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Momentum under different market climates: Evidence from the South African market

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Abstract

In this study, we examine the existence and persistence of return momentum in the South African market between March 1995 and December 2009. We investigate three different momentum strategies, and examine their risk-return relationship under different market climates. We mainly use a one-factor market model to identify possible differences in systematic risk exposure conditional on the market climate. We find momentum to be positive and economically significant in the South African market. The best strategy, based on the previous 12 months returns and held for 3 months, generate an average annual return of 29.84 percent, however trading costs diminishes the profits. While there seems to be a relationship between negative market climate and increased correlation between momentum returns and the market factor, our results only give weak evidence for that the market climate has impact on the magnitude of momentum returns.

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I – Introduction

Examining trading patterns is always of interest since their returns affect investors in deciding investment strategies and portfolio selection. Today, many stock market analysts and portfolio managers believe that momentum strategies earn significant returns. A momentum strategy buys the best performing stocks, and sells the worst performing stocks, based on their returns over a chosen period of time. The positions are then held for a predetermined time before the pattern is repeated. While the evidence on momentum profits under different market conditions is contradictory, interesting characteristics has been revealed about the return patterns. For example, Griffin, Ji and Martin (2003) suggests that momentum strategies earn positive abnormal returns and show no increased market correlation in negative market climates. We find the last suggestion especially noteworthy, since increased market correlation in economic downturns makes investors miss out on the benefits of diversification when they need them the most. If this doesn't apply to momentum, the use of momentum strategies could reach beyond simply trying to beat the market.

The purpose of our study is to further investigate the nature of return momentum under different market climates. We examine the profitability and risk-return relationship of return momentum in the South African market between March 1995 and December 2009. In general, there are few studies on return momentum from the African markets. As far as we know, there are none with the approach of describing the risk-return relationship of return momentum under different market climates. We have chosen to study the South African market since it is by far the most developed African market in terms of number of listed companies, trading volume, liquidity and so forth. These characteristics are important to us since we don't want our results to be attributable to illiquid stocks in a malfunctioning market.

We assess three different momentum strategies; 3 month evaluation period held for 3 months, 6 month evaluation period held for 6 months and 12 month evaluation period held for 3 months. First we examine their return patterns; we compare their profitability, investigate trading costs and evaluate the strategies performance under different market climates. Second, we study the strategies' exposure to systematic risk and estimate the risk measurements conditional on the market climate. The main contribution of this paper is on the evidence of how momentum returns and market risk are related under different market climates. Potential findings can be used as starting point for further studies with more complex models, or as base for a better understanding of return momentum. We also contribute by constructing momentum portfolios that can be used for future studies, and by extending the research on momentum both cross-sectional and in the time dimension.

To preview our findings, we find that momentum is persistent and significant in the South African market. The magnitude of momentum profits are of economic significance and our best strategy earns an average annual return of 29.8 percent. We find little evidence for differences in momentum returns conditional on the market climate. There is however weak evidence for increased market correlation in negative market climates, suggesting that our momentum strategies are more risky than implied by a one factor market model. Trading costs appear to be an important issue in evaluating momentum profits, but we think there is a need for more reliable measurements in order to make a fair analysis. High portfolio turnover ratios make trading costs, even at very low levels, economically significant. We also find evidence for higher momentum profits among portfolios containing smaller sized stocks, thus

we believe that the Fama and French three factor model might be a better approach to explaining momentum returns.

The rest of our paper will be outlined as follows; we begin with a review on previous research related to our paper (Section II). In section III we give a detailed description of the dataset. Section IV describes our empirical methodology; how we set up and evaluate the momentum strategies, how we control for systematic risk factors and how we measure momentum performance under different market climates. In section V we discuss problems associated with our dataset and methodology. We present our results in section VI and section VII concludes the paper.

II – Previous research

Return momentum - a tendency for past winner stocks to outperform past losers, was revealed by Jegadeesh and Titman (1993). They found that between 1965 and 1989, their strategy based on 6-month returns and held for 6-month, on average earned an excess return of 12.01 percent annually in the U.S market. Their results persisted after adjustments for systematic risk and trading costs had been made. Jegadeesh and Titman believed the market to under react to information in the short run while over reacting in the long run, a view in line with their further findings of a reversal trend subsequent to the holding period, along with the long-term reversal effect identified by DeBondt and Thaler (1985). A common criticism to Jegadeesh and Titman's early work was that their return pattern was due to data mining, a problem hard to overcome in a non-experimental setting, when limited by data availability. However, Jegadeesh and Titman (2001) found their momentum strategies continuously profitable in the 1990 to 1998 sample period. Contrary to other market anomalies, such as the size effect discovered by Banz (1981), momentum seemed to be persistent in sample periods subsequent to the original study.

Multiple other studies find momentum present and significant in a numbers of markets. Rouwenhorst (1998, 1999) and Chui, Titman and Wei (2000) find momentum in many of the European markets, Emerging markets and five Asian markets. Griffin, Ji and Martin (2003) find significant momentum profits in the African, American, Asian and European markets.

Besides return momentum, several profitable momentum strategies seem present in the market. Vandell and Parrino (1986) find that a model with earnings momentum[1] largely outperformed the U.S. market. Chan, Jegadeesh, and Lakonishok (1996) show that return momentum coexists with earnings momentum while Scott, Stumpp, and Xu (2003) document earnings momentum in all major markets they examine[2]. However Hong, Lee, and Swaminathan (2003) only find positive and significant earnings momentum in six of the eleven international markets they examine. Griffin, Ji and Martin (2005) find that both price and earnings momentum yields high profits in a range of markets. They also find that price and earnings momentum are correlated but that a strategy using both earns higher profits than each one alone. Grinblatt and Moskowitz (1999) find industry momentum[3] to be significant.

Studies also show higher momentum profits for certain types of stocks. Lee and Swaminathan (2000) find momentum to be stronger among stocks with high turnover. Hong, Lim, and Stein (2000) find small firms with low analyst coverage to earn higher momentum profits than large firms. Grinblatt and Moskowitz (2003) give a profound research on the matter and show that momentum is higher for growth firms, firms with high volume and small firms with few institutional owners.

The explanations for momentum are mainly behavioral. Jegadeesh and Titman (1993) concludes that momentum profits are not due to systematic risk or delayed stock price reactions to common factors. However they claim it's possible that the market under reacts to information about the short-term prospect of firms while overacting in the long-term. More

[1] Firms with unexpectedly high earnings outperform firms with unexpectedly low earnings in periods subsequent to the earnings announcement.

[2] France, Germany, Japan, U.K, U.S

[3] Strategies that buy stocks from past winning industries and sell stock from past losing industries

over- and under reaction theories are presented by Barberis, Shleifer, and Vishny (1998), Daniel, Hirshleifer, and Subrahmanyam (1998), and Hong and Stein (1999). They focus on how investors form expectations about the future prospects of firms, how they respond to new information and their overconfidence in private information. Conrad and Kaul (1998) argue that momentum profits are due to cross-sectional differences in expected returns rather than because of time-series patterns in data, a hypothesis rejected by Jegadeesh and Titman (2001) who find that momentum profits are due to delayed overreaction that eventually reverses. Fama and French (1996) demonstrate that their three-factor model cannot explain momentum. Griffin, Ji and Martin (2003) find no evidence that macroeconomic risk variables based on the Chen, Roll and Ross (1986) model can explain phenomenon. Neither do Cooper, Gutierrez and Hameed (2004) find evidence that macroeconomic risk drives momentum. Like Jegadeesh and Titman (1993) they find that momentum profits tend to reverse over a longer time horizon.

The research closest related to our paper is on the evidence of momentum profits under different market climates. Griffin, Ji and Martin (2003) show that momentum profits are statistically large in good and bad economic states and that the co-movement between momentum strategies and markets are weak. Contrary, Cooper, Gutierrez and Hameed (2004) find that momentum depends critically on the state of the market and only is profitable following up-market trends. However, later research by Griffin, Ji and Martin (2005) gives further evidence of momentum in both up and down markets. They also find foreign momentum strategies much less correlated with US momentum strategies than their respective market indices. Contrary to market indices, they find momentum profits to be no more highly correlated in down-markets. In addition they also find momentum strategies less volatile than their corresponding market indices.

III – Data

This section describes how we obtain and modify the data that is used throughout the study. All stock data is provided by Thomson Datastream Advance.

South Africa is a medium-developed country that in 2008 had a GDP per capita of EUR 4,040[4, 5] according to World Economic Forum (2009). The same study ranked the country 32nd out of 55 in financial stability among the world's leading economies - taking measures as financial policies, financial institutions and financial access into account. Johannesburg Stock Exchange (JSE) was established in 1887 and became a member of the World Federation of Exchanges in 1963. Mkhize and Msweli-Mbanga (2006) tells that JSE was deregulated to its present standards beginning in 1995, mainly as an attempt to attract foreign investors and increase market activity.

On December 31, 2009, the JSE had 396 companies listed with a total market capitalization of EUR 550bn, and a total trading volume in 2009 of EUR 260bn[6]. This can be compared to NASDAQ OMX Nordic that had 797 listed companies with a market capitalization of EUR 570bn and a trading volume in 2009 of EUR 560bn according to World Federation of Exchanges (2010).

The original dataset contains daily data on all stocks on the JSE considered major securities and primary quotes, from January 1994 until December 2009. For each security we obtain daily *Total Return Index*[7] as well as market capitalization. All values are measured in South African Rand (ZAR). The sample consists of a total of over 1000 companies and includes both dead and active stocks. We note that many stocks get delisted during the period, only 104 of the companies listed in 1994 remains in the sample by 2009.

TABLE 1: Final sample descriptives

This table shows the characteristics of the final sample. Volatility, average return and number of observations are calculated for each stock in our final sample, over the whole sample period (quoted monthly). Reported is the equal-weighted average value of the sample, independent of number of observations per stock.

No of stocks			**Monthly Average**
Max	461	Return	1.05%
Min	225	Volatility	64.27%
Average	329	No obs	89

Our final sample consists of data on a total of 710 stocks. This leaves us with a minimum of 225 cross-sectional observations per month, which will ensure well-diversified momentum portfolios. The characteristics of the final sample are reported in Table 1.

[4] Originally quoted in US Dollar, EUR/USD=0.7094 (Oanda.com, Dec 31, 2008)

[5] Compared to Sweden, GDP/capita EUR 37,450

[6] Originally quoted in South African Rand, EUR/ZAR=0.0942 (Oanda.com, Dec 31, 2009)

[7] Total Return Index is a measure provided by Thomson Datastream that includes price level increase and dividends reinvested.

