Quantitative or Momentum based Multi-Style Rotation? UK Experience

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ABSTRACT

The objective of this paper is to examine whether short-term variation in the ranking of size and style index returns in the UK equity market is better predictable and exploitable by means of quantitative or momentum style rotation strategies. Using UK index data, we assess the profitability of a number of long-only and long/short multi-style rotation strategies based on these two alternative methods. The findings suggest that trading rules based on simple short-term momentum strategies are able to generate higher Sharpe ratios and greater end-of-period wealth at a reasonable level of transaction costs than our quantitatively based trading rules. This result is particularly pronounced among the long-only strategies.

KEY WORDS: MULTI-STYLE ROTATION, ORDERED LOGIT, MOMENTUM

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1. INTRODUCTION

Consistent style approach is often the preferred investment strategy with mutual funds and traditional asset managers. Although staying true to one style only may be a viable strategy for investors with long investment horisons or those being strong proponents of the particular investment style they follow, investors with shorter term horizons and less strong views about any of the styles can enhance portfolio value by rotating across the different styles. In particular, although we can identify significant number of value, growth, large capitalisation and small capitalisation funds, there is extensive evidence which suggests that each of those styles does not persistently outperform the market or the remaining three styles. This implies that being style consistent is risky as it can lead to underperformance due to inevitable reversal in the performance of the selected style. Specifically, the existing literature suggests that short-term reversals in style performance are exploitable by various market-timing techniques. Additionally, most of the literature examines style rotation between pairs of styles at the opposite end of the spectrum, namely: value vs. growth rotation and small vs. large rotation. However, there is no reason why an investor should switch from value to growth stock when the forecast suggests so, if small cap stocks are expected to perform better that both value and growth style. In other words, more profit potential lies in the multi-style rotation which is enabling an investor to switch across all four styles. Therefore, creating a strategy that will enable us to successfully switch from one style performing at its best in one period of time to another style expected to be the best performer in the next period, is of essence.

In this study, we examine whether short-term variation in the ranking of size and style index returns in the UK equity market is better predictable and exploitable by means of quantitative or momentum multi-style rotation strategies. We assess the profitability of a number of long-only and long/short trading strategies based on these two alternative methods, using data on UK equity style and size indexes. The recent increase in availability and popularity of Exchange Traded Funds (ETFs) as well as the existence of style index futures contracts makes the suggested trading strategies very cost effective, in terms of lower comparable costs and high liquidity.

2. REVIEW OF THE LITERATURE

The majority of literature available on styles focuses on assessing performance of style consistency in the long run. Hence, there is a mount of evidence[4] supporting the fact that value and small capitalisation stocks outperform their counterparts growth and large stocks in the long run. In the short-run though, there is no such consistency in the outperformance of a style, due to the style drift or a simple underperfomance. This creates the need for style rotation strategy that will exploit these short-term variations in styles' performances.

The key to success of rotation strategies is the choice of variables used for forecasting as well as the sophistication of the forecasting model. Kao and Shumaker (1999), using the yield-curve, real bond yield, corporate credit spread, high yield spread, estimated GDP growth and the earnings-yield gap, found that timing strategies in the US market, based on asset class and size, have historically provided more opportunity for out-performance than a timing strategy based on value stocks. Asness et al. (2000) propose an approach of forecasting the style

[4] For example: Capaul et al. (1993), Arshanapalli et al. (1998), Fama and French (1998), Bauman et al. (1998), Coggin and Doukas (1998), Reinganum (1999) etc.

spread through the spread in valuation multiples between a value portfolio and a growth portfolio (the value spread) and the spread in expected earnings growth between a growth portfolio and a value portfolio (the earnings growth spread). Lucas et al. (2001) showed that the impact of firm-specific characteristics, such as size and book-to-price, on future excess stock returns varies over time. By linking the impact of macroeconomic conditions, using the term structure variable and the business cycle indicator, they found excess returns to style rotating investment strategies. Arshanapalli et al. (1998) implemented the concept of style rotation strategies across international markets. Jacobs and Levy (1996) find that both index based style rotation and high-definition style rotation, which is based on classifying individual equities into styles using a combination of fundamental indicators, outperform the Russell 3000 index. In the UK, Levis and Liodakis find that greater forecasting accuracy in predicting the direction of the style spread is required for successful value/growth rotation (over 80%) rather than for small/large rotation (around 65%). Levis and Tessaromatis (2004) use value and growth indices for the FTSE100 and FTSE250 in the UK and different implementation rules to control for risk, and find that style rotation strategies are profitable for investors with different benchmarks and risk constraints.

