is significantly different from zero at the 1% level. Similarly, the worst performing portfolio is the 3;12 with a return of 0.7% per month and is not significantly different from zero. The medium liquidity

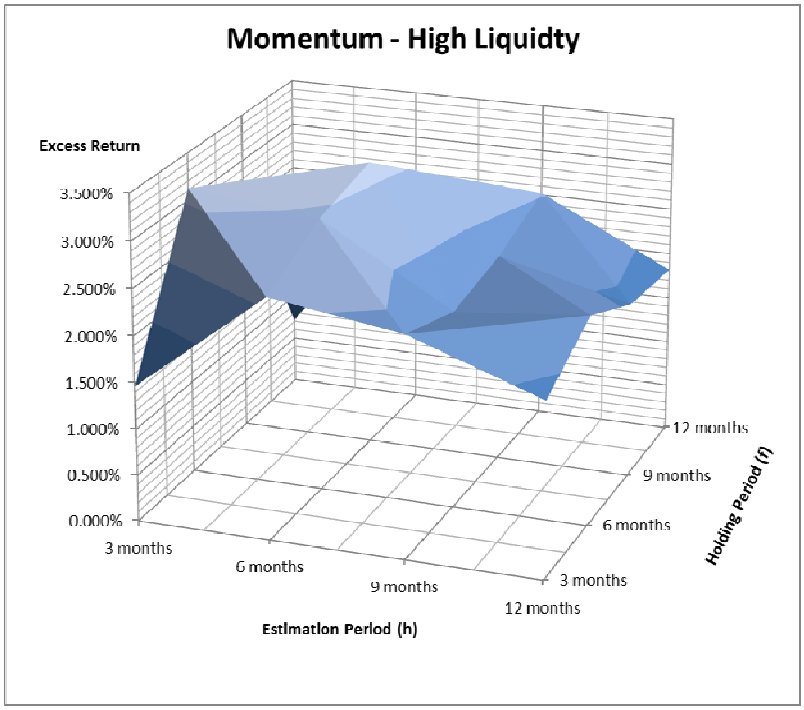
excess returns are also impressive as they are all positive and significant at the 1% level barring portfolio 12;12. The best performing portfolio in the medium liquidity category is the 9;6 portfolio with an excess average monthly return of 2.6% per month and is significant at the 1% level. The worst performing portfolio in the medium liquidity category is 12;12 with an excess average return of 1.1% per month. The low liquidity results are both inconsistent and poor in comparison to those of the high and medium liquidity categories. Half of the average excess returns reported are not significantly different from zero and of the eight that are significant, only portfolio 12;3 at the 1% level. The best performing portfolio in the low liquidity category is portfolio 12;6 with an average excess return of 2% per month that is significantly different from zero at the 5% level. The worst performing portfolio was the 3;3, with a negative excess return of -0.06% but was not significantly different from zero.

The results presented above are consistent with international findings yet a number of caveats are in order. Firstly, arithmetic returns were used in the calculation of excess returns achieved by the momentum portfolios. An improvement to the study would use arithmetic, geometric and buy and hold returns simultaneously. Secondly, the usage of turnover as the sole liquidity proxy may result in incorrect inferences as there are many more accepted liquidity proxies. Thirdly, the sample period used is relatively short (15 years) in relation to international studies conducted on momentum and lastly (and mentioned previously), the application of a price filter as a proxy for transaction costs favours the momentum effect by excluding the possibility of bid-ask bounce, yet can possibly negatively affect the detection of a liquidity premium.

