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ABSTRACT

This article investigates the influence that the market state (bull versus bear) upon the effects of equity characteristics such as size, value and momentum. We find that the definition of positive and negative markets has a substantial effect on the results with shorter-term definitions proving more useful. Size effects are largely confined to positive market states whilst value, as defined by dividend yield, has defensive characteristics and outperforms during negative periods. Momentum, in contrast, provides positive excess returns across both market states. This persists when size and value are controlled for in all but the very smallest of stocks. We show that portfolio performance can be improved by investing tactically using market state analysis.

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Identification of factors affecting individual equity performance has been a source of much interest in the finance literature for many years. Many characteristics have been linked to abnormal returns performance. Firstly, Banz (1981) observed a size effect whereby small firms have historically outperformed their larger counterparts. Value investing is another anomaly whether measured in terms of price-to-book (Fama and French, 1992), dividend yield (Morgan and Thomas, 1998) or price-to-cashflow (Lakonishok et al, 1994), whereby cheap stocks on these measures have delivered excess returns to investors. Third, the existence of a momentum effect (e.g. Jegadeesh and Titman, 1993), where stocks with the strongest short-term performance deliver higher future returns has been widely accepted. Theories about why momentum investing may be profitable include Daniel et al (1998), who posit that investors suffer from overconfidence and self-attribution bias which leads in turn to overvaluation and Hong and Stein (1999) who suggest that information is absorbed gradually by the market and that this leads to an under-reaction to fundamentally changing news.

Most of the prior research on these effects has been based on lengthy time periods, that have encompassed both strong bull and bear markets. More recent papers have examined whether momentum profits are consistent across market states, i.e. whether the market is in a bull or bear phase. Cooper et al (2004) define the market state as being "up" when the preceding 3-year return has been positive and as "down" if the reverse is true. They find that momentum profits are only identified when the market state is positive and that these profits are higher when the lagged return is greater. Huang (2006) tests the importance of the market state in explaining momentum profits using seventeen international indexes. The findings confirm Cooper et al (2004) that momentum profits are largely attributable to only positive markets using a lagged return definition. It is also observed that a market state definition based on lagged global industrial production growth gives rise to momentum profits in both up and down markets with the suggestion that a better market classification metric may improve results still further.

Evidence for the importance of the market state has also been provided recently by Faber (2007, 2009). Using a variety of asset classes, including stocks, bonds and commodities, it is demonstrated that risk-adjusted returns are considerably more favourable for investors when the market is trending higher rather than lower. The trend is defined by the price relative to the 10-month simple moving average. When prices are above the moving average, the market state is defined as "up" and this is shown to produce far improved risk-adjusted returns compared to "down" markets when the price is trading below the moving average. A trading rule is developed whereby investors are long the market when the trend is "up" and switch to cash when the trend is "down". This approach offered a significant improvement on traditional buy-and-hold investing.

The aim of this paper is to investigate how the market state affects the behaviour of a variety of different equity investment factors including size, dividend yield and momentum perform in different market states. In addition, we consider how the choice of definition of market state influences the results and study which method offers the best distinction between bull and bear market phases. Using a market state approach, we also investigate how the equity factors interact with each other. Both Asness (1997) and ap Gwilym et al (2009) have observed that momentum effects have been greater amongst stocks that appear expensive on a value basis whilst value effects have been more pronounced in low momentum equities. Finally, we suggest some investment approaches that may be useful for investors looking to allocate tactically towards equities.

We find that:

(i) The choice of definition of the market state has a considerable influence upon the results. If the rationale of a market state metric is to produce a clear difference between the market behaviour in terms of returns then we conclude that the 10-month moving average is superior to the lagged market return, especially so when the lagged return is calculated over a multi-year period.

(ii) Size effects are largely contained to positive market states. The exception to this is for the very smallest of firms where the evidence is unclear.

(iii) Dividend yield outperforms during negative market states. Switching into value stocks during bear markets may have some tactical "defensive" advantage.

(iv) Momentum profits are observed to be robust across BOTH market states. These remain when size and value are controlled for in all but the smallest market capitalization stocks. This contrasts with Cooper et al (2004) and Huang (2006) who observe that momentum profits are largely confined to just positive market states.

(v) Tactical methods using market timing based on the current state can give rise to improved performance relative to buy-and-hold for long only investors.