The literature examining multiple style rotation is quite scarce. For example, Arshanapalli, Switzer and Karim (2005) suggest that the active multi-style rotation strategies they have developed for Russell large-cap and small-cap growth and value style indexes are outperforming the best performing buy-and-hold strategy even when accounting for transaction costs. Ahmed et al. (2002) document that a manager having an initial investment of $10,000 in 1981, would generate $92,000 in 1997 by investing 65% in large stocks and 35% in small stocks. On the other hand, a manager that is engaged in multi-style rotation strategies would incur a terminal wealth of $264,000 for the same period.

All the evidence noted above shows the profitability of long-only style rotation strategies based on quantitative forecasting models. Wang (2005) suggests that style rotation strategies in spirit are comparable to technical trading rules, such as relative strength indicator which is a form of a momentum strategy. This implies that the use of momentum based style rotation should achieve similar results as a quantitatively based one. Evidence of profitability of various momentum strategies in the US can be found in Lo and McKinley (1990) and Jegadeesh and Titman (1993) for example. Levellen (2002) documents that the momentum is pronounced in style index portfolio based trading and that, in some cases, it is even stronger than in individual stocks. Rouwenhorst (1998) study provides the evidence of international momentum effect. Ellis and Thomas (2004) focused on the UK market and incorporated five percent of transaction costs[5] to their momentum strategies on the FTSE 350 index. Their results confirmed that momentum profits prevail for holding periods greater than five months.

It is evident from the review of the literature that 1) style returns are predictable, but the degree of predictability depends on the specification of the forecasting model; 2) quantitatively based two-way style rotation is profitable, however there is significantly more potential in multi-style rotation; 3) style rotation can be implemented by using simple momentum approach rather than a complex quantitative one and 4) transaction costs do play a significant role in the profitability of these strategies. In addition of taking into account these four issues when devising our trading strategies, we will include the possibility of short-selling a style which is expected to be out of favour, as our strategies can be applicable in the ETF and futures markets where short-selling is permitted.

[5] see Carhart (1997) for the impact of transaction costs on profitability of momentum strategies

3. DATA

3.1. Equity Size and Style Index Selection

As a representation of the two style segments, we use FTSE 350 Growth Index and the FTSE 350 Value Index as proxies for the growth stocks and the values stocks respectively. In addition, to represent the size segments of the market, FTSE 100 and the FTSE Small-Cap Indexes are taken as proxies for the large capitalization stocks and the small capitalization stocks respectively. The former index covers the top 100 largest, by market capitalization, companies listed on the London Stock Exchange whereas the FTSE Small-Cap Index contains companies representing bottom 5% of the UK market capitalisation. Our monthly data sample covers the period from February 1987 to April 2006[6].

3.2 Potential Forecasting Variables for the Quantitative Model

For the purpose of effective style timing and ultimately investing in the index that is expected to earn the highest return, it is vital to primarily establish the appropriate forecasting variables. From the previous studies and financial theory it has been proven that economic variables and business cycles together with stock-specific fundamentals do have an impact on the direction and magnitude of the stock index returns. For this study we have selected a collection of variables based on macroeconomic, market and fundamental factors that we believe have a forecasting potential. The model we intend to imply should have predictive power, so to insure that the variables we use are predictive in nature, we use lagged values of all explanatory variables.

The set of potential explanatory variables are shown in Table1[7]:

- Insert Table 1 –

The rationale for the relationship between inflation and style returns can be found in Anderson (1997), while Sorensen and Lazzara (1995) and Kao and Schumaker (1999) find the predictive power of interest rate related variables and the term structure. We use Industrial production Index as a proxy for GDP and also evidence exists that it can be linked to the earnings of a company. Sterling/dollar exchange rate is likely to help predict performance of size indices, as suggested by Levis and Liodakis (1999). The measures of the level of money supply, M0 and M4 are included as they are able to affect the economy as a whole, primarily prices in the long-run and in essence influence future cash-flow expectations within the market. Fama and French (1998) give evidence for the predictive power of dividend yield for stock returns. We believe that including the change in the price of Brent Oil variable will add to our analysis the impact of oil price volatility which is becoming increasingly important in the 1990s and 2000s. Finally, lagged values of style indices are used to enhance the predictive power of the model. It goes without saying that not all of these variables will be used for the prediction of performance of all styles. Section 5 will show the choice of the variables with most significant predictive power for anticipating the ranking of performance for each of our four style and size indexes.