5.3 Graphical Representation of Momentum and Liquidity

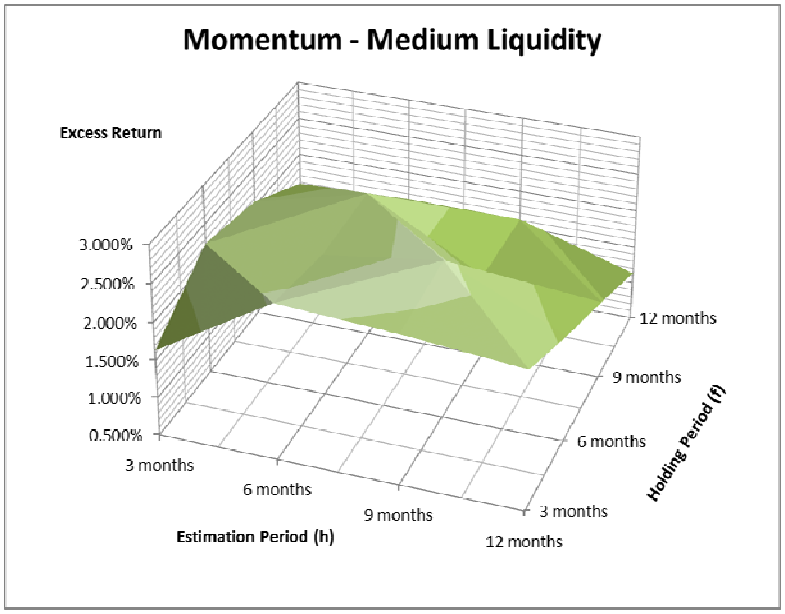
In order to identify the effects of variation in estimation period (*h*), holding period (*f*) and liquidity (*l*), all results are displayed graphically. Figures 1 - 3 present the results of the liquidity grouped momentum portfolios.

Figure 1 – High liquidity momentum excess returns over the sample period January 1995 to December 2010



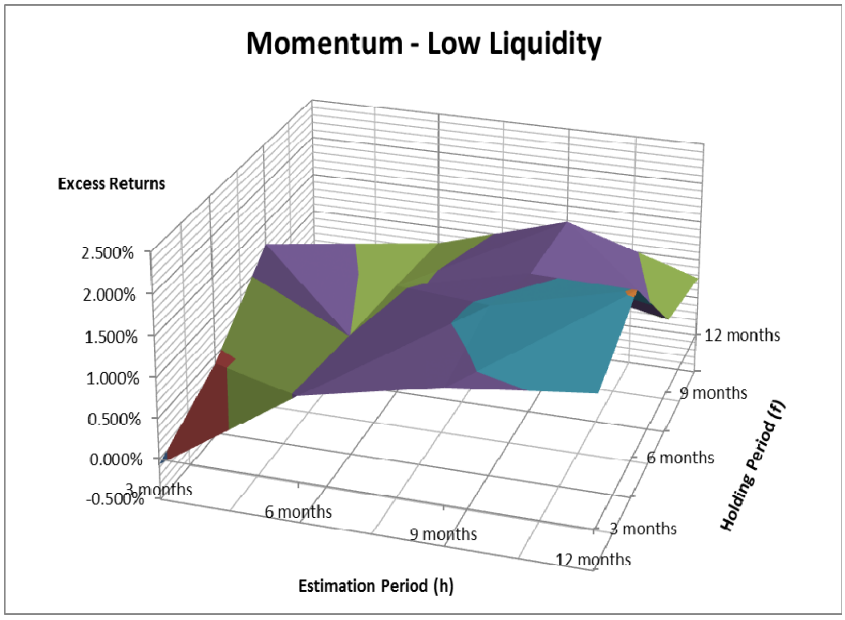
The high liquidity momentum surface diagram above indicates that excess returns increase as the estimation period (*h*) moves from three to six months but begins decreasing when the estimation period increases from six to twelve months. Considering the variation in the holding period (*f*), excess returns plateau at a holding period of nine months and experience a decrease when moving from nine to twelve months. The results seem to imply that using estimation and holding periods of nine months or more seem to pick up the beginnings of long term reversal.

Figure 2 – Medium liquidity momentum excess returns over the sample period January 1995 to December 2010



The medium liquidity momentum surface diagram indicates that excess returns increase as the estimation period (*h*) increases from three to six months; yet from six months onwards momentum profits experiences a decline, represented by the downward slope. Similarly, excess returns begin to experience a decline as the holding period (*f*) increases from six to nine months, resulting in a similarly shaped convex surface to that of the high liquidity momentum excess returns.

Figure 3 – Low liquidity momentum excess returns over the sample period January 1995 to December 2010



The low liquidity excess returns are inconsistent with the high and medium liquidity sorts as the diagram indicates an upward slope as the estimation period (*h*) increases. Extending the holding period (*f*) does not result in a monotonic increase or decrease in excess returns, making the surface diagram lumpier and more concave. The results of the low liquidity momentum excess returns should be interpreted with caution as only half of the sixteen portfolios excess returns were significantly different than zero.