Data and Methodology

This study uses monthly data for the UK market for the period of 1980-2006. All values are abstracted from the London Share Price Database (LSPD). Any firm with a complete set of data is included. For a firm to qualify it must have market capitalization and dividend data along with at least twelve months of price data to facilitate momentum and yield calculations. Dividend yield is calculated on a rolling 12-month historic basis with splits and consolidations accounted for. The momentum variable used is PAST (2,12), consistent with Asness (1997), whereby the historical return of the previous 12 months is calculated excluding the most recent month. This avoids any contamination of the variable through picking up a "bid-offer bounce".

Each month a calculation is made as to whether the market is in a positive (bull) or negative (bear) state. Initially, this is achieved by following the method of Faber (2007, 2009) whereby if the price of the market at the beginning of the month, as determined by the FTSE All-Share Index, is in excess of the 10-month moving average (10MA) then it is determined to be a bull market for the remainder of that month. If the price is below the average then it is

categorized as a bear market. Portfolios based on size, dividend yield and PAST (2,12) are also formed monthly on a quintile basis. In the case of zero-dividend stocks, these are placed in their own group as some evidence points to these firms having their own distinct properties (see Keim, 1985, and Morgan and Thomas, 1998). To examine the interaction between effects sub-portfolios are formed numbering either 25 or 30 (depending on whether dividend yield is one of the sorts) by combining two relative rankings for each stock.

Empirical Results

Table 1 reports summary statistics for the three variables, size, dividend yield and PAST (2,12) using a single sort. All returns displayed are compound monthly averages calculated on an equally weighted basis within each portfolio. Where a distinction is made between bull and bear markets, we use the 10MA rule described earlier. For the market size sort we observe the "small firm" effect whereby the lowest quintile has the highest average monthly return (2.45%) when no distinction is made for the market state (transaction costs in terms of bid-ask spread would make this much harder to capture realistically). This group also has the lowest momentum and smallest dividend yield; characteristics that would not typically be associated with positive excess returns. In bull market periods there is a generally negative relationship between size and return, however, in bear phases the largest firms offer greater returns. The very smallest firms continue to perform better than the remaining three quintiles.

The summary statistics for the dividend yield sort demonstrate the "U-shaped" profile observed by Keim (1985) and Morgan and Thomas (1998). In positive market phases we report that non-paying firms do particularly well with the highest yielding firms also outperforming the remaining quintiles. In bear periods there is a notable change with zero-dividend firms losing an average 0.79% per month compared to a gain of 2.36% in positive months. High yield firms also see a comparatively large variation in return across market states. Perhaps this reflects an aversion to speculative firms during bear periods with zero-

dividend stocks being seen as riskier businesses that may be loss-making and high-yielders potentially being forced to cut dividends if economic conditions are contemporaneously poor.

Finally, looking at the PAST (2,12) sort we notice that in all markets there is the positive relationship between momentum and returns with the highest momentum portfolio generating approximately 1% per month more than the lowest. In bull months this spread remains positive but is reduced to 0.9% per month. During bear phases, however, the spread actually increases to 1.45%. The interesting preliminary finding is thus that momentum profits, unlike size and value, appear to be fairly consistent across all market states even though the overall level of return in down markets is considerably lower to individual portfolios.

To further examine how stock variables behave in different trading environments we now consider alternative definitions of the market state. Faber (2007, 2009) has previously demonstrated that the 10MA is a satisfactory means of categorizing market states. Cooper et al (2004) and Huang (2006) use a lagged market return of either 1, 2 or 3 years to determine the state, with a positive return equating to an "up" market and a negative return signalling a "down" market. Table 2 reports the returns profile for our size, dividend yield and PAST (2,12) sorts using the alternative lagged return methodology alongside the initial 10MA results. Firstly, we note the relative proportions of up and down months. Using the 10MA method approximately 77% of months during the study period were considered as being positive markets states. The lagged return method saw a notably higher proportion of bull months, particularly when the return period lengthened. Given that equity markets have generally risen in the longer-term, it does suggest that if too long a period is used for it will be a weak discriminator between market states.