[6] UK Style indexes and FTSE Small cap only became available in 1986 and 1987 respectively.
[7] All of the potential forecasting variables were corrected for stationarity.

4. INDICATION OF PROFIT POTENTIAL IN MULTI-STYLE ROTATION

Comparing the twelve-month moving averages of the returns for our four size and style indices it is evident that different times of the economic cycles favour different types of stocks. Figure 1 indicates that although all four indices follow a similar trend, the Small cap stocks experience the most extreme movements in comparison to all other ones. In terms of outperformance, we can identify a somewhat cyclical behaviour of all four indices. For example: Small cap stocks perform the best from mid 1999 to 2001 to become the worst performing stocks in 2002 to mid 2003; similarly growth stocks were the worst performing ones in 1993-95, but technology boom reverted their position to the top between 1995 and 1999. Additionally it is worth noting that value index never appeared as the worst performing one in this period, on the contrary, it was quite often leading the way.

- Insert Figure 1 -

This simple analysis of the graph suggests that effective implementation of switching between the different indices at favourable times would ensure maximum profit and performance enhancement for the investors. Nevertheless, the implementation of successful rotation between the indices requires a realistic assessment of the degree of forecasting ability.

5. METHODOLOGY

5.1. The Quantitative Forecasting Model: Multinomial Ordered Logit

In order to establish a successful model that will have the potential in forecasting the best performing index, the appropriate choice of explanatory variables has to be made. Since the goal of our style-timing model is to select the best performing index among the four FTSE indices, a statistical technique able to generate a probabilistic forecast of a group membership is most suitable. There are various statistical models that have the aptitude to predict the direction of stock index returns, such as linear discriminate analysis, probit model, logit model and probabilistic neural networks. The logistic approach has been widely used in the style-timing literature and, similarly with for example Arshanapalli, Switzer and Panju (2005) or Levis and Liodakis (1999) we use the logit model. However, our study differs from the existing literature in that we use a multinomial ordered logit model as opposed to binary logit model which dominates other studies. To the best of our knowledge, this is the first study that uses this methodology for the style-timing analysis for the UK market. Therefore, we use recursive multinomial ordered logit model for selecting our forecasting variables and for forecasting which index will be ranked as the best performing one.

The ordered logit model has come to be applied in a framework for analysing ordered responses. More specifically, in an ordered logit model, the observed dependent variables (y_t) represent ordered outcomes or ranks. In our case, the ranking of the style/size index performance can be categorized as 1, 2, 3 or 4 in a particular month. As specified by Greene (2003), the model is built around a latent regression, where y^* is unobserved variable that depends linearly on the explanatory variables, and has the following transformation:

$$y_t^* = x_t' \beta + \varepsilon_t \qquad (1)$$

The explanatory variables are denoted by vector x_t and ε_t are independent and identically distributed random variables. The random disturbance term in this case has a logistic distribution. The observed y_t is determined from y_t^* and follows the following conditions:

$$\begin{aligned} &y = 1 \quad \text{if } y_t^* \le \gamma_1 \\ &y = 2 \quad \text{if } \gamma_1 < y_t^* \le \gamma_2 \\ &y = 3 \quad \text{if } \gamma_2 < y_t^* \le \gamma_3 \\ &\vdots \\ &y = J \quad \text{if } \gamma_J < y_t^* \end{aligned} \qquad (2)$$

The threshold values gammas, γ, are estimated along with the β coefficients using the maximum likelihood estimation. Under very general conditions, the estimators are consistent, asymptotically normal and asymptotically efficient. The value of the observed variable y depends on whether or not the gamma thresholds have been crossed. Therefore, in order to evaluate the logistic probabilities[8] of observing each value of y_t, the following calculations are required:

$$\begin{aligned} &\Pr(y_t = 1 | x_t, \beta, \gamma) = F(\gamma_1 - x_t'\beta) \\ &\Pr(y_t = 2 | x_t, \beta, \gamma) = F(\gamma_2 - x_t'\beta) - F(\gamma_1 - x_t'\beta) \\ &\Pr(y_t = 3 | x_t, \beta, \gamma) = F(\gamma_3 - x_t'\beta) - F(\gamma_2 - x_t'\beta) \\ &\vdots \\ &\Pr(y_t = J | x_t, \beta, \gamma) = 1 - F(\gamma_J - x_t'\beta) \end{aligned} \qquad (3)$$

For all the probabilities to be positive, each gamma needs to be smaller in value than the previous one. Specifically, it needs to entail the following specification:

$$\gamma_1 < \gamma_2 < \ldots < \gamma_{J-1}. \qquad (4)$$

Therefore, in our study, we run recursive ordered logit model having original in-sample period of 120 months and the total number of 111 out-of sample observations from February 1997 to April 2006.