All observations without valid return data, or stocks with price data showing no return over six following months is deleted from the original data set. Since the volatility of some stocks is extreme[8], we suspect data input error and have chosen to exclude the stocks with the 5 percent highest and 5 percent lowest volatility over the entire sample period. We limit the sample period to reach between March 1995 and December 2009 because of insufficient data on the risk free rate prior the period. The limitation also fits well considering the time when the South African market was deregulated to its present standards. To simplify the portfolio construction procedure, we calculate the monthly return as the cumulative return over each calendar month.

(1) $$r_{i,d} = \frac{P_{i,d} - P_{i,d-1}}{P_{i,d-1}} - 1$$

Equation 1 shows the daily return calculations, $P_{i,d}$ and $r_{i,d}$ is the price[9] and return for stock$_i$ in day d respectively.

(2) $$r_{i,t} = (1 + r_d)(1 + r_{i,d+1}),.., (1 + r_{i,d+n}) - 1$$

Equation 2 shows the monthly return calculations. n is the number of days, and $r_{i,t}$ the return for stock i in month t.

As proxy for the risk-free rate we use the rate on 3-month bonds issued by the South African Reserve bank. We calculate the monthly rate according to the following formula.

(3) $$r_{month} = (1 + r_{year})^{1/12} - 1$$

We calculate the return on an equal-weighted index containing all stocks from our final sample and use this as proxy for the common risk factor in the market.

(4) $$r_{index,t} = \frac{1}{n}\sum_{i=1}^{n} r_{i,t}$$

From Equation 4 follows that the return on the equal-weighted index in month t simply is the arithmetic average return of all stocks in the final sample in month t.

[8] Some stocks in the sample show a volatility exceeding 1000% annually, while other has almost zero volatility. Our proposed restriction assures the sample volatility to be in parity with previous research on the South African market. Bae, Lim and Wei (2006) measure the average annual volatility among South African stocks to 57,38%, which makes our sample volatility of 64.27% reasonable.

[9] All prices are obtained from the total return index in order to calculate the dividend-adjusted returns.

IV – Empirical Methodology

In this section, we describe the empirical methodology used for setting up and evaluating the momentum strategies. We begin with describing how the strategies are constructed and how we estimate trading costs. We continue with describing how we define market climates and how we measure the return on our momentum strategies. Finally, we lay out the methodology used for describing the relationship between risk and momentum returns.

Strategy selection and portfolio construction

We evaluate three momentum strategies with different evaluation period (J) and holding period (K).

A. 3 months evaluation period, 3 months holding period (3/3).

B. 6 months evaluation period, 6 months holding period (6/6).

C. 12 months evaluation period, 3 months holding period. (12/3)

Strategy A is chosen since we find it interesting to evaluate a shorter strategy. Strategy B is studied by Jegadeesh and Titman and is one of the most examined by others. We chose strategy C since it was the most profitable in the Jegadeesh and Titman (1993) study.

In every month t, all stocks in our final sample are ranked (worst to best) by their return during the previous months J, that is their performance during the period t-J to t. The stocks in the first decile form the *loser portfolio* while the *winner portfolio* contains the tenth decile of companies ranked by stock market performance. The *zero-cost portfolio* is formed out of the winner portfolio minus the loser portfolio. All portfolios are equal-weighted. To avoid issues associated with lagged reaction effects, price pressure and bid-ask spread we leave out one week between the portfolio formation period and the holding period[10]. Further, due to illiquidity reasons we exclude the 5 percent smallest stocks according to market capitalization in each period.

In any given time $t \geq t_0+J$, where t_0 is the beginning of our sample period and J the evaluation period, we adopt our strategies by buying the winner portfolio and selling short the loser portfolio. In line with Jegadeesh and Titman (1993) we hold overlapping portfolios. This means that in any given month the winner-portfolio consists of K equal-weighted portfolios of stocks evaluated over J months, and held for K months. The same holds for the loser- and zero-cost portfolios. The strategies exhibits their first return in $t^*=t_0+J+K$, when they hold K equal-weighted momentum portfolios. For example, our strategy based on the previous 12 months returns and held for 3 months will show its first return observation 15 months subsequent to the beginning of the sample period. The winner-, loser-, and zero-cost portfolios' will each consist of three equal-weighted portfolios; the first based on the returns over t_0-t_{11}, the second of the returns between t_1-t_{12}, and the third portfolio will be based on the returns from t_2-t_{13}. Since we hold overlapping portfolios we will revise the weights of 1/K of the securities in each portfolio every month. By doing this, we reduce the importance of market timing and decrease the impact of the noisy return pattern of individual stocks on portfolio return (i.e. diversifiable risk). In the beginning of each month, we will ensure that

10 We follow the methodology suggested by Jegadeesh and Titman (1993) that is in line with previous findings of Jegadeesh (1990) and Lehman (1990).

the strategies maintain equal-weighted. This is done to simplify the modeling procedure. Previous evidence by Jegadeesh and Titman (1993) show only minor differences if the portfolios are not rebalanced.

TABLE 2: Portfolio formation

The strategies are quoted J/K. Each portfolio contains K equal-weighted (1/K), overlapping momentum portfolios. The stocks in each of the K portfolios are chosen based on their returns over the previous J months.

	Portfolio		
Strategy	Winner	Loser	W-L
3/3	A_W	A_L	A_w-A_L
6/6	B_W	B_L	B_w-B_L
12/3	C_W	C_L	C_w-C_L

Trading costs, market climates and momentum returns

We use the measurement of *one-way equity trading costs for active managers in South Africa*, estimated by Domowitz, Glen and Madhavan (2000) to calculate the average trading cost for each strategy. We calculate the average turnover for the winner-, loser- and zero-cost portfolios as the weighted average turnover for the K portfolios they contain. Since the portfolios are equal-weighted, that is simply the number of new stocks in the portfolio in month t divided by the total number of stocks at t-1. As we hold overlapping portfolios, every sell order is associated with a buy order. Hence we use two-way trading cost in our calculations.

$$T_{P,t} = \frac{1}{K}\sum_{p=1}^{K}\left(2(TO_{p,t} \cdot 0{,}81)\right) \tag{5}$$

In Equation 5, 0.81 is the Domowitz, Glen and Madhavan (2000) measurement for one-way equity trading costs in the South African market, quoted in percent of portfolio turnover. $TO_{p,t}$ and $T_{p,t}$ are the turnover and trading cost respectively for each of the p=1,…,K overlapping portfolios in month t. $T_{P,t}$ is the average trading cost for the P=winner-, loser-, and zero-cost portfolios in month t. The trading cost measurement is quoted in percent to simplify the comparison with strategy return.

We define *Up-months* as months when the market return is positive and *Down-months* as months when the market return is negative. *Bull* is defined as months when the return of our equal-weighted market index is above its 6-months simple moving average, while *Bear* is the months when it is below.

$$RMA_t = \frac{1}{6}\sum\left(r_{index,t},\ldots,r_{index,t-6}\right) \tag{6}$$

In Equation 6 ,$r_{index,t}$ and RMA_t is the return and simple moving average of our equal-weighted index respectively in month t.

In this way, we make a difference between periods with a negative *market state* and periods with a negative *market trend* in order to capture two different effects. We use the first definition to measure the momentum strategies correlation with the market factor when the

market return is negative. The other definition allows us to determine if momentum strategies exhibit higher (or lower) market exposure in pessimistic market trends. Our approach also enables us to examine if the strategies are able to generate positive returns conditional on the market climate.

For each strategy, returns are measured for the winner-, loser- and zero-cost portfolios respectively. The returns are measured from $t^*=t_0+J+K$, that is the month when the strategy is completed, to the end of the sample period.

We first calculate the monthly returns for all the K lagged portfolios that form each part of the momentum strategies.

$$r_{p,t} = \frac{1}{n}\sum_{i=1}^{n} r_{i,t} \tag{7}$$

In Equation 7, $r_{i,t}$ is the return on stock$_i$ in month t in the p=1,…,K portfolios. Since we hold equal weighted portfolios, $r_{p,t}$ is simply the arithmetic average return of the n stocks in the portfolio.

We then calculate monthly returns for the winner-, loser-, and zero-cost portfolios as the average monthly return on the K overlapping portfolios.

$$r_{P,t} = \frac{1}{K}\sum_{p=1}^{K} r_{p,t} \tag{8}$$

In Equation 8, $r_{P,t}$ is the return on each of the P=winner-, loser- and zero-cost portfolios in month t while $r_{p,t}$ is the return on each of the p=1,…,K overlapping portfolios. We maintain equal weights of stocks in the overlapping portfolios as well as equal weights between the overlapping portfolios.

By definition, all returns are measured in percentage per month. We do not attempt to calculate the returns adjusted for exchange rate fluctuations to any other currency. The reason for this is that we primarily are interested in the relationship between momentum return and the domestic market climate, and do not want our returns to be affected by fluctuating exchange rates.

Framework for risk measurements

We perform two tests to assess if the momentum returns are due to conventional risk measurements. First, we use a one-factor model with the excess return of our equal-weighted index as proxy for the market factor. The model is also estimated allowing for different intercepts and factor loadings conditional on the market climate. Based on those results, we test if return differences among strategies can be related to differences in stock size between the momentum strategies.

We perform the following regression in the time-series for each strategy's winner-, loser- and zero-cost portfolio. We interpret the regression intercept (α_p) as the portfolios abnormal return, and the slope coefficient (β_p) as the portfolios exposure to the systematic risk factor.

$$r_{P,t} - r_{f,t} = \alpha_P + \beta_P(r_{index,t} - r_{f,t}) + \varepsilon_{P,t} \tag{9}$$

In Equation 9, $r_{P,t}$ and $r_{f,t}$ is the return on portfolio P and the rate on 3-month bonds issued by the South African Reserve bank in month t respectively. $r_{index,t}$ is the return on our equal-weighted index in month t. β_p is the factor

loading, or the portfolios sensitivity to the market factor. α_p is the portfolio's risk-adjusted or abnormal return, and $\varepsilon_{p,t}$ is the error term.

Next, we use the regression model in *Equation 10* to allow for different intercepts and factor loadings conditional on the market climate. From our definitions of market climate follows that we run two subsets of regressions. In the first set, D_t is a dummy-variable taking a value of one in *down-months*. That is months when the market return is negative. In the second set of regressions, D_t takes the value of one if the market return is below its 6-month simple moving average, our definition of *bear* months. We run the two sets of regressions for the winner-, loser- and zero-cost portfolio of each strategy.

$$r_{P,t} - r_{f,t} = \alpha_{1,P} + D_t\alpha_{diff,P} + \left(\beta_{1,P} + D_t\beta_{diff,P}\right)\left(r_{index,t} - r_{f,t}\right) + \varepsilon_{P,t} \tag{10}$$

In Equation 10, $\alpha_{1,P}$ and $\beta_{1,P}$ are interpreted as the abnormal return and factor loading respectively when the market climate is Up or Bull. In opposition $\alpha_{1,p}$ + $\alpha_{diff,P}$ and $\beta_{1,P}$+$\beta_{diff,P}$ are the abnormal return and factor loading when the market climate is Down or Bear.