We propose that the most suitable definition of market states should be one which results in considerable differences in the average returns during the different types of market, i.e. the average return in positive (defined as "bull") states should be higher than that negative

(defined as "bear") states. If this cannot be achieved then any market state analysis is questionable in its nature. That said, it is equally unrealistic to expect a simple method to accurately pick market tops and bottoms without the use of hindsight. To this extent it perfectly possible for a "down" market state to still have a positive return. For example, the stock market price index may be trending mildly lower but the dividend yield is large enough to more than compensate and still provide a positive return. Also, with trend-following methods it is very feasible that "whipsawing" takes place where, for example, the price just falls below the moving average creating a "down" market only to subsequently rally higher back above the average thus having delivered a "false" trading signal (see Kaufman, 1999, for more on trend following methods). This too can create positive aggregate returns for "down" period signals and significantly curtail positive returns attributable to "up" signals.

We observe that the 2 and 3-year lagged returns do not appear to be good descriptors of the market environment. In none of the thirty-two return sorts for these cases were negative returns achieved in bear markets. Furthermore the difference between comparable returns in bull and bear periods is much smaller than under the shorter period definitions. The 1-year lagged return does a better job of describing the market state. Compared to the 2-year return, 15 out of the 16 return groups are higher during bull market periods and lower during bear market periods (the only exception being the largest size quintile). We find that the 10MA method is an improvement still further though on the 1-year lagged return. Again, 15 out of the 16 return groups are higher in bull markets using the moving average approach and hence does a better job of discriminating between market state. We thus suggest that the choice of definition for describing market conditions is important in any market state investigation.

Previous work by Asness (1997) and ap Gwilym et al (2009) has studied how value and momentum strategies interact. The value effect was found to be less powerful amongst high momentum stocks when returns were calculated on a market-capitalization basis. Thus far

we have observed that the size effect (i.e. small firms) is prevalent during bull markets, the value effect is more pronounced during bear markets (as would be expected) and momentum is fairly consistent across both environments. We now combine sorts on two variables to examine how the interactions vary across markets states to determine which, if any, is the dominant variable.

Table 3 displays the results of combinations of size and dividend yield. Firstly, in bull markets the size effect is observed across all dividend yield quartiles with small stocks significantly outperforming their large peers. Value effects are hard to come by with the only fairly substantial results being within the smallest size quintile where zero-dividend firms do particularly well compared to high yielders. The results change dramatically, however, when one looks at the bear market results. Large stocks outperform small in four of the six yield categories with the two negative results being statistically insignificant. Non-dividend payers do particularly poorly in bear markets with high yielding firms offering considerably greater returns in most of the size quintiles. High yielders also outperform low (but positive) yielding firms although this is largely confined to the largest and smallest size quintiles.

Table 4 reports the results of the interaction between dividend yield and momentum. The first point of note is that momentum generates only a small positive excess return (as defined by Q5-Q1) in the zero-dividend category during both bull and bear markets. Previously, ap Gwilym et al (2009) have observed that momentum is particularly effective amongst low value firms, however, their results were reported on a value-weighted basis rather than the equally-weighted basis used here. The inference is that momentum is less effective amongst the smallest of stocks (of which a large proportion reside in the zero-dividend category). Across the remaining yield quintiles momentum is very effective at generating a positive excess returns during bull markets. Positive returns of a similar magnitude are also observed during bear markets based on the difference between Q5 and Q1. Across momentum quintiles, in positive markets zero-dividend stocks again often

outperform high yield firms but it is largely contained to those low momentum portfolios. In negative markets investors would have been better off having avoided zero-dividend stocks irrespective of the momentum. The higher excess returns to value in bear markets were found in both the highest and lowest momentum firms, although both Q5-Q0 and Q5-Q1 were positive in every instance. We therefore posit that any outperformance to value strategies may well be a result of better capital preservation in bear markets rather than dramatic outperformance in positive market states. Value appears to be a "defensive" approach to stock selection.

Table 5 displays the results of the interactions between size and momentum. Across both bull and bear markets, momentum (as measured by Q5-Q1) is negative in the smallest quintile. This confirms the observation made from Table 4 that momentum failed to be effective in the zero-dividend category on an equally-weighted basis but was significant when reported on a value-weighted basis. Amongst the remaining size quintiles we observe that momentum is a strongly significant effect in both positive and negative markets, with excess returns to Q5-Q1 in many instances being greater than 2% per month. When momentum is controlled during bull markets there is a small firm size effect in all cases. In bear markets this is reversed and becomes positive with the exception of the lowest market quintile.