[8] Other distributions, particularly the normal distribution using the probit model, could be used just as easily. We assume logistic distribution in our analysis, although both distributions generally give similar results in practice.

5.1.1. Determining the Forecasting Variables

In order to determine the forecasting variables, we run the recursive ordered logit model using all of the potential variables over the first in-sample period. Our in-sample period contains 120 monthly observations, starting from February 1987 and ending on January 1997. As a result, we determine the statistically significant variables and optimal lags to consider for each variable. Table 2 shows the initial set of the statistically significant variables from February 1987 to January 1997 for the FTSE Small-Cap Index. Those variables shown in Table 2 will than be used in ordered logit model from February 1997 to January 1998 to forecast the probability of the Small Cap index to be ranked 1st, 2nd, 3rd or 4th.

- Insert Table 2 -

The first set of forecasting variables obtained for FTSE 100, FTSE 350 Growth Index and FTSE 350 Value Index for the same period are presented in Table 3, 4 and 5 in the Appendix 1[9].

To obtain the next set of explanatory variables for each style/size index which will be used for forecasting the ranking probabilities in the period February 1998 to January 1999, we extend our in-sample window by one year, having now 132 observations in total. The same recursive procedure is carried out until the end of the sample data, April 2006. Different factors affect the style indices at different time periods and we believe that by implementing the proposed method in which we recursively change the forecasting variables, we will be able to forecast style/size index ranking with greater accuracy.

5.1.2. Implementation Strategies

Our trading simulation assumes that at the beginning of each month an investor needs to decide which of the four FTSE indices to invest in. At the end of every month, we run the ordered logit model and study the conditional probabilities estimated by our model to allocate the funds according to our guidelines. Using those probabilities, we devise a set of long-only and long/short trading strategies that we believe are feasible in practice.

Strategy 1 entails investing 100% of the funds in the index that has the highest probability of ranking first. **Strategy 2** is aimed at buying two style indices so that: 50% of the funds is invested in the index with the highest probability of ranking first and the remaining 50% of the funds is invested in the index whose probability was the second highest in ranking first. **Strategy 3** follows the same approach as strategy 1, but in addition to probability of an index being ranked first, it uses empirical cut-off rates[10]. For example, if the cut-off for the FTSE Small-Cap Index is 0.35 for a certain month and its probability of being ranked first obtained from our ordered logit model is higher than of any other index and higher than 0.35 , we will then invest 100% in the FTSE Small-Cap Index. Otherwise, we leave the portfolio invested in the same index as in the previous month. **Strategy 4** aims at going long in the index that has

[9] Note that 1) the variables shown in Tables 2, 3, 4 and 5 are only the initial set of variables which will be changing through the recursive process and 2) only significant variables used for further forecasting are shown. The detailed set of the variables used in each period can be obtained on the request from the authors.

[10] For each month a cut-off is calculated based on the historical return rankings of each style index, as the number of months an index was ranked the first in relation to the total number of months.

the highest probability of being ranked first and short-selling in the index that has the (lowest probability of being ranked first). Finally, in **Strategy 5** we create equally weighted long investment portfolio of the two indices for which the ordered logit model generated the highest probabilities of being ranked first, and short sell the other two indices for which the ordered logit model obtained the lowest probabilities of being ranked first. Finally, the **Perfect Foresight** multi-style rotation strategy is a strategy in which we assume the investor with 100% forecasting accuracy, i.e. investing every month in the winning style index. This strategy is used to reflect the profit potential in multi-style rotation.

For comparative performance assessment, the long-only **buy-and-hold** FTSE 350 Value index strategy is implemented as it is historically (over the long) run the best performing style in the UK market.

5.2. Methodology of the Momentum Strategies

To assess weather similar results can be obtained without going through subjective and complex quantitative process, we implement a number of momentum-based multi-style rotation strategies using the same data set and period under analysis as in the quantitative model for comparative purposes.

We compute cumulative compound returns for each of the four style indices for compounding periods based on 2-12 historical months:

$$r_t = \prod_{n=-2}^{j}((1+r_{t-1})....(1+r_{t-n}))-1 \qquad (5)$$

where j denotes historical compound return period used for portfolio formation, taking values j = -2, -3, -4, -5, -6, -9, -12 months.