We are especially interested in $\alpha_{diff,P}$ and $\beta_{diff,P}$ from the two regression sets. These estimators will tell us if the momentum strategies tend to earn lower (or higher) abnormal returns and exhibit increased (or decreased) market correlation when the market climate is negative.

Based on the results from our one-factor model, we test if differences in the strategies' returns can be related to differences in median firm size among the momentum portfolios. We test the hypothesis that the average median firm size for the different winner-, loser-, and zero-cost portfolios' are equal to the median market firm size against a two-sided alternative with a paired t-test.

$$\begin{aligned} H_0 &: \overline{Median_{P,t}} - Median_{Index,t} = 0 \\ H_1 &: \overline{Median_{P,t}} - Median_{Index,t} \neq 0 \end{aligned} \tag{11}$$

Equation 11 shows the null-hypothesis under which the difference between the average median firm size of the momentum portfolios and the median firm size of our equal-weighted index is equal.

The median is in our opinion a better estimator of portfolio firm size than a simple average for two reasons. Since portfolio returns are equal-weighted among the included stocks, using the median gives each firm's size the same weight. Also, Fama and French (1996) did use firm ranking to construct the factor portfolios that lay ground for their findings on firm size return differences.

We calculate the median firm size for all the K lagged portfolios that form each part of the momentum strategies.

$$Median_{p,t} = (n+1)/2 \tag{12}$$

In Equation 12,$Median_{p,t}$ is the median size for each of the K portfolios in month t.

We then calculate the average median firm size for the winner-, loser-, and zero-cost portfolios' as the average of the K portfolio's they contain.

(13) $$\overline{Median_{P,t}} = \frac{1}{K}\sum_{p=1}^{K} Median_{p,t}$$

Equation 13 show that the average median size of the winner-, loser-, and zero-cost portfolios are equal to the average median size of the K lagged portfolios they contain.

The median firm size of the market in month t is calculated according to *Equation 14*

(14) $$Median_{Index,t} = (N+1)/2$$

V - Discussion of data, methodology and econometric issues

In this section, we discuss problems related to our dataset and empirical methodology. The busy reader proceeds to the next section with full understanding of our results. We begin with problems related to the characteristics of our dataset and continue with a motivation to our strategy selection. We then discuss our trading cost measurement and market climate definitions along with tax related issues. The section is completed with theoretical and empirical evidence supporting our risk measurements and a discussion of the econometric issues.

Data

The median firm size of the momentum portfolios is biased upwards since we exclude stocks from the final sample based on firm size when constructing the portfolios. This bias results in problems with comparing the median firm size of the portfolios with the median firm size of the market. As a result, there is a chance that we underestimate the strategies ability to systematically pick small stocks.

All portfolios are based on calendar months rather than trading days. This is done mainly to simplify the portfolio construction procedure. When skipping a week between the portfolio formation period and the holding period, there is a small possibility of striking several holidays in a row. This will diminish the intended effect. Since there are an unequal number of trading days per month, the rating system will overstate the performance of longer months. Also, due to the large sample size, we have not had time to manually verify that all data is correct. However, since the descriptive statistics of our final sample seems reasonable and our tests give good results, we have no reason to suspect data errors.

Since we are concerned with survivorship bias in the index series provided by Thomson Datastream, we have chosen to construct an equal weighted index that each month contains all stocks in our final sample. That will eliminate the problem and ensure that the average beta among the stocks is one.

In theory, the risk-free rate is the rate on an investment with zero default- and interest rate risk. In practice government bonds with short maturity dates are used as a proxy for the risk-free rate. The short maturity date ensures low interest rate risk while the issuer, in our case the South African Reserve Bank, exhibit the lowest possible default risk in the market. We note that the risk-free rate in South Africa has been high during our sample period (Table A.1 Appendix). This is reasonable since data provided by Statistics South Africa (2010) suggests that the inflation rate in the country has been relatively high over the last twenty years. Since we use nominal values in our calculations, the performance of the South African market and our momentum strategies are probably overestimated in real terms.

Strategy selection and trading costs

There are by definition an infinite number of possible momentum strategies. Most of the explanations for momentum are based on investor's short-term reaction to information about firms. The evidence also suggests an opposite long-term pattern, where momentum returns eventually reverses and become negative[11]. Since we are interested in the profitability of momentum strategies under different market climates, we have chosen to evaluate strategies

[11] See section II

that previously have been proven significant. To get good results for the comparison we have chosen not to evaluate extremely short or long strategies since their returns might disappear due to trading costs or reversion effects.

A simple way to measure trading costs is to use the bid-ask spread as a rough estimation. We have chosen to use the Domowitz, Glen and Madhavan (2000) measurement since it incorporates both *explicit* and *implicit* components of asset trading. Explicit costs are the direct cost of trading, for example taxes and broker commissions. Implicit costs represent the indirect costs of trading, where the most important is the price impact of large trades. Since bid-ask spread measurements fails to capture the price impact, Domowitz, Glen, Madhavan (2000) have chosen to use the volume-weighted average price (VWAP) over the trading day to measure implicit costs. VWAP is calculated as the mean of the day's open, close, high and low prices. The price impact is then measured as the percentage difference between the effective price and this benchmark.

We are aware of that short-selling impose additional costs beyond those associated with long position in stocks. When taking negative position, investors are usually required to post cash or equity as collateral. If the short positions rise in value, the investor then needs to borrow in order to maintain the margin requirements. The interest cost associated with this potential loan is not included in our trading cost measurement. However, we consider the buy side as equity collateral for the sell side of our zero-cost portfolios. This implies that the issue of interest costs only arises when the value of the loser portfolio falls by a greater amount than the value of the winner portfolio raises. Nevertheless, since we show that most of the returns of our zero-cost portfolios come from the sell side, interest costs are probably significant. Beyond this cost, short-selling is also associated with the cost of paying back dividends, inverse price impacts and broker fees. Since we use the Total Return Index, we indirect calculate for dividends since it is incorporated in the stock price movements. The inverse price impact is captured by the Domowitz, Glen and Madhavan (2000) measurement, so are the broker fees even if there sometimes are additional fees to borrowing stocks. Altogether, we see that our trading costs measurement have some limitations but that it suits our purpose of giving a rough estimation of whether or not it's interesting to further investigate the profitability of return momentum in the South African market.

Market climates

Kim and Zumwalt (1979) use a conditional dual-beta model to describe stock returns. They regress stock excess returns on the market excess return, separating positive and negative market returns. In this way, they are able to separate up-market and down-market betas. Kim and Zumwaltuse months when the average market return exceeds the risk-free rate, the average long run market return, or zero as cut-off levels for up-and down-markets. Since they show that the results for the three measurements are similar, we use months when the market return exceeds zero as our definition of up-months.

Neftci (1984) suggests that monthly observations of return series have been suggested to be too noisy to reveal cyclical trends. Hence, other measurements than monthly index returns have been used in the literature to differentiate market climates. When defining bull- and bear markets, Bowlin, Dukes, and MacDonald (1987) use periods when the market increase or decrease by at least 20 percent from peak to peak. Pagan and Sossounov (2000) use trend based definitions of bull and bear markets that focus on systematic movements in the market, ignoring short-term effects. Stock market analysts often use simple moving averages (SMAs) of various lengths to capture market trends. To be able to capture a mid- to

long-term trend in the market, we have chosen to use the 6-months simple moving average as cut-off point for bull and bear periods.

Taxes

In order to give a somewhat more fair view the real world applicability of our strategies it makes sense to give a brief discussion of tax considerations. Even if regulations differ among countries, we can conclude that our strategies would force investors to continuously realize wins and losses. This implies that the investable amount each year would be reduced by tax payments. However, as previously mentioned, taxes are included among explicit trading costs in the Domowitz, Glen and Madhavan (2000) measurement for equity trading costs.

Empirical evidence and theory supporting our risk-measurements

Previous research conducted by Fama and MacBeth (1973), Banz (1981) and Fama and French (1993) indicate that beta and size are related to both risk and expected returns.

We use a single-factor model to describe the returns from our momentum strategies. The single-factor model divides security returns into a common, systematic, and a firm specific part. A frequently used approach to making the single-factor model useable is to use the return on a broad based index of securities as proxy for the common factor. The systematic part of portfolio risk is determined by the portfolios exposure to the variance of the common factor. The exposure of all assets in the portfolio will be reflected by this systematic component. In contrast to the systematic risk, the firm-specific part of portfolio variance is independent and uncorrelated across securities. This implies that the firm-specific risk can be diversified away and hence is not priced in the market. When the number of securities in the portfolio gets large, the firm-specific component become small. Our momentum portfolios hold a sufficiently large number of individual stocks to be well diversified. This is an important implication since momentum strategies based on a small subset of securities can exhibit high firm-specific, nonmarket risk. We think that our factor model with the return on the market index as factor suits the purpose of investigating the risk return relationship of momentum returns.

Kim and Zumwalt (1979), and Tang and Shum (2004), suggest that securities may respond differently in up- and down- markets. We use a dual-beta model to capture differences in factor loadings and abnormal returns conditional on the market climate. Our approach captures both short-term and trend based effects. The methodology of dividing the sample period in subsamples depending on the market climate has previously been used by Kim and Zumwalt (1979) and Pettengill, Sundaram and Mathur (1995) to name a few. We chose to use dummy-variables to simplify the interpretation of, and comparison between, regression estimates.

An increasingly used model for describing asset returns is the Fama and French three-factor model. The model suggests that firm size and book-to-market ratio in combination with the market factor does a better job of describing cross-sectional differences in expected returns than the excess return of the market alone. Fama and French (1996) state that the only anomaly the model fully can't explain is short-term momentum. Jegadeesh and Titman (1993) also find that momentum is not due to picking small stocks. We are aware that the Fama and French three-factor model can be an alternative approach to study momentum in the South African market. However, time limitations make such an analysis beyond the scope of this paper.

Econometric issues

We test for serial correlation in the error terms using the Durbin and Watson (1950) alternative test with lags up to 6-months. We use this test since it allows for non-strictly exogenous explanatory variables and works even if the explanatory variable would happen to be strictly exogenous. The results from the tests are presented in Table A.2 in appendix and show that serial correlation is not a problem for statistical inference. Time series regressions are sensitive to serial correlation among the error terms. The most important implication is that when serial correlation is present, the usual OLS standard errors and test statistics are not valid. The effect is usually that the regression estimators appear overly significant. However, serial correlation robust standard errors can be poorly behaved even when the sample size is large as 100 observations. Nevertheless, as a robustness test of our results, we did perform a regression with serial correlation and heteroscedasticity robust Newey-West standard errors. These results are reported in Table A.3 and A.4 in appendix, but show very little deviation from the ordinary regression statistics.