Investment Strategy

We have observed thus far how the effects of size, value and momentum have varied according to market states. To extend this we consider how this might be incorporated into investment strategy. The results from the previous sections suggest that in bull markets one would prefer to hold small stocks. In bear markets high value is preferable to zero-dividend firms. Momentum is a positive contributor towards returns in both market states. Realistically, it is much harder to trade profitably within the small-cap space as transaction costs are high and it can be difficult to trade meaningful amounts of stock without price

distortion. In light of this, we only focus on stocks that are in the largest three size quintiles in this section.

Table 6 displays the results of a number of different investment strategies. As previously, all returns are calculated on an equally-weighted. The notation used to denote portfolios is "S" for size, "D" for dividend yield and "M" for momentum with the numerical values indicating the portfolio quintile consistent with the values used in Tables 1-5. Combinations of portfolios indicate a double sort, e.g. S3M1 is the Q3 size quintile, Q1 momentum quintile sort. The first panel of Table 6 shows the results of standard strategies where an approach is applied across both positive and negative market states. It is observed that the compound annual growth rate (CAGR) decreases from S3 to S5 albeit with an accompanying small decline in volatility. The effects of momentum are shown in the differences between portfolios containing M1 and M5. For example, the difference in CAGR between S3M1 and S3M5 is over 30% and also the highest momentum portfolio has lower volatility. The advantage to yield portfolios is more dubious with S4D1 having a higher Sharpe ratio than S4D5 although the former also exhibits a higher maximum drawdown.

The second panel in Table 6 reports the results of using tactical strategies based on market states. If at the beginning of a month the trend is determined as positive based on the 10MA then the "up" portfolio is held, if the trend is negative then the "down" portfolio is held. The first set of tactical portfolios include holding S3, S4 and S5 and switching into cash in down markets, consistent with the approach of Faber (2007, 2009). The use of timing improves the CAGR compared to the buy-and-hold portfolios along with both reduced volatility and drawdowns. Similar improvements are also noted for S3M5 and S4M5 although the tactical approach to S5M5 is inferior to the standard method. The final three portfolios show how switching into a more defensive portfolio, by either increasing size or value in down markets, compares to switching into cash. This approach adds to the CAGR compared to cash but it comes at the expense of added volatility and drawdown. Typically there is little to choose

between the Sharpe ratios. The advantage to switching into S5M5 or S5D5 rather than cash would arise for the long-only investor who has a remit for remaining fully invested and thus is restricted from holding 100% cash.

The final panels of Table 6 show the results of hedged strategies where no timing is employed but rather there is just a consistent approach to forming long and short portfolios. Given that the proceeds of long and short positions should cancel out, it is assumed that the return each month is equal to the sum of the long and short positions plus the monthly return on short-term UK Treasury bills. The first set of portfolios are 100% gross exposure (i.e. 50% long, 50% short) to provide something with comparable leverage to the long-only portfolios (see Lo and Patel, 2007 for leverage changes from adding short positions). These hedged portfolios offer lower comparable returns than both standard and tactical strategies (i.e. those containing S3M5, S4M5 and S5M5) but the volatility is reduced very substantially. Overall this leads to improved Sharpe ratios and drawdowns in all cases. To get a higher CAGR than standard or tactical approaches one needs to increase the gross exposure. If 200% gross exposure (i.e. 100% long, 100% short) is undertaken then the return increases but so too naturally does the volatility and the drawdown. There is little difference in the Sharpe ratios compared to the 100% exposure portfolios. The suggestion from this sample of portfolios and strategies is that hedged portfolios probably offer the most favourable outcome. Not all investors are able to pursue a short strategy and in these cases tactical strategies involving either going to 100% cash or alternatively moving to a more defensive allocation based on size and value characteristics give a generally improved performance.