Our holding periods, K, range from one to six months. In particular, we create 13 long-only strategies based on the idea of investing in the style with highest positive momentum as indicated by the compound return in our portfolio formation period. Additionally, we apply equivalent 13 long-short strategies where we go long in the index with the highest positive momentum and short the index with the highest negative momentum.

5.3. Transaction costs

Break-even transaction costs per trade are calculated for all our strategies. This should give an indication of practical feasibility of both quantitative and momentum based multi-style rotation as both type of strategies are expected to have large number of switches across different investment styles. The average level of transaction costs for ETFs is 12-20bps, with maximum expense ratio for UK ETFs being 0.5% (50bps)[11]. We will use this level of transaction costs as a benchmark for our feasibility assessment.

6. ANALYSIS OF THE RESULTS

6.1. Quantitative multi-style rotation results

[11] www.trustnet.com

In this section we present the benefits of rotating across different style and size indices based on our quantitative signals, rather than committing to one style only.

Table 6 provides the results based on the ordered logit forecasting model for our long-only and long/short multi-style rotation strategies. Our buy-and-hold style index strategies indicate that Large cap and Growth style actually underperformed Value and Small cap style, generating negative Sharpe ratios as their average annualised returns were actually lower than the average return on UK 1 month Treasury bill. The period of analysis for buy-and-hold strategies is February 1997 to April 2006, matching the out-of-sample period of multi-style rotation strategies. Therefore, as our benchmark buy-and-hold strategy we choose FTSE 350 Value Index strategy as it has the highest Sharpe ratio of 0.206 during the sample period.

- Insert Table 6 –

The Perfect Foresight multi-style rotation attains average annualized returns of 35.3%, Sharpe ratio 1.87 and end of period value in April 2006 of £14,669,652.6 obtained as a cumulative growth on £1 million initial investment from February 1997. Therefore, it is obvious that investing always in the winning style has a huge profit potential.

Out of the strategies based on our forecasting model, the ordered logit model, the highest end of period wealth of £2,105,518.36 is generated by a long-only strategy, Strategy 1, which is higher than end of period value obtained through any of the buy-and hold strategies. The strategy also has the highest Sharpe ratio of 0.261, again higher than any of the buy-and-hold style index strategy. Nevertheless, given that the number of switches from one style to another in this strategy is 50, only marginal level of transaction costs of 15bps per switch will allow this strategy to breakeven with the best performing buy-and-hold Value index strategy.

This level of transaction costs may be attainable by some institutional investors through ETFs but not by the smaller investor. However, the strategy outperforms consistent Large cap, Small cap and Growth investing at much more feasible level of transaction costs of 73bps, 47bps and 93bps respectively. Additionally, Strategy 3, which is essentially similar to Strategy 1, is the next best strategy both in terms of end-of-period wealth (£2,049,877.38) and the Sharpe ratio (0.241). It has only 36 switches over the period analysed and one would expect that the breakeven transaction costs for this strategy would be more realistic thanks for Strategy 1; however, lower level of forecasting accuracy of Strategy 3, makes breakeven transaction costs of similar (14bps) to those in Strategy 1. Strategy 2, which represents equally weighted portfolio of the two style indices with the highest probability of being ranked first, underperforms the best buy-and-hold Value index strategy, but manages to outperform Large cap, Small cap and Growth buy-and-hold at breakeven transaction costs of 33bps, 11bps and 50bps respectively. The results for Strategy 4 and Strategy 5 imply that introducing short-selling does not improve the performance of quantitative multi-style rotation. In particular, both of these strategies generate negative Sharpe ratios even though their average annualised returns are positive, indicating that those returns were actually lower than the average value of UK 1 Month T-bill. The reason for this may be in the nature of the model: the ordered logit model will indicate to us which index has the lowest probability to be the best, but it will no tell us if we should expect negative return on that index. If the return of the index to be shorted is simply the lowest positive return out of the four, then the return of the long/short strategy will be lower than the return of the long-only strategy.

This brings us to evaluate the accuracy of our forecasting models in correctly predicting the style index performance. Given that the forecasting accuracy of our best performing strategies, Strategy 1 and Strategy 3 is 33% and 31% respectively and that Perfect Foresight strategy suggests profit potential of over £14.5 Million, there is definitely a scope for further improvement of our forecasting model specification.