We use heteroscedasticity robust standard errors and t-statistics in all our regressions sinceSchewert and Seguin (1990) give evidence on heteroscedasticity in stock returns. Heteroscedasticity robust standard errors are normally used when the problem is suspected, since the standard errors have good properties in large samples.

VI - Results

Average monthly excess returns give evidence of economically significant momentum profits in the South African market (Table 3). Our best portfolio, that is the winner-loser portfolio from our 12/3 strategy, earns an average return of 2.20 percent per month (29.84 percent annually) over the sample period. This can be compared to the average return of the equal-weighted index, which is 0.95 percent per month (12.01 percent per annually). Our results suggest relatively high momentum returns compared to the findings of Jegadeesh and Titman (1993). They find their 12/3 strategy earning a return of 1.31 percent per month (16.90 percent annually) in the U.S market. Also Griffin, Ji and Martin (2003) find large momentum profits in the South African market. Their 6/6 strategy earns an average monthly return of 1.82 percent in the 1990 to 2000 sample period. There are small differences in average returns between our strategies. However, the 12/3 strategy shows a return that appears higher but is not statistically significant at a five percent level. Raw momentum returns suggest that the winner portfolios provide the main contribution to zero-cost portfolio returns, the same result as found by Jegadeesh and Titman (1993). We note that all loser portfolios actually have positive average returns, they are however not significantly different from zero at a five percent level. Since they are all less than the risk-free rate, it appears as if they make a small contribution to zero-cost portfolio return. All zero-cost portfolios show average returns that are higher than the average index return. The result is significant at the five percent level. Griffin, Ji and Martin (2005) find their strategies to be less volatile than the corresponding market index. Our volatility measures imply that the winner portfolios have lower volatility than the loser portfolios while the volatility of the zero-cost portfolios falls in between. Their volatility is slightly higher than that of the equal-weighted index, but differences are fairly small.

TABLE 3: Average monthly excess returns and volatility

In every month t, all stocks in our final sample are ranked (worst to best) by their return during the previous months J, that is their performance during the period t-J to t. The stocks in the first decile form the *loser-portfolio* while the *winner-portfolio* contains the tenth decile of companies ranked by stock market performance. The *zero-cost portfolio* is formed out of the winner portfolio minus the loser portfolio. All portfolios are equal- weighted. To avoid issues associated with lagged reaction effects, price pressure and bid-ask spread we leave out one week between the portfolio formation period and the holding period. Each portfolio is held for K months and consists of K overlapping portfolios.

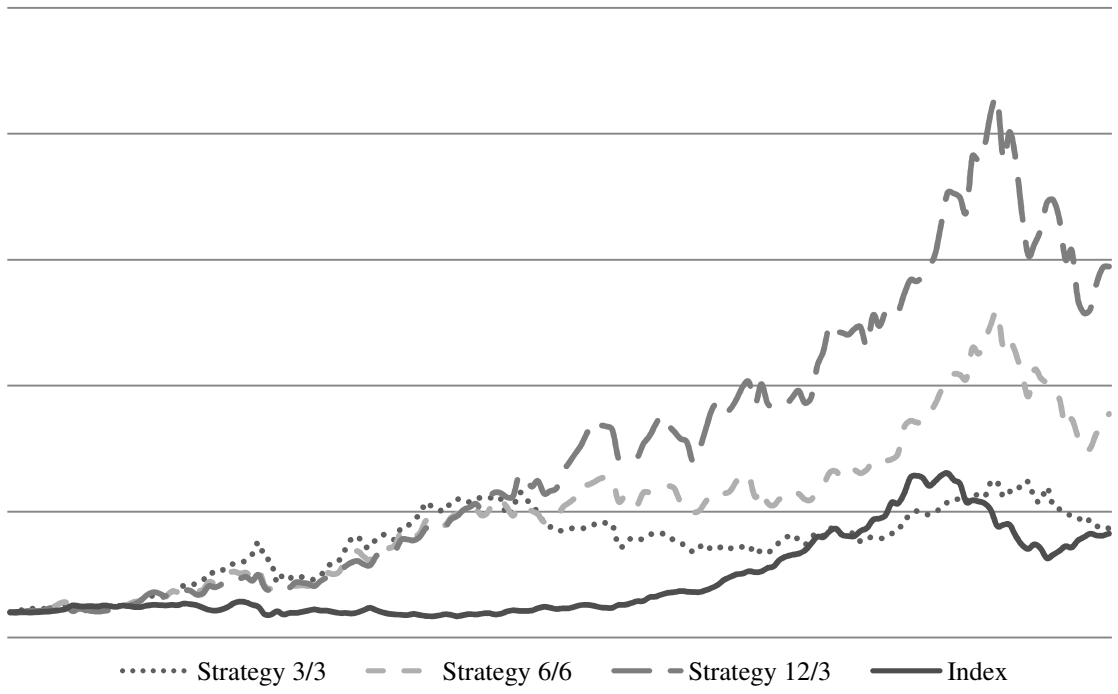
In this table, *Excess return* is the strategy return less the risk-free rate. All values are measured on a monthly basis.

Strategy	*Average*	Winner	Loser	Winner-Loser	Index
3/3	Excess return	0.0176	-0.0016	0.0192	0.0095
	(Volatility)	*(0.0620)*	*(0.0753)*	*(0.0626)*	*(0.0529)*
6/6	Excess return	0.0176	-0.0010	0.0187	
	(Volatility)	*(0.0676)*	*(0.0712)*	*(0.0612)*	
12/3	Excess return	0.0191	-0.0029	0.0220	
	(Volatility)	*(0.0677)*	*(0.0732)*	*(0.0619)*	

When accounting for trading costs, the magnitude of zero-cost momentum profits are diminished by on average 0.6 percent per month. Differences among strategies are due to differences in average portfolio turnover, which vary from 13 to 29 percent per month. Our most actively traded strategy, the 3/3 strategy, has an average portfolio turnover of 28 percent

CHART 1: Performance over time (trading costs accounted for)

Chart 1 shows the theoretical development of an investment of 100 South African Rand in the zero-cost portfolios, from March 1, 1995 until December 31, 2009. Momentum returns have been adjusted for trading costs.



per month (~80 percent for each of the three overlapping portfolios per month), which implies a total trading cost of 0.9 percent per month on the zero-cost portfolio (10.8 percent per year).

After adjusting for trading costs, momentum strategies still tend to outperform the index even if the differences are not statistically significant on a monthly basis. However, as seen in Chart 1, accumulated overa longer horizon both the 12/3 and 6/6 strategies largely outperform the index.

Our trading cost measurement is higher than the measurement used by Jegadeesh and Titman (1993). As suggested by Domowitz, Glen and Madhavan (2000) trading costs are higher in emerging- and less developed markets. Therefore, it makes sense that the trading costs are higher for the South African market than for example the U.S market. In fact, Lesmond, Schill and Zhou (2004) means that trading costs actually are even higher than our measurement. Our results show that trading costs are a factor to count with when measuring the profitability of momentum.

Risk adjusted momentum returns

The results in this section are based on the regression model with the excess return of the equal-weighted index as the only factor. Recall Equation 9. The intercept is interpreted as the portfolio's abnormal return and we consider the factor loadings as the portfolio's exposure to systematic risk. All values are reported on a monthly basis.

$$r_{P,t} - r_{f,t} = \alpha_P + \beta_P(r_{index,t} - r_{f,t}) + \varepsilon_{P,t}$$

All single portfolios, winners-, and losers, show alphas and betas that are statistically different from zero with at least 98 percent certainty. The average zero-cost alpha of 2.08 percent suggests that the observed raw returns are not due to high exposure to the systematic risk component captured by our one-factor model. The winner- and loser portfolios have beta values higher than one, suggesting that they are more risky than the market. But, since both have roughly the same betas, all zero-cost portfolios have non-significant betas at the five percent level. They appear to lack systematic risk. We can see a small deviation on the 3/3 strategy, where the loser portfolio has a slightly higher beta leading to a small but negative zero-cost beta (P =0.11 compared to P=0.97 on 6/6 and 12/3). In line with Jegadeesh and Titman (1993) we find significant alphas and betas when the equal-weighted index is used as market proxy. Our monthly alpha of 1.86 percent for the zero-cost portfolio of our 6/6 strategy is slightly larger than the corresponding value from the Jegadeesh and Titman (1993) study, yet again suggesting higher momentum returns in the South African market. Furthermore, the pattern of slightly negative- to zero-betas for the winner-loser portfolios seems applicable for the South African market. Contrary to what was suggested by the raw return data, it appears as if the loser portfolios contribute the most to abnormal returns with an average alpha of -1.27 percent. All alphas show strong significance. The alpha for the zero-cost portfolio of our 6/6 strategy is significant at the 1.8 percent level, and all other alphas below the 0.5 percent level of significance.

TABLE 4: Monthly abnormal returns and systematic risk measurements

In every month t, all stocks in our final sample are ranked, worst to best, by their return during the previous months J, that is their performance during the period t-J to t. The stocks in the first decile form the *loser-portfolio* while the *winner-portfolio* contains the tenth decile of stocks ranked by stock market performance. The *zero-cost portfolio* is formed out of the winner portfolio minus the loser portfolio. All portfolios are equal-weighted. To avoid issues associated with lagged reaction effects, price pressure and bid-ask spread we leave out one week between the portfolio formation period and the holding period. Each portfolio is held for K months and consists of K overlapping portfolios.
In this table, *Alpha* is the abnormal return adjusted for systematic risk while *Beta* is each strategy's individual exposure to systematic risk. All values are measured on a monthly basis.

Strategy		Winner	Loser	Winner-Loser
3/3	Alpha	0.0086	-0.0132	0.0218
	(p-value)	*(0.005)*	*(0.000)*	*(0.000)*
	Beta	0.9430	1.2191	-0.2760
	(p-value)	*(0.000)*	*(0.000)*	*(0.109)*
6/6	Alpha	0.0071	-0.0115	0.0186
	(p-value)	*(0.018)*	*(0.000)*	*(0.000)*
	Beta	1.1041	1.0990	0.0051
	(p-value)	*(0.000)*	*(0.000)*	*(0.975)*
12/3	Alpha	0.0086	-0.0134	0.0220
	(p-value)	*(0.003)*	*(0.000)*	*(0.000)*
	Beta	1.1110	1.1061	0.0049
	(p-value)	*(0.000)*	*(0.000)*	*(0.974)*

Risk adjusted momentum returns conditional on the market climate

The results in this section are based on the two regression sets using the conditional dual-beta model. Recall Equation 10. In the first regression set, D_t is a dummy-variable taking a value of one in down-months. In the second regression set, D_t is a dummy-variable taking a value of one in bear-months. $\alpha_{diff,p}$ and $\beta_{diff,p}$ are interpreted as the differences in abnormal return and factor loading respectively for portfolio p depending on the market climate. All values are reported on a monthly basis. We begin each subset with some descriptive statistics of the raw momentum returns.

$$r_{P,t} - r_{f,t} = \alpha_{1,P} + D_t\alpha_{diff,P} + (\beta_{1,P} + D_t\beta_{diff,P})(r_{m,t} - r_{f,t}) + \varepsilon_{P,t}$$

We find that both winner- and loser-portfolios show positive average returns when the market goes up, and negative average returns when the market goes down. However, all zero-cost strategies show positive average returns regardless of the market state. The volatility of winner portfolios tends to be higher in down markets while loser portfolios tend to have about the same volatility unconditional of the market state.