Conclusion

This article investigates how the effects of factors such as size, value and momentum vary across market states in the UK market. The smallest stocks perform particularly well during bull markets but this outperformance relative to large firms disappears in bear markets. Value is found to perform better in bear markets (as would be expected). Non-dividend

paying stocks exhibit high returns in positive market states but perform poorly in down markets. We suggest that value may outperform in the long-run because of its defensive characteristics providing a means of improved capital preservation in bear markets. Momentum is observed to perform fairly consistently across both up and down markets. The exception is amongst the very smallest stocks where momentum does not produce favourable results for investors. We also report that the choice of definition for explaining the market state considerably affects the overall results. Previous studies have used lagged broad market returns, sometimes up to 3-years long. We find that this method is inferior compared to the 10-month moving average rule implemented by Faber (2007, 2009). The latter produces a greater difference between the two market states and provides a more balanced number of bull and bear months.

Finally, we consider how the analysis of market states can be implemented in portfolio management. We observe that tactical switching to either cash or portfolios with more defensive characteristics can improve the risk-adjusted performance of standard strategies. The most favourable results for investors, however, are achieved from hedged portfolios. For investors who are restricted from going short or moving entirely into cash instruments, the tactical use of defensive portfolios based on market state analysis can offer some improved performance.

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Table 1

Summary Statistics for Size, Dividend Yield and Momentum Across Market States

		All Markets			Bull Market	Bear Market
Portfolio	Size (Median, £m)	Dividend Yield (Median, %)	PAST (2,12) (Median, %)	Equally-Weighted Return per Month (%)	Equally-Weighted Return per Month (%)	Equally-Weighted Return per Month (%)
Size						
Q1 (Low)	3	2.18	-0.37	2.45	3.02	0.55
Q2	12	3.31	0.41	1.11	1.67	-0.75
Q3	29	3.10	1.00	0.99	1.47	-0.60
Q4	81	3.08	1.39	1.14	1.48	0.01
Q5 (High)	510	3.50	1.18	1.54	1.28	1.07
Div. Yield						
Zero Div	10	0	0.00	1.63	2.36	-0.79
Q1 (Low)	49	1.45	1.77	1.21	1.65	-0.23
Q2	66	2.89	1.64	1.25	1.59	0.12
Q3	69	4.14	1.36	1.30	1.54	0.53
Q4	49	5.66	0.87	1.38	1.62	0.59
Q5 (High)	24	9.02	0.14	1.49	1.85	0.31
PAST (2,12)						
Q1 (Low)	11	3.04	-3.41	1.00	1.52	-0.71
Q2	30	3.72	-0.44	1.05	1.51	-0.50
Q3	48	3.77	0.95	1.21	1.58	-0.03
Q4	54	3.47	2.16	1.52	1.87	0.35
Q5 (High)	39	2.48	4.33	2.02	2.41	0.74

Table 2

Effect of Choice of Market State Definition on Returns to Equity Factors

	10-month Moving Average		1-year Market Return		2-year Market Return		3-year Market Return	
	Bull Market	Bear Market	Bull Market	Bear Market	Bull Market	Bear Market	Bull Market	Bear Market
No. of	249	74	268	55	285	38	290	33
Size								
Q1 (Low)	3.02	0.55	2.67	1.38	2.34	3.26	2.33	3.48
Q2	1.67	-0.75	1.39	-0.24	1.16	0.73	1.13	0.91
Q3	1.47	-0.60	1.24	-0.21	1.08	0.34	1.03	0.69
Q4	1.48	0.01	1.31	0.30	1.23	0.49	1.19	0.70
Q5 (High)	1.28	1.07	1.32	0.81	1.36	0.31	1.31	0.52
Div. Yield								
Zero Div	2.36	-0.79	2.01	-0.24	1.72	0.91	1.67	1.22
Q1 (Low)	1.65	-0.23	1.49	-0.11	1.38	0.01	1.32	0.28
Q2	1.59	0.12	1.45	0.31	1.35	0.54	1.32	0.65
Q3	1.54	0.53	1.42	0.76	1.36	0.84	1.35	0.89
Q4	1.62	0.59	1.47	0.95	1.38	1.39	1.38	1.41
Q5 (High)	1.85	0.31	1.64	0.75	1.52	1.29	1.48	1.57
PAST (2,12)								
Q1 (Low)	1.52	-0.71	1.25	-0.17	0.99	1.08	0.96	1.42
Q2	1.51	-0.50	1.34	-0.38	1.16	0.19	1.11	0.50
Q3	1.58	-0.03	1.44	0.10	1.34	0.21	1.29	0.52
Q4	1.87	0.35	1.67	0.79	1.58	1.09	1.56	1.17
Q5 (High)	2.41	0.74	2.18	1.25	2.06	1.75	2.04	1.89