6. Conclusion

The results of the study are consistent with international literature .Over the chosen sample period, there is a significant short to medium term momentum present on the cross-section of shares of the JSE. The results of the univariate momentum sorts over the sub-samples and overall sample period produce some interesting findings. In the first sub-sample, momentum profits were higher than the second sub-sample by at least 1% per month. This is possibly attributable to the financial market crisis experienced over 2008 and 2009. Interestingly, the overall sample and the first sub-sample favour estimation and holding periods of between six and nine months, yet the second sub-sample seemed to favour

estimation and holding periods of three, six and twelve months. This result may imply that in periods of market growth, portfolio estimation and holding periods should be intermediate (between six and nine months) while in periods of market contraction, more extreme estimation and holding periods should be used (three, six and twelve months).

The results of the liquidity sorted momentum portfolios are inconsistent with the findings of Demir et al (2004) yet in line with those of Lee and Swaminathan (2000). We find that the high and medium liquidity momentum portfolios outperform the low liquidity momentum portfolios on an absolute return basis and illiquidity seems to have a significantly negative effect on momentum profits. The findings are not surprising when viewed in light of the behavioural under/overreaction hypothesis. As the market underreacts to positive news, the increased demand for high momentum shares starts to drive up share prices. A highly liquid share is easily bought and therefore has a higher upside from buying pressures. Similarly, as the market realises the overreaction and that the share has been overbought, more liquid shares should begin to experience the long-term reversal at a higher rate. Barring the potential methodological issues, this study is unique as it is the first to consider multiple momentum strategies and the effects of liquidity on momentum profits achieved on the cross-section of shares on the JSE.

Bibliography

Barberis, N., A. Shleifer, and R. Vishny (1998), "A model of investor sentiment", *Journal of*
Financial Economics 49(3), 307-343

Bhardwaj RK and Brooks LD. (1992) "The January anomaly: effects of low share price, transaction costs, and bid-ask bias", *Journal of Finance,* 42: 553-575.

Chan, K., Hameed, A., Tong, W. (1999), "Profitability of momentum strategies in the international equity markets", *Working paper, Hong Kong University of Science and Technology.*

Chen, Z., Ibbotson, R., and Hu, W., (2010), "Liquidity as an Investment Style" *Zebra Capital Management and Yale School of Management*

Conrad, J., and G. Kaul (1998), "An anatomy of trading strategies*", Review of Financial Studies* (11) 489-519.

Demir, I., Muthuswamy, J., and Walter, T. (2004), "Momentum returns in Australian equities: The influence of size, risk, liquidity and return computation", *Pacific-Basin Finance Journal* (12) 143-158

Fraser, E., and Page, M. (2000) "Value and Momentum Strategies: Evidence from the Johannesburg Stock Exchange", *Investments Analyst Journal* (50) 25-35

Griffin, JM., Ji, X., and Spencer, J. (2005), "Global Momentum Strategies: A portfolio perspective", *The Journal of Portfolio Management* 23-39

Hoffman, AJ., (2012),"Stock return anomalies: Evidence from the Johannesburg Stock Exchange", *Investments Analyst Journal* (75) 21-41

Hong, H., and Stein, J. (1998), "A unified theory of underreaction, momentum trading and
overreaction in asset markets", *Working paper, MIT Sloan School of Management.*

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

Korajczyk, RA., and Sadka, R. (2004) "Are momentum profits robust to trading costs?",
Journal of Finance (59) 1039-1082.

Lee, C., and Swaminathan, B. (2000), "Price momentum and trading volume", *Journal of Finance* (55) 2017–2069.

Pástor, L., and Stambaugh, RF (2003), "Liquidity risk and expected stock returns", *Journal
of Political Economy* (111) 642-685

Rouwenhorst, G. (1999), "Local return factors and turnover in emerging markets", *Journal of Finance* (54) 1439–1464.

Sadka, R. (2006), "Momentum and Post-earnings-announcement Drift Anomalies: The Role of Liquidity Risk", *Journal of Financial Economics* 80:309–49.

Stevenson, S. (2002) "Momentum effects and mean reversion in real estate securities", *Journal of Real Estate* 23,47– 64

Taylor, S.J. (1998), "Forecasting market prices", *International Journal of Forecasting* 4, 421–426.

Venter, JH., (2009). "Intraday momentum and contrarian effects on the JSE", *Investment Analysts Journal* (70) 47-60