The results from the up/down regression (see Table 5) suggest momentum profits regardless of the market state. However the correlation with the market factor seems to increase when the market is down. The winner portfolio of our 6/6 strategy shows increased down market correlation with a p-value of 0.058. The corresponding portfolios for the 3/3- and 12/3 strategies show the same, but weaker, results with p-values of 0.402 and 0.165 respectively. All loser portfolios shows decreased down market correlations with $beta_{diff}$ of -0.377, -0.427 and -0.422 and p-values of 0.068, 0.074 and 0.070 for the 3/3, 6/6 and 12/3 strategies. All zero-cost portfolios show increased down market betas. The evidence for the 6/6 and 12/3 strategies are strong, with p-values of 0.032 and 0.052 respectively. Regarding the winner portfolios, it's only the one of the 6/6 strategy that shows evidence of a different alpha when the market is down. Interestingly, the results suggest a higher alpha with a p-value of 0.020. None of the loser portfolios show any evidence of differences in alpha estimates depending on the market state. As for the corresponding winner portfolio, the zero-cost portfolio of the 6/6 strategy shows a higher return in down markets. The p-value is 0.071. The two other strategies show similar results but with p-values suggesting low levels of significance. Altogether, there seem to be a relationship between the market state and differences in beta while we find very little evidence for differences in abnormal returns conditional on the market climate. Griffin, Ji and Martin (2003) suggested that momentum profits are higher in down markets, a result which is true only for our 6/6 strategy.

TABLE 5: Regression coefficients Up/Down

In every month t, all stocks in our final sample are ranked (worst to best) by their return during the previous months J, that is their performance during the period t-J to t. The stocks in the first decile form the loser-portfolio while the winner-portfolio contains the tenth decile of companies ranked by stock market performance. The zero-cost portfolio is formed out of the winner portfolio minus the loser portfolio. All portfolios are equal-weighted. To avoid issues associated with lagged reaction effects, price pressure and bid-ask spread we leave out one week between the portfolio formation period and the holding period. Each portfolio is held for K months and consists of K overlapping portfolios.
Up is defined as a month t when the market return is positive, while Down is a month t when the market return is negative.

In this table, $Beta_{diff}$ is the estimated difference in exposure to systematic risk between Up and Down periods. Respectively, $Alpha_{diff}$ is the estimated difference in abnormal return. All values are measured on a monthly basis.

Portfolio 3/3			
	Winner	**Loser**	**Winner-Loser**
$Beta_{up}$	0.844	1.383	-0.539
$Beta_{down}$	1.091	0.961	0.130
$Beta_{diff}$	0.246	-0.422	0.668
$P\text{-value}_{diff}$	0.402	0.068	0.168
$Alpha_{up}$	0.012	-0.019	0.031
$Alpha_{down}$	0.015	-0.025	0.041
$Alpha_{diff}$	0.003	-0.006	0.010
$P\text{-value}_{diff}$	0.778	0.541	0.608
Portfolio 6/6			
	Winner	**Loser**	**Winner-Loser**
$Beta_{up}$	1.039	1.238	-0.199
$Beta_{down}$	1.491	0.861	0.630
$Beta_{diff}$	0.452	-0.377	0.829
$P\text{-value}_{diff}$	0.058	0.074	0.032
$Alpha_{up}$	0.007	-0.016	0.023
$Alpha_{down}$	0.030	-0.023	0.053
$Alpha_{diff}$	0.023	-0.007	0.030
$P\text{-value}_{diff}$	0.020	0.498	0.071
Portfolio 12/3			
	Winner	**Loser**	**Winner-Loser**
$Beta_{up}$	0.989	1.274	-0.285
$Beta_{down}$	1.309	0.847	0.462
$Beta_{diff}$	0.319	-0.427	0.746
$P\text{-value}_{diff}$	0.165	0.070	0.052
$Alpha_{up}$	0.013	-0.019	0.032
$Alpha_{down}$	0.018	-0.026	0.044
$Alpha_{diff}$	0.005	-0.006	0.011
$P\text{-value}_{diff}$	0.612	0.555	0.494

As for up- and down markets, the winner- and loser portfolios show positive average returns in bull markets and negative average returns in bear markets. However, the zero-cost portfolios earn positive and economically significant momentum returns regardless of the market trend. Contrary to up- and down markets, the winner portfolio seems to be less volatile in bull markets while the loser portfolios show higher volatility in bull markets. However, differences are small and not statistically significant at the five percent level. For the zero-cost portfolios, the results are ambiguous even though it seems like they are more volatile in bull- than in bear markets.

The results from the bull/bear regression are in general weaker than the results from the up/down regression. In line with previous findings, there is some evidence for increased market correlation in negative market trends. However, the relationship is weak; the highest p-value is only 12.0 percent. Contrary to the evidence from up- and down markets, there seems to be a correlation between lower risk-adjusted momentum returns and negative market trends. All winner portfolios show positive $beta_{diff}$ even if the corresponding p-values are low. The strongest evidence is from the 12/3 strategy where the winner portfolio has a $beta_{diff}$ of 0.223 with a p-value of 0.218. All loser portfolios have negative $beta_{diff}$. The significance among the loser portfolios is in general higher than for the winner portfolios. The 3/3, 6/6 and 12/3 strategies have p-values of 0.120, 0.188 and 0.332 respectively. All zero-cost portfolios have positive $beta_{diff}$ suggesting increased market correlation in bear markets. However, the relationship is weaker than suggested by the results based on the market state. The 3/3, 6/6 and 12/3 strategies have $beta_{diff}$ of 0.545, 0.495 and 0.460 respectively with corresponding p-values of 0.180, 0.184 and 0.198. The $alpha_{diff}$ coefficients for all winner portfolios are negative, suggesting that the abnormal return is lower in bear markets. For the 3/3 and 12/3 portfolios, $alpha_{diff}$ is equal to -1.4 percent and -1.1 percent respectively with corresponding p-values of 0.069 and 0.164. For the loser portfolios, differences in alpha values are smaller. It appears as if the loser portfolios earn higher returns in bear markets, but none of the $alpha_{diff}$ are significant at reasonable levels. All zero-cost portfolios show evidence of lower abnormal returns in bear markets. The relationship is however very weak, the most significant difference is shown by the 3/3 strategy with an $alpha_{diff}$ of -2.0 percent and a p-value of 0.116.

Our trend measurement is not perfectly comparable to the one of Cooper, Gutierrez and Hameed (2004). They define positive market trends as when the three years lagged market return is positive, while we use the 6-months SMA hence capturing a shorter trend. They only find momentum profitable following up markets while our evidence (see Table 6) suggests positive momentum profits regardless of the market trend.

TABLE 6: Regression coefficients Bull/Bear

In every month t, all stocks in our final sample are ranked (worst to best) by their return during the previous months J, that is their performance during the period t-J to t. The stocks in the first decile form the loser-portfolio while the winner-portfolio contains the tenth decile of companies ranked by stock market performance. The zero-cost portfolio is formed out of the winner portfolio minus the loser portfolio. All portfolios are equal-weighted. To avoid issues associated with lagged reaction effects, price pressure and bid-ask spread we leave out one week between the portfolio formation period and the holding period. Each portfolio is held for K months and consists of K overlapping portfolios.
Bull is defined as a month t when the market return is above its 6-month simple moving average while Bear is a month t when the market return is below its 6-month simple moving average.
In this table, $Beta_{diff}$ is the estimated difference in exposure to systematic risk between Bull and Bear periods. Respectively, $Alpha_{diff}$ is the estimated difference in abnormal return. All values are measured on a monthly basis.

Portfolio 3/3			
	Winner	**Loser**	**Winner-Loser**
$Beta_{bull}$	0.752	1.424	-0.672
$Beta_{bear}$	0.970	1.097	-0.127
$Beta_{diff}$	0.218	-0.327	0.545
$P\text{-value}_{diff}$	0.350	0.120	0.180
$Alpha_{bull}$	0.020	-0.022	0.042
$Alpha_{bear}$	0.006	-0.016	0.022
$Alpha_{diff}$	-0.014	0.007	-0.020
$P\text{-value}_{diff}$	0.069	0.417	0.116
Portfolio 6/6			
	Winner	**Loser**	**Winner-Loser**
$Beta_{bull}$	0.988	1.282	-0.294
$Beta_{bear}$	1.211	1.009	0.202
$Beta_{diff}$	0.222	-0.273	0.495
$P\text{-value}_{diff}$	0.310	0.188	0.184
$Alpha_{bull}$	0.011	-0.020	0.032
$Alpha_{bear}$	0.011	-0.013	0.023
$Alpha_{diff}$	-0.001	0.008	-0.008
$P\text{-value}_{diff}$	0.924	0.386	0.539
Portfolio 12/3			
	Winner	**Loser**	**Winner-Loser**
$Beta_{bull}$	0.930	1.235	-0.305
$Beta_{bear}$	1.163	1.008	0.154
$Beta_{diff}$	0.233	-0.227	0.460
$P\text{-value}_{diff}$	0.218	0.332	0.198
$Alpha_{bull}$	0.018	-0.019	0.037
$Alpha_{bear}$	0.008	-0.016	0.024
$Alpha_{diff}$	-0.011	0.003	-0.013
$P\text{-value}_{diff}$	0.164	0.785	0.333

R-Square

The adjusted R-square value increases with added variables (market state/market trend) for all strategies and portfolios except the 12/3 loser portfolio (see Table 7). This points to the fact that the dual-beta model does a better job in explaining momentum returns than the simple one-factor model. In general, the dual-beta model that takes market state into account has a slightly higher adjusted R-square than the model that is based on market trend.

TABLE 7: R-square

This table shows the adjusted R-square values from all factor regressions. The adjusted R-square is a *goodness-of-fit* measurement, stating the share of total variance explained by the dependent variable(s). In difference to ordinary R-square, the adjusted measure also takes the number of explanatory variables into account.