Table 3

Interactions Between Dividend Yield and Size According to Market States

BULL MARKET

Size Quintiles	Dividend Yield Quintiles							
	Zero (Q0)	Q1 (Lo)	Q2	Q3	Q4	Q5 (Hi)	Q5-Q0 (t-	Q5-Q1 (t-
Q1 (Small)	3.55	2.19	2.17	2.33	2.06	2.93	-0.62	0.73
							(-	(1.63)
Q2	1.42	1.74	1.71	1.88	1.75	1.76	0.34	0.01
							(1.10)	(0.15)
Q3	1.29	1.63	1.68	1.42	1.48	1.33	0.04	-0.30
							(0.21)	(-
Q4	1.19	1.67	1.56	1.46	1.43	1.27	0.08	-0.40
							(0.02)	(-
Q5 (Large)	1.49	1.18	1.19	1.18	1.41	1.66	0.17	0.48
							(0.21)	(1.89)
Q5-Q1	-2.06	-1.01	-0.99	-1.16	-0.66	-1.26		
(t-stat)	(-5.38)	(-	(-	(-	(-	(-		

BEAR MARKET

Size Quintiles	Dividend Yield Quintiles							
	Zero (Q0)	Q1 (Lo)	Q2	Q3	Q4	Q5 (Hi)	Q5-Q0 (t-	Q5-Q1 (t-
Q1 (Small)	0.18	0.01	-0.32	0.41	0.28	2.41	2.23	2.40
							(3.02)	(2.43)
Q2	-1.33	-0.53	-0.07	-0.24	-0.44	-0.79	0.54	-0.26
							(1.05)	(-
Q3	-1.46	-0.61	-0.33	0.13	0.11	-0.57	0.89	0.04
							(1.78)	(0.26)
Q4	-1.16	-0.12	0.12	0.43	0.76	0.33	1.49	0.46
							(2.46)	(1.13)
Q5 (Large)	0.10	0.53	0.87	1.40	1.79	1.31	1.20	0.78
							(1.73)	(1.71)
Q5-Q1	-0.08	0.53	1.19	0.98	1.51	-1.10		
(t-stat)	(-0.17)	(0.77)	(1.83)	(1.44)	(2.44)	(-		

Table 4

Interactions Between Dividend Yield and Momentum According to Market States

BULL MARKET

Momentum Quintiles	Dividend Yield Quintiles							
	Zero (Q0)	Q1 (Lo)	Q2	Q3	Q4	Q5 (Hi)	Q5-Q0 (t-	Q5-Q1 (t-
Q1 (Low)	2.51	0.58	0.69	0.90	0.85	1.44	-1.07 (-	0.86 (3.28)
Q2	2.39	1.03	1.26	1.19	1.46	1.71	-0.68 (-	0.68 (4.02)
Q3	1.90	1.55	1.39	1.44	1.56	1.73	-0.17 (-	0.18 (0.76)
Q4	2.03	1.66	1.66	1.64	1.81	2.08	0.05 (0.09)	0.42 (2.39)
Q5 (High)	2.76	2.44	2.27	2.19	2.30	2.68	-0.07 (-	0.25 (0.86)
Q5-Q1 (t-stat)	0.25 (0.89)	1.86 (6.59)	1.58 (6.15)	1.29 (5.27)	1.45 (6.07)	1.24 (3.76)		

BEAR MARKET

Momentum Quintiles	Dividend Yield Quintiles							
	Zero (Q0)	Q1 (Lo)	Q2	Q3	Q4	Q5 (Hi)	Q5-Q0 (t-	Q5-Q1 (t-
Q1 (Low)	-0.86	-1.55	-0.94	-0.97	-0.79	0.29	1.15 (1.59)	1.84 (1.98)
Q2	-1.34	-0.99	-0.59	-0.25	0.47	-0.65	0.70 (1.44)	0.34 (0.84)
Q3	-0.64	-0.28	-0.09	0.40	0.45	-0.07	0.57 (1.31)	0.21 (0.52)
Q4	-0.41	-0.02	0.58	0.76	1.00	0.72	1.13 (2.52)	0.73 (2.15)
Q5 (High)	-0.27	0.63	0.61	1.09	0.85	1.38	1.66 (2.76)	0.75 (1.41)
Q5-Q1 (t-stat)	0.58 (0.65)	2.18 (2.26)	1.55 (1.44)	2.06 (2.55)	1.64 (1.76)	1.09 (0.35)		