The following conclusions can be drawn from the quantitative multi-style rotation analysis: a) long-only multi-style rotation strategies have a profit potential over style-consistent strategies, particularly over Large Cap and Growth Style at reasonable level of transaction costs for institutional investors and b) the introduction of short-selling does not add value if we do not assess the magnitude of the expected style return but rather look at the probability of ranking best/worst as in the model proposed.

6.2. Momentum based multi-style rotation results

6.2.1. Long-Only Momentum Strategies

Tables 7 and 8 provide the results of the long only momentum strategies. In particular, Table 7 provides the results of the long only positive momentum strategies based on formation periods 1-6months, 9 months and 12 months (J=1, 2, 3, 4, 5, 6, 9, 12) and the holding period of one month (K=1) only. In other words, in this table we examine strategies based on both shorter, medium and longer term portfolio formation periods, but short term holding period of 1 month.

- Insert Table 7 -

- Insert Table 8 -

In terms of average annual returns, all strategies except (J=3; K=1), (J=4; K=1) and (J=9; K=1) perform better than our highest return quantitative strategy, Strategy 1 of the ordered logit model. The Sharpe ratios for 6 months, 2 months, 1 month, 12 months and 5 months formation period strategies are 0.713, 0.677, 0.580, 0.339 and 0.310 respectively, which are all higher than the Sharpe ratio of buy-and-hold FTSE 350 Value strategy and quantitative Strategy 1. All mentioned strategies have greater level of break-even transaction costs than the best quantitative strategy, Strategy 1. It is important to note that the best performing positive momentum strategy in terms of both Sharpe ratios and end of period wealth is the medium term strategy of 6 months formation and one month holding period. It generates end of period wealth around £1.16 million higher than buy and hold FTSE 350 Value index. The strategy also has the highest break-even transaction costs of 113 bps per switch which make it very feasible in reality.

Therefore, to check the robustness of this best performing positive momentum strategy (6 months formation – 1 month holding period), we extend the holding period of the strategy from 1month to 6months. The results are presented in Table 8. All of the momentum strategies in Table 8 outperform the buy-and-hold Value strategy in terms of Sharpe ratios and end of period wealth at the reasonable and easily feasible level of transaction costs for even smaller investors. In comparison to best performing quantitative strategy, Strategy 1, similarly, all momentum strategies form Table 9, with the exception of (J=6; K=5) strategy, outperform Strategy 1. Additionally, 6 months-5 months momentum strategy only just

marginally underperforms quantitative Strategy 1 with Sharpe ratio 0.229 in comparison with the Sharpe ratio achieved through quantitative rotation of 0.261.

Taking into account all of the results from Tables 7 and 8, strategy (J=6; K=2) yields the highest end-of-period wealth with £3,296,294.90 with 22 switches and 235 bps break-even transaction costs per switch. The strategy generates £1,346,860.20 extra profits over the buy-and-hold Value index strategy. Furthermore, its end-of period wealth is substantially higher than that of quantitative Strategy 1 which generated profits of £2,105,518.36.

In conclusion, it is worth noting that the long-only momentum strategies with six months historical compounded returns showed higher end-of-period wealth and higher levels of break-even transaction costs, which is consisted with the literature of Jegadeesh and Titman (1993). Additionally, these simple long-only momentum strategies are exhibiting better overall performance than more complex quantitative multi-style rotation strategies.

6.2.2 Long/Short Momentum Strategies

Let us now examine how an investor would benefit from exploiting the negative momentum in addition to the positive one. In particular, we study the same momentum strategies that were used for the long only scenarios; however, this time we buy the style index with the highest positive momentum and short the style index with the most negative past compounded return, i.e. the lowest negative momentum. The results for all 13 strategies are presented in Table 9 and Table 10.

- Insert Table 9 –
- Insert Table 10 –

Table 9 displays results for the long/short strategies entailing past 1-6, 9 and 12 months compounded returns and only month one holding period. Out of all the long/short momentum strategies from Table 10, short term strategy (J=1; K=1) and medium term strategy (J=6; K=1) have the highest average annual returns of 11.73% and 11.24% respectively. Furthermore, their Sharpe ratios amount to 0.409 and 0.369 respectively. The two strategies both outperform the buy-and-hold Value strategy and Strategy 1 from the quantitative multi-style rotation in terms of the average annual returns and Sharpe ratios. Break-even transaction costs of these two strategies are higher than that of Strategy 1, but nevertheless are not substantially high to be considered realistic for smaller investors in the UK market. In comparison to the long-only momentum strategies from Table 7, based on purchasing an index with highest positive momentum only, it can be seen that the introduction of the negative momentum reduces the overall profitability of these strategies. This is consistent to our findings from quantitative multi-style rotation.