3/3	**One-factor**	**State**	**Trend**
Winner	0.644	0.645	0.649
Loser	0.731	0.738	0.736
W-L	0.049	0.074	0.074
6/6	**One-factor**	**State**	**Trend**
Winner	0.745	0.764	0.747
Loser	0.665	0.670	0.667
W-L	-0.006	0.054	0.009
12/3	**One-factor**	**State**	**Trend**
Winner	0.752	0.756	0.755
Loser	0.635	0.642	0.635
W-L	-0.006	0.029	0.007

Exposure to the Fama and French size factor

As discussed earlier, it is possible that high exposure to the Fama and French size factor plays a significant role in explaining abnormal returns provided by our momentum strategies.

As seen in Table 8, our findings show that winner portfolios do tend to pick stocks with a market value that is significantly higher than loser portfolios. We can also see that loser portfolios appear to have significantly lower average market values than the market itself, where p-values for all strategies are below 0.1 percent. Findings also imply that winner portfolios are larger than the market, with 2 out of 3 strategies showing p-values that are significant on a 5 percent and 0.1 percent level respectively.

TABLE 8: Average firm size

Firm size is measured as the average median market value per strategy and month, and is reported in million South African Rand. The P-value reported is the p-value corresponding to a two-tailed, paired independent t-test between median firm size on the market, and average median firm size per portfolio and month.

Firm Size	Winner	Loser	Winner-Loser
3/3	676	263	469
6/6	856	232	544
12/3	1160	213	687
Market	679		
P-value	**Winner**	**Loser**	**Winner-Loser**
3/3	0.9563	0.0000	0.0000
6/6	0.0493	0.0000	0.0034
12/3	0.0001	0.0000	0.8980

VII – Conclusions

In this study, we have examined the existence and persistence of momentum profits on the South African market. We have investigated three different strategies, and examined their risk-return relationship under different market climates. We mainly used a one-factor market model to identify possible differences in systematic risk between our strategies and the market.

In general, momentum strategies earn economically significant returns in the South African market. We find that returns from zero-cost momentum on average provides an annual return of up to 29.84 percent (12/3 strategy). On the other hand, our momentum portfolios tend to have slightly higher volatility than the equal-weighted market proxy. All zero-cost portfolios show returns that are significantly higher than the market.

Trading costs seems to be an important issue considering the strategies' real world applicability. High portfolio turnovers make short strategies more sensitive than long ones. After adjustments for trading costs, we no longer find any significant differences between our momentum strategies and the index portfolio. However, our momentum strategies still tend to outperform the index in the long run. Our findings are ambiguous and we believe that further research is needed to draw clear conclusions.

When using a single factor model with the excess return of the market as explanatory variable, all portfolios show alphas and betas that are statistically significant with at least 98 percent certainty. Abnormal returns are in parity with average returns, suggesting that momentum returns are not due to picking stocks with high market risk.

We show that the beta values for the winner and loser portfolios are roughly equal, leading to zero-cost portfolios with beta values around zero. This implies that the zero-cost portfolios seem to lack systematic risk. In difference to Jegadeesh and Titman's previous findings and our general average return results, our findings show that loser portfolios contribute more than winners to momentum profits. We find large differences in average firm size between both portfolios and strategies. Since our results suggests that the momentum profits of our zero-cost strategies mainly comes from the short portfolio, one might expect that a part of the returns come from the strategies ability to pick small stocks. Hence, we believe that the Fama and French three factor model might be a better approach for further research on momentum returns.

Overall, we find little evidence for differences in momentum returns conditional on the market climate. While it is possible that there is a weak relationship between negative market trends[12] and lower momentum returns, the same does not seem to hold in negative market states[13]. However, the correlation with the market factor for all zero-cost portfolios tends to increase in bad market states while the evidence is ambiguous for different market trends. Altogether, our results indicate that momentum strategies might be more risky in negative market climates than expected when considering a single beta model.

[12] *Negative market trend* is when the market return is below its six month simple moving average.

[13] *Negative market state* is when the market return is negative.

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Appendix

TABLE A.1: Returns plotted by strategy and month

	3/3			6/6			12/3			Index	Risk-free
Month	**W**	**L**	**W-L**	**W**	**L**	**W-L**	**W**	**L**	**W-L**		**Quoted monthly**
Mar-95	0.027	0.032	-0.004	0.033	0.031	0.002	0.041	-0.006	0.048	0.026	0.010
Apr-95	0.019	-0.008	0.028	0.017	0.015	0.002	-0.004	0.002	-0.007	0.024	0.010
May-95	0.028	-0.060	0.088	0.021	0.015	0.006	0.030	-0.009	0.040	0.012	0.011
Jun-95	0.044	-0.028	0.073	0.024	-0.013	0.038	0.029	-0.015	0.044	-0.010	0.011
Jul-95	0.000	0.031	-0.031	0.013	0.000	0.013	0.020	0.018	0.002	0.016	0.011
Aug-95	0.048	0.020	0.028	0.066	0.034	0.031	0.061	0.041	0.020	0.030	0.011
Sep-95	0.036	0.040	-0.004	0.070	0.008	0.061	0.074	0.012	0.061	0.026	0.011
Oct-95	0.034	0.003	0.031	0.043	-0.037	0.081	0.037	-0.063	0.100	0.029	0.011
Nov-95	0.131	-0.026	0.157	0.089	-0.030	0.119	0.102	0.005	0.097	0.044	0.011
Dec-95	0.057	0.099	-0.042	0.099	0.064	0.034	0.088	0.110	-0.021	0.055	0.011
Jan-96	0.099	0.253	-0.154	0.110	0.290	-0.180	0.121	0.324	-0.203	0.133	0.011
Feb-96	0.032	-0.041	0.072	0.033	-0.030	0.063	0.031	-0.063	0.095	-0.010	0.011
Mar-96	-0.006	0.032	-0.038	-0.019	0.039	-0.058	-0.037	-0.008	-0.029	0.003	0.011
Apr-96	0.063	0.005	0.058	0.024	0.081	-0.057	0.023	0.057	-0.034	0.020	0.011
May-96	0.035	-0.002	0.037	0.028	0.001	0.027	-0.035	-0.009	-0.026	-0.004	0.013
Jun-96	0.041	0.054	-0.014	0.084	-0.007	0.091	0.058	0.030	0.028	0.048	0.012
Jul-96	0.018	-0.064	0.081	0.003	-0.022	0.025	-0.002	-0.047	0.045	-0.003	0.012
Aug-96	0.000	-0.042	0.042	0.002	-0.029	0.032	0.013	-0.011	0.024	-0.018	0.013
Sep-96	0.078	0.050	0.028	0.082	0.060	0.022	0.097	0.045	0.053	0.054	0.012
Oct-96	0.007	-0.046	0.052	-0.009	-0.062	0.053	0.006	-0.066	0.072	0.000	0.012
Nov-96	-0.013	-0.048	0.035	0.023	-0.061	0.084	0.028	-0.041	0.069	-0.018	0.012
Dec-96	0.103	0.006	0.096	0.026	-0.005	0.031	0.109	0.001	0.108	0.010	0.012
Jan-97	0.128	0.007	0.121	0.140	0.013	0.127	0.148	0.002	0.146	0.063	0.013
Feb-97	0.044	0.031	0.013	0.066	0.001	0.065	0.072	-0.004	0.076	0.033	0.012
Mar-97	0.022	0.010	0.012	0.020	0.010	0.010	0.006	0.027	-0.021	0.004	0.012
Apr-97	-0.020	0.001	-0.020	-0.026	0.038	-0.064	-0.028	0.028	-0.056	0.005	0.012
May-97	0.097	-0.023	0.120	0.088	-0.042	0.129	0.091	-0.043	0.134	0.024	0.012
Jun-97	0.067	-0.044	0.111	0.028	0.036	-0.009	0.007	-0.015	0.021	0.008	0.012
Jul-97	0.094	0.041	0.053	0.057	0.046	0.011	0.062	0.060	0.002	0.060	0.012
Aug-97	0.023	0.022	0.001	0.008	-0.004	0.012	0.004	0.008	-0.004	-0.007	0.012

Sep-97	0.047	-0.020	0.067	0.010	-0.007	0.017	-0.082	-0.003	-0.078	-0.016	0.011
Oct-97	-0.056	-0.105	0.048	-0.064	-0.088	0.024	-0.066	-0.090	0.025	-0.065	0.011
Nov-97	-0.021	-0.172	0.150	0.009	-0.162	0.171	-0.007	-0.184	0.177	-0.066	0.011
Dec-97	-0.018	-0.017	-0.001	-0.025	-0.002	-0.023	-0.026	-0.004	-0.021	-0.017	0.011
Jan-98	0.057	0.013	0.044	0.093	0.032	0.061	0.096	0.032	0.064	0.048	0.011
Feb-98	0.185	0.094	0.091	0.157	0.036	0.122	0.169	0.045	0.124	0.096	0.011
Mar-98	0.154	0.117	0.036	0.134	0.097	0.037	0.150	0.151	-0.001	0.143	0.010
Apr-98	0.101	0.081	0.020	0.056	0.080	-0.024	0.066	0.066	0.000	0.059	0.010
May-98	0.038	-0.009	0.047	0.015	-0.002	0.016	0.033	0.000	0.033	-0.011	0.010
Jun-98	0.009	-0.076	0.085	-0.087	-0.029	-0.058	-0.089	-0.030	-0.060	-0.056	0.013
Jul-98	0.092	-0.060	0.152	0.044	-0.087	0.131	0.006	-0.103	0.109	-0.048	0.015
Aug-98	-0.341	-0.182	-0.159	-0.412	-0.170	-0.242	-0.376	-0.177	-0.198	-0.229	0.015
Sep-98	0.007	0.031	-0.024	-0.011	0.039	-0.050	0.007	0.054	-0.047	0.004	0.017
Oct-98	0.014	0.287	-0.274	0.193	0.149	0.044	0.167	0.092	0.075	0.162	0.014
Nov-98	-0.011	-0.176	0.165	-0.130	-0.135	0.005	-0.087	-0.102	0.014	-0.111	0.014
Dec-98	0.061	0.100	-0.039	0.139	0.105	0.034	0.107	0.121	-0.015	0.080	0.013
Jan-99	0.002	0.026	-0.023	0.004	0.009	-0.005	0.088	-0.021	0.109	0.015	0.013
Feb-99	0.099	0.051	0.048	0.038	0.020	0.018	0.042	0.047	-0.005	0.058	0.012
Mar-99	0.039	0.053	-0.014	0.036	0.044	-0.008	0.055	0.066	-0.011	0.062	0.011
Apr-99	0.027	0.039	-0.011	0.083	0.038	0.045	0.030	0.069	-0.039	0.052	0.011
May-99	0.001	-0.083	0.084	0.034	-0.097	0.130	0.026	-0.077	0.102	-0.029	0.011
Jun-99	0.009	-0.121	0.130	0.018	-0.057	0.076	0.014	-0.054	0.068	0.002	0.010
Jul-99	0.018	-0.081	0.099	-0.031	-0.014	-0.017	-0.002	-0.046	0.045	-0.036	0.009
Aug-99	-0.048	-0.075	0.027	-0.010	-0.053	0.043	0.000	-0.045	0.045	-0.031	0.009
Sep-99	0.066	-0.085	0.151	0.054	-0.110	0.165	0.047	-0.056	0.102	0.009	0.009
Oct-99	0.024	-0.107	0.132	0.006	-0.104	0.110	-0.008	-0.068	0.060	-0.008	0.009
Nov-99	0.044	0.017	0.027	0.066	0.039	0.027	0.055	0.030	0.024	0.049	0.009
Dec-99	0.079	0.162	-0.083	0.075	0.136	-0.061	0.103	0.143	-0.040	0.107	0.009
Jan-00	0.115	0.123	-0.008	0.072	0.105	-0.033	0.092	0.095	-0.003	0.084	0.008
Feb-00	-0.036	-0.143	0.107	-0.030	-0.144	0.114	-0.037	-0.171	0.134	-0.076	0.008
Mar-00	-0.092	-0.140	0.048	-0.097	-0.124	0.027	-0.067	-0.111	0.044	-0.065	0.008
Apr-00	-0.119	-0.100	-0.019	-0.081	-0.099	0.018	-0.056	-0.066	0.010	-0.051	0.008
May-00	0.006	0.016	-0.010	-0.005	-0.049	0.043	0.007	-0.012	0.020	-0.015	0.008
Jun-00	0.020	-0.108	0.128	0.044	-0.098	0.142	0.028	-0.105	0.134	-0.012	0.008
Jul-00	0.045	0.022	0.023	-0.001	0.044	-0.045	0.021	0.014	0.007	0.001	0.008
Aug-00	0.077	0.009	0.068	0.052	0.044	0.008	0.082	0.087	-0.004	0.054	0.008