Table 5

Interactions Between Size and Momentum According to Market States

BULL MARKET

Momentum Quintiles	Size Quintiles					
	Q1 (Small)	Q2	Q3	Q4	Q5 (Large)	Q5-Q1 (t-
Q1 (Low)	3.36	0.88	0.22	0.40	0.48	-2.87 (-
Q2	2.90	1.55	1.11	0.99	0.95	-1.96 (-
Q3	2.51	1.65	1.64	1.25	1.17	-1.34 (-
Q4	2.73	2.07	1.64	1.73	1.31	-1.42 (-
Q5 (High)	3.13	2.56	2.55	2.28	1.77	-1.36 (-
Q5-Q1	-0.22	1.67	2.33	1.88	1.29	
(t-stat)	(-0.82)	(7.32)	(8.67)	(6.62)	(3.91)	

BEAR MARKET

Momentum Quintiles	Size Quintiles					
	Q1 (Small)	Q2	Q3	Q4	Q5 (Large)	Q5-Q1 (t-
Q1 (Low)	1.28	-2.34	-1.89	-1.18	-1.26	-2.54 (-
Q2	-0.25	-0.80	-1.08	-0.78	0.47	0.71 (1.25)
Q3	0.13	-0.60	-0.68	-0.23	1.01	0.88 (1.72)
Q4	0.46	0.21	-0.07	0.41	1.50	1.04 (1.86)
Q5 (High)	0.02	0.54	0.62	0.95	1.39	1.37 (2.82)
Q5-Q1	-1.26	2.88	2.51	2.13	2.65	
(t-stat)	(-1.78)	(3.68)	(2.84)	(2.18)	(2.07)	

Table 6

Selection of Investment Strategies for Tactical Equity Investing

Portfolio		CAGR	Standard Deviation	Sharpe Ratio	Maximum Drawdown
Standard Strategy					
S3		15.85	17.25	0.45	40.71
S4		14.58	17.13	0.38	44.39
S5		12.61	16.30	0.28	47.52
S3M1		-3.12	23.18	-0.48	90.01
S3M5		28.44	18.41	1.11	42.06
S4M1		0.41	24.63	-0.31	85.79
S4M5		26.41	19.04	0.97	42.64
S5M1		1.00	26.40	-0.27	91.09
S5M5		22.22	19.52	0.73	43.92
S4D1		16.19	18.13	0.45	61.66
S4D5		13.43	19.48	0.28	49.39
S5D1		13.11	18.37	0.28	63.90
S5D5		20.69	21.49	0.59	43.83
Tactical Strategy					
Up: S3	Down: Cash	16.38	12.98	0.64	29.39
Up: S4	Down: Cash	16.44	13.34	0.63	29.63
Up: S5	Down: Cash	14.36	13.59	0.47	28.22
Up: S3M5	Down: Cash	28.36	16.37	1.24	27.83
Up: S4M5	Down: Cash	25.20	16.48	1.04	27.71
Up: S5M5	Down: Cash	19.60	17.21	0.67	35.71
Up: S4D1	Down: Cash	18.50	14.65	0.71	27.15
Up: S5D5	Down: Cash	18.38	16.02	0.65	40.31
Up: S3M5	Down: S5M5	31.17	18.70	1.24	38.55
Up: S4M5	Down: S5M5	27.93	18.82	1.06	38.45
Up: S4D1	Down: S5D5	20.81	20.49	0.62	43.58
Hedged Strategy (100% Gross)					
Long: S3M5	Short: S3M1	23.28	8.52	1.79	17.50
Long: S4M5	Short: S4M1	19.99	8.91	1.34	17.73
Long: S5M5	Short: S5M1	17.18	10.73	0.85	31.48
Hedged Strategy (200% Gross)					
Long: S3M5	Short: S3M1	39.55	16.92	1.86	35.27
Long: S4M5	Short: S4M1	32.16	17.70	1.36	36.97
Long: S5M5	Short: S5M1	25.64	21.36	0.82	57.60