To ensure comparability with long-only positive momentum strategies from Table 8, Table 10 focuses solely on the results for the past six month compounded returns and various holding periods. Extending the holding period from 1 month to 2, 4, 5, and 6 months does not improve the profitability of the long-short momentum strategies from Table 9. Although strategy (J=6; K=2), having a Sharpe ratio of 0.349 and end of period wealth of £2.27 million, performs better than the best performing quantitative strategy, Strategy 1, it has low level of break-even transaction costs and doesn't outperform the equivalent long-only momentum strategy.

Evidently, as a comparison to the long-only positive momentum strategies in general, the average annual returns and the Sharpe ratios do decrease when shorting is introduced into the portfolio.

Overall, we can conclude that negative momentum is not persistent and that adding a short position in the index with the most negative historical momentum does not improve the profitability of long-only momentum strategies. This is consistent with the results from quantitative rotation which finds that construction of long/short portfolios based on quantitative multi-style rotation signals generated through ordered logit model is not profitable either.

7. CONCLUDING REMARKS

Previous literature on style investing and style rotation suggests that being style consistent is not always the most profitable strategy. In this study we have examined the profitability of quantitative versus momentum multi-style rotation where we alternated our investment in four different style segments (Value, Growth, Small cap and Large cap) as suggested by the quantitative or the momentum signal.

Our findings suggest that quantitative multi-style rotation strategies based on the ordered logit approach are not as profitable and as robust as the strategies based on various momentum trading rules. Additionally, multi-style rotation is more successful when following a long only, rather than a long/short investment approach regardless of whether momentum or quantitative trading rules are implemented. In particular, our best quantitative strategy in terms of Sharpe ratios, Strategy 1, is a long only strategy which generated profit over buy-and-hold strategies of all four style indexes (profits ranging from over £150,000 over value index to over £750,000 over growth index). If the forecasting accuracy of the model is improved, these profits have a great scope for improvement as the multi-rotation strategy with perfect foresight generates profit of £12,720,217.86 over buy-and-hold Value index strategy. Momentum strategies on the other hand are showing that better and more robust results can be obtained through a much simpler approach. Most of our momentum strategies generate higher end of period wealth and Sharpe ratios than all of the quantitative strategies and than buy-and-hold index strategies. The profitability of the momentum strategies is better for shorter holding periods and for medium term (6 months) formation periods at a very realistic level of transaction costs. However, with introduction of shorting in our trading rules, the profitability of both quantitative and momentum strategies is reduced, with momentum multi-style rotation still having an edge over the quantitative one.

Appendix 1

Tables 3, 4, and 5 present significant variables only.

Table 3: Determinants of FTSE Large-Cap Index

	Coefficient	Std. Error	z-Statistic	Prob.
CPI(-2)	-0.168389	0.086412	-1.948681	0.0513*
DYS_L(-1)	0.634674	0.361617	1.755100	0.0792**
RISKPREM(-1)	57.95229	27.27952	2.124388	0.0336*

*Significant at 5% significance level

Table 4: Determinants of FTSE Growth 350 Index

	Coefficient	Std. Error	z-Statistic	Prob.
CONSCONF(-2)	-0.064208	0.027658	-2.321478	0.0203*
CPI(-1)	-0.278054	0.086005	-3.232978	0.0012*
M4(-1)	1.335756	0.469112	2.847412	0.0044*
MO(-1)	-1.075791	0.465056	-2.313251	0.0207*
MONBO(-1)	3.297721	1.862488	1.770600	0.0766*

*Significant at 5% significance level

Table 5: Determinants of FTSE Value 350 Index

	Coefficient	Std. Error	z-Statistic	Prob.
VALUE_RET(-1)	5.688850	3.359873	1.693174	0.0904**
CONSCONF(-2)	0.065861	0.026975	2.441524	0.0146*
M4(-1)	-0.963185	0.460886	-2.089857	0.0366*
MONIPMAN(-1)	-35.52409	21.15829	-1.678967	0.0932**
YLD_SPR(-1)	-0.527808	0.192255	-2.745359	0.0060*

*Significant at 5% significance level

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Figure 1: 12 Month Moving Averages of FTSE 350 Growth, FTSE 350 Value, FTSE Small Cap and FTSE 100 Index Returns

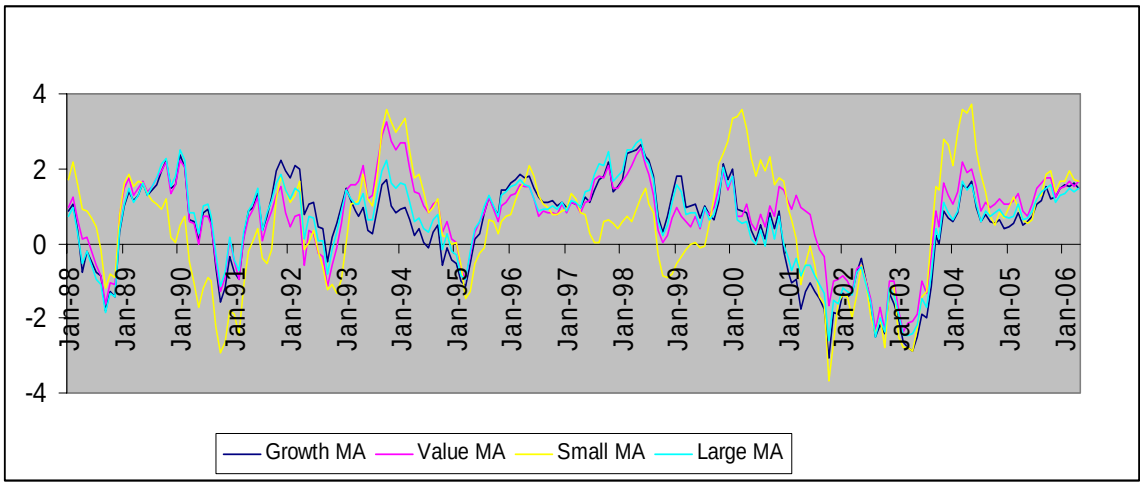

Table 1: Host of Potential Variables for the Forecasting Model

Measure	Code	Description
Inflation	cinfl	Monthly change in UK CPI
Interest Rates	c_ts	Monthly change in the 10 year UK Benchmark Bond Yield minus the UK 3 month T-Bill – The Term Structure
Interest Rates	mc3mtb	Monthly change in 3 month T-Bill
Exchange Rate	c_er	Monthly change in the GBP/USD exchange rate
Consumer Confidence	c_conf	Monthly change in the UK Consumer Confidence Indicator
Liquidity	c_ukindpro	Monthly change in the UK Production Index
Liquidity	c_pm	Monthly change in the UK Industrial Production of the Manufacturing Sector
Money Supply	c_m0ms	Monthly change in the M0 UK money supply (narrow money)
Money Supply	c_m4ms	Monthly change in the M4 UK money supply (broad money)
Commodity	per_c_oil	Monthly percentage change in the price of Brent Oil
Dividend Yield	dysmall_large*	FTSE Small-Cap Dividend Yield minus FTSE 100 Large-Cap Dividend Yield
Risk Premium	C_riskprem	Monthly change in the UK Risk Premium
Lagged Dependent Variable	Small-cap	1 month lagged FTSE Small-Cap Index
Lagged Dependent Variable	Large-cap	1 month lagged FTSE Large-Cap Index
Lagged Dependent Variable	Value	1 month lagged FTSE Value 350 Index
Lagged Dependent Variable	Growth	1 month lagged FTSE Growth 350 Index

*measure only applicable for the size indices

Table 2: Determinants of FTSE Small-Cap Index Feb 1987 – Jan 1997

	Coefficient	Std. Error	z-Statistic	Prob.
SMALLRET(-1)	-32.17842	6.210421	-5.181359	0.0000**
CONSCONF(-1)	-0.066085	0.037356	-1.769037	0.0769**
CPI(-1)	-1.527482	0.569980	-2.679888	0.0074**
CPI(-2)	1.292298	0.546335	2.365396	0.0180**
DYS_L(-1)	-1.455415	0.546850	-2.661453	0.0078**
MONEX(-1)	12.38289	6.311049	1.962097	0.0498**
TS(-1)	-0.516409	0.242673	-2.128005	0.0333**

**Significant at 5% significance level

Table 6: Results of Ordered Logit Forecasting Model for UK FTSE style Indices (1987:02 to 2006:04, with out-of-sample 1997:02 to2006:04

	Buy-and Hold Strategies				Style Rotation Strategies					
	Large Cap	**Small Cap**	**Value350**	**Growth350**	**Perfect