Sep-00	-0.047	-0.099	0.052	-0.030	-0.076	0.046	-0.038	-0.082	0.044	-0.041	0.008
Oct-00	0.033	-0.072	0.105	0.039	-0.084	0.123	0.011	-0.079	0.090	-0.030	0.008
Nov-00	-0.029	0.000	-0.028	0.004	-0.010	0.015	-0.037	-0.036	0.000	-0.009	0.008
Dec-00	0.031	0.040	-0.009	0.019	0.007	0.012	0.034	0.027	0.007	0.043	0.008
Jan-01	0.030	0.031	-0.001	0.041	0.095	-0.053	0.055	0.042	0.013	0.067	0.008
Feb-01	0.025	-0.053	0.078	0.024	-0.048	0.072	0.002	-0.078	0.080	-0.016	0.008
Mar-01	-0.076	-0.108	0.033	-0.066	-0.101	0.035	-0.043	-0.074	0.032	-0.055	0.008
Apr-01	0.053	0.063	-0.010	0.054	0.048	0.006	0.096	0.041	0.055	0.066	0.008
May-01	0.062	0.055	0.007	0.094	0.050	0.044	0.092	0.066	0.026	0.052	0.008
Jun-01	-0.019	-0.054	0.035	-0.044	-0.047	0.002	-0.035	-0.065	0.030	-0.011	0.008
Jul-01	0.044	0.031	0.013	0.016	0.063	-0.047	0.029	0.065	-0.036	0.046	0.008
Aug-01	0.023	0.020	0.003	0.029	-0.009	0.038	0.051	-0.040	0.091	0.031	0.007
Sep-01	-0.047	-0.074	0.027	-0.013	-0.112	0.099	-0.065	-0.109	0.044	-0.045	0.007
Oct-01	0.011	0.019	-0.008	0.008	0.005	0.003	0.025	0.022	0.003	0.029	0.007
Nov-01	0.069	0.180	-0.110	0.085	0.133	-0.048	0.151	0.175	-0.023	0.103	0.007
Dec-01	0.108	0.041	0.068	0.042	0.104	-0.062	0.052	0.041	0.011	0.056	0.008
Jan-02	0.005	-0.126	0.131	-0.004	-0.094	0.089	0.026	-0.132	0.159	-0.012	0.008
Feb-02	-0.010	0.023	-0.034	-0.015	-0.006	-0.009	0.004	0.020	-0.015	0.004	0.008
Mar-02	0.012	0.048	-0.036	0.018	0.042	-0.024	0.001	0.050	-0.049	0.024	0.008
Apr-02	0.092	0.142	-0.050	0.149	0.170	-0.021	0.142	0.099	0.043	0.089	0.008
May-02	0.053	0.125	-0.072	0.026	0.083	-0.058	0.051	0.127	-0.077	0.061	0.009
Jun-02	-0.074	-0.047	-0.027	-0.028	-0.064	0.036	-0.062	-0.085	0.023	-0.022	0.009
Jul-02	-0.056	-0.027	-0.029	-0.031	-0.036	0.005	-0.032	-0.055	0.023	-0.032	0.009
Aug-02	0.029	0.014	0.015	0.081	-0.013	0.094	0.094	-0.019	0.113	0.032	0.009
Sep-02	-0.012	-0.037	0.024	-0.004	-0.044	0.040	0.015	-0.043	0.058	0.014	0.010
Oct-02	0.100	0.087	0.014	0.066	0.021	0.045	0.066	0.008	0.057	0.068	0.010
Nov-02	0.038	0.033	0.005	0.091	-0.004	0.095	0.051	-0.002	0.053	0.059	0.010
Dec-02	0.004	-0.016	0.019	-0.018	-0.020	0.002	0.018	-0.052	0.070	0.012	0.010
Jan-03	-0.013	-0.047	0.035	0.024	0.003	0.022	0.041	-0.017	0.058	-0.017	0.010
Feb-03	-0.047	-0.050	0.003	-0.019	-0.047	0.027	-0.052	-0.037	-0.015	-0.035	0.010
Mar-03	-0.034	-0.062	0.029	-0.034	-0.045	0.011	-0.043	-0.040	-0.002	-0.008	0.010
Apr-03	0.033	0.041	-0.007	0.011	0.014	-0.003	0.020	0.031	-0.011	0.013	0.010
May-03	0.038	0.221	-0.183	0.073	0.213	-0.140	0.074	0.209	-0.135	0.104	0.010
Jun-03	-0.002	-0.022	0.021	-0.008	-0.046	0.038	-0.044	-0.049	0.006	0.008	0.009
Jul-03	0.132	0.049	0.083	0.052	0.117	-0.065	0.107	0.109	-0.002	0.062	0.009
Aug-03	0.051	0.059	-0.007	0.061	0.043	0.018	0.062	0.046	0.016	0.066	0.008

Sep-03	0.035	0.010	0.026	0.041	-0.055	0.097	0.041	-0.041	0.082	0.015	0.007
Oct-03	0.152	0.103	0.049	0.129	0.122	0.007	0.096	0.050	0.046	0.108	0.006
Nov-03	0.042	0.030	0.012	0.009	-0.006	0.014	0.050	-0.013	0.063	0.022	0.006
Dec-03	0.080	0.065	0.015	0.075	0.042	0.032	0.083	0.039	0.045	0.061	0.006
Jan-04	0.036	0.073	-0.037	0.073	0.064	0.009	0.036	0.075	-0.039	0.042	0.006
Feb-04	0.029	0.036	-0.007	0.038	0.052	-0.013	0.011	0.037	-0.026	0.019	0.006
Mar-04	0.042	0.065	-0.023	0.003	0.088	-0.085	0.008	0.038	-0.031	0.032	0.006
Apr-04	-0.059	-0.021	-0.038	-0.016	-0.018	0.001	-0.055	-0.044	-0.010	-0.007	0.006
May-04	-0.029	0.007	-0.036	-0.049	0.015	-0.064	-0.029	0.068	-0.097	-0.001	0.006
Jun-04	0.012	-0.065	0.076	0.010	-0.003	0.013	0.021	-0.053	0.074	0.002	0.006
Jul-04	0.051	0.095	-0.044	0.089	0.016	0.073	0.114	0.004	0.110	0.045	0.006
Aug-04	0.047	-0.004	0.051	0.072	0.008	0.064	0.088	-0.011	0.099	0.058	0.006
Sep-04	0.068	0.051	0.018	0.061	0.037	0.024	0.085	0.048	0.037	0.069	0.006
Oct-04	0.075	0.110	-0.035	0.090	0.100	-0.010	0.102	0.140	-0.038	0.101	0.006
Nov-04	0.073	0.048	0.025	0.081	0.060	0.021	0.091	0.071	0.021	0.053	0.006
Dec-04	0.052	0.022	0.030	0.057	-0.014	0.071	0.084	0.037	0.047	0.050	0.006
Jan-05	0.030	0.027	0.002	0.051	0.002	0.049	0.044	-0.014	0.057	0.019	0.006
Feb-05	0.026	0.003	0.023	0.022	0.032	-0.010	0.023	0.002	0.022	0.042	0.006
Mar-05	0.008	0.090	-0.081	-0.018	0.107	-0.126	-0.007	0.076	-0.083	-0.009	0.006
Apr-05	-0.009	-0.062	0.054	0.003	-0.057	0.060	0.012	-0.077	0.089	0.017	0.005
May-05	0.097	0.115	-0.017	0.070	0.159	-0.090	0.060	0.134	-0.073	0.058	0.005
Jun-05	0.061	0.001	0.061	0.037	0.050	-0.013	0.040	0.054	-0.014	0.030	0.005
Jul-05	0.157	0.076	0.081	0.153	0.099	0.054	0.125	0.109	0.016	0.101	0.005
Aug-05	0.063	0.011	0.052	0.048	0.041	0.007	0.046	0.041	0.005	0.044	0.005
Sep-05	0.033	-0.005	0.038	0.038	-0.014	0.052	0.063	0.030	0.033	0.027	0.005
Oct-05	-0.022	0.023	-0.045	-0.004	0.005	-0.009	0.006	-0.026	0.032	0.020	0.005
Nov-05	0.030	0.069	-0.039	0.026	0.062	-0.036	0.041	0.086	-0.045	0.043	0.006
Dec-05	0.119	0.038	0.081	0.095	0.094	0.002	0.106	0.080	0.026	0.082	0.005
Jan-06	0.081	0.017	0.065	0.103	0.036	0.067	0.113	-0.024	0.136	0.080	0.005
Feb-06	-0.017	0.005	-0.022	0.033	-0.015	0.048	0.041	-0.019	0.060	0.002	0.005
Mar-06	0.102	0.026	0.077	0.100	0.018	0.083	0.108	0.013	0.095	0.063	0.005
Apr-06	0.026	0.026	0.000	0.038	0.025	0.013	0.020	0.036	-0.015	0.031	0.005
May-06	-0.040	-0.005	-0.035	-0.038	-0.002	-0.036	-0.023	-0.022	-0.001	-0.052	0.006
Jun-06	0.010	-0.011	0.021	0.041	-0.004	0.045	0.012	0.013	-0.001	-0.006	0.006
Jul-06	0.004	0.004	0.000	0.001	-0.011	0.013	0.018	-0.006	0.023	0.005	0.006
Aug-06	0.012	0.073	-0.061	0.035	0.051	-0.015	0.058	0.046	0.011	0.058	0.006

Sep-06	0.070	0.025	0.045	0.048	0.021	0.027	-0.008	0.049	-0.057	0.032	0.006
Oct-06	0.103	0.088	0.015	0.137	0.083	0.054	0.137	0.026	0.112	0.083	0.007
Nov-06	0.020	0.022	-0.003	0.012	0.023	-0.011	-0.002	0.027	-0.029	0.017	0.007
Dec-06	0.046	0.024	0.022	0.051	0.030	0.021	0.051	0.002	0.049	0.035	0.007
Jan-07	0.110	0.063	0.046	0.086	0.072	0.014	0.090	0.071	0.019	0.111	0.007
Feb-07	0.033	-0.004	0.037	0.047	0.012	0.035	0.012	0.020	-0.008	-0.001	0.007
Mar-07	0.155	0.048	0.107	0.189	0.039	0.149	0.113	0.055	0.058	0.082	0.007
Apr-07	0.114	0.062	0.051	0.086	0.051	0.035	0.086	0.039	0.046	0.117	0.007
May-07	0.030	-0.013	0.043	0.013	0.016	-0.003	0.017	0.017	0.001	0.018	0.007
Jun-07	-0.017	-0.006	-0.011	0.001	-0.003	0.005	-0.007	-0.026	0.019	-0.006	0.007
Jul-07	-0.051	-0.054	0.003	-0.025	-0.070	0.046	-0.038	-0.070	0.032	-0.042	0.007
Aug-07	0.044	0.010	0.034	0.074	0.028	0.046	0.078	0.041	0.037	0.038	0.007
Sep-07	0.052	0.018	0.034	0.067	0.004	0.063	0.085	0.000	0.085	0.044	0.008
Oct-07	0.052	-0.003	0.056	0.031	-0.015	0.046	0.069	-0.008	0.077	0.022	0.008
Nov-07	-0.028	-0.043	0.015	-0.020	-0.048	0.027	-0.019	-0.022	0.003	-0.034	0.008
Dec-07	-0.008	-0.042	0.035	0.011	0.009	0.002	0.002	0.007	-0.005	-0.016	0.008
Jan-08	-0.092	-0.078	-0.014	-0.078	-0.066	-0.012	-0.087	-0.058	-0.029	-0.109	0.008
Feb-08	0.082	0.027	0.055	0.099	-0.026	0.125	0.130	-0.007	0.137	0.021	0.008
Mar-08	-0.031	-0.037	0.006	-0.027	-0.012	-0.015	-0.015	-0.008	-0.006	-0.001	0.008
Apr-08	0.030	0.028	0.002	0.056	0.007	0.049	0.026	-0.013	0.039	-0.007	0.008
May-08	0.009	-0.106	0.116	-0.004	-0.066	0.062	0.002	-0.070	0.072	-0.044	0.008
Jun-08	-0.132	-0.137	0.006	-0.098	-0.144	0.046	-0.102	-0.132	0.030	-0.112	0.009
Jul-08	-0.069	0.017	-0.085	-0.079	0.030	-0.109	-0.105	0.004	-0.110	0.020	0.009
Aug-08	-0.001	-0.045	0.044	-0.008	-0.041	0.033	-0.009	-0.072	0.062	0.009	0.009
Sep-08	-0.099	-0.145	0.046	-0.165	-0.124	-0.041	-0.172	-0.119	-0.053	-0.092	0.009
Oct-08	-0.051	-0.050	-0.001	-0.111	-0.044	-0.068	-0.136	-0.027	-0.109	-0.079	0.009
Nov-08	-0.007	-0.056	0.049	-0.087	-0.007	-0.080	-0.074	0.015	-0.089	-0.034	0.009
Dec-08	0.052	0.148	-0.096	0.129	0.013	0.116	0.058	0.022	0.036	0.060	0.008
Jan-09	-0.047	-0.034	-0.014	-0.057	-0.031	-0.026	-0.033	-0.077	0.043	-0.038	0.008
Feb-09	-0.023	-0.137	0.115	-0.115	-0.100	-0.015	-0.078	-0.149	0.071	-0.102	0.007
Mar-09	-0.013	0.099	-0.113	0.051	0.066	-0.014	0.071	0.060	0.011	0.052	0.007
Apr-09	0.057	0.074	-0.016	0.032	0.069	-0.037	0.037	0.077	-0.041	0.052	0.007
May-09	0.055	0.071	-0.015	0.045	0.159	-0.114	0.055	0.149	-0.094	0.060	0.006
Jun-09	-0.049	-0.026	-0.023	-0.011	-0.053	0.042	0.002	-0.026	0.029	-0.008	0.006
Jul-09	0.110	0.109	0.001	0.074	0.150	-0.076	0.064	0.188	-0.124	0.085	0.006
Aug-09	0.006	0.041	-0.036	0.009	0.070	-0.061	0.028	0.063	-0.035	0.040	0.006

Sep-09	0.053	0.018	0.035	0.046	0.030	0.016	0.054	0.036	0.018	0.039	0.006
Oct-09	-0.068	-0.023	-0.045	-0.017	-0.100	0.083	-0.022	-0.105	0.083	-0.012	0.006
Nov-09	0.025	0.011	0.013	0.028	-0.008	0.035	0.037	-0.013	0.050	0.005	0.006
Dec-09	0.024	0.041	-0.017	0.074	0.008	0.067	0.052	0.043	0.009	0.025	0.006

TABLE A.2: Durbin's alternative statistic - H_0: No serial correlation

Durbin's alternative statistic is a measure of the existence of serial correlation in time series data. H_0 is no serial correlation, and this hypothesis is true at the probability P. Our table reports this probability quoted per strategy and portfolio with up to 6 lags.

	3/3			**6/6**			**12/3**		
Lags	Winner	Loser	Winner-Loser	Winner	Loser	Winner-Loser	Winner	Loser	Winner-Loser
1	0.34	0.59	0.73	0.58	0.50	0.77	0.28	0.89	0.46
2	0.32	0.53	0.88	0.85	0.65	0.94	0.17	0.19	0.62
3	0.52	0.63	0.92	0.94	0.82	0.96	0.32	0.34	0.79
4	0.68	0.73	0.95	0.87	0.64	0.86	0.46	0.50	0.90
5	0.43	0.84	0.90	0.75	0.32	0.88	0.36	0.60	0.84
6	0.56	0.84	0.95	0.81	0.44	0.94	0.48	0.69	0.84

TABLE A.3: Beta statistics with Newey-West standard errors

In every month T, all stocks in our final sample are ranked (worst to best) by their return during the previous months J, that is their performance during the period T-J to T. The stocks in the first decile form the loser-portfolio while the winner-portfolio contains the tenth decile of companies ranked by stock market performance. The zero-cost portfolio is formed out of the winner portfolio minus the loser portfolio. All portfolios are equal-weighted. To avoid issues associated with lagged reaction effects, price pressure and bid-ask spread we leave out one week between the portfolio formation period and the holding period. Each portfolio is then held for K months and consists of K overlapping portfolios.

Newey-West standard errors are used to prevent serial correlation. Beta in this table is the Newey-West robust exposure to systematic risk.

Strategy		**Winner**	**Loser**	**Winner-Loser**
3/3	Beta	0.9430	1.2191	-0.2760
	(P-value)	*(0.000)*	*(0.000)*	*(0.0029)*
6/6	Beta	1.1041	1.0990	0.0051
	(P-value)	*(0.000)*	*(0.000)*	*(0.977)*
12/3	Beta	1.1110	1.1061	0.0049
	(P-value)	*(0.000)*	*(0.000)*	*(0.976)*

TABLE A.4: Alpha statistics with Newey-West standard errors

In every month T, all stocks in our final sample are ranked (worst to best) by their return during the previous months J, that is their performance during the period T-J to T. The stocks in the first decile form the loser-portfolio while the winner-portfolio contains the tenth decile of companies ranked by stock market performance. The zero-cost portfolio is formed out of the winner portfolio minus the loser portfolio. All portfolios are equally weighted. To avoid issues associated with lagged reaction effects, price pressure and bid-ask spread we leave out one week between the portfolio formation period and the holding period. Each portfolio is then held for K months and consists of K overlapping portfolios.

Newey-West standard errors are used to prevent serial correlation. Alpha in this table is the Newey-West robust abnormal return.

Strategy		Winner	Loser	Winner-Loser
3/3	Alpha	0.0086	-0.0132	0.0218
	(P-value)	*(0.003)*	*(0.000)*	*(0.000)*
6/6	Alpha	0.0071	-0.0115	0.0186
	(P-value)	*(0.022)*	*(0.001)*	*(0.001)*
12/3	Alpha	0.0086	-0.0134	0.0220
	(P-value)	*(0.007)*	*(0.000)*	*(0.000)*

TABLE A.5: Average trading costs per month

We calculate average trading costs using the measurement for one way equity trading costs in the South African market provided by Domowitz, Glen and Madhavan (2000). The measurement account for both implicit and explicit costs of trading and is estimated to 81 basis point for 100 percent portfolio turnover.

Strategy	*Average*	Winner	Loser
3/3	Trading costs	0.0046	0.0043
	(Volatility)	*(0.00038)*	*(0.00046)*
6/6	Trading costs	0.0023	0.0022
	(Volatility)	*(0.00022)*	*(0.00023)*
12/3	Trading costs	0.0024	0.0022
	(Volatility)	*(0.00053)*	*(0.00046)*

TABLE A.6: Average turnover

Portfolio turnover is calculated as the number of new stocks divided by the total number of stocks in the beginning of the month. Averages are calculated over the whole sample period.

Strategy	Winner	Loser
3/3	0.286	0.267
6/6	0.141	0.133
12/3	0.147	0.139

TABLE A.7: Average returns after trading costs

Each month, portfolio trading costs are subtracted from monthly returns in order to calculate the average returns adjusted for trading costs. We use the measurement for one way equity trading costs provided by Domowitz, Glen and Madhavan (2000).

Strategy	Winner	Loser	W-L
3/3	0.0129	0.0026	0.0103
6/6	0.0153	0.0010	0.0143
12/3	0.0167	-0.0006	0.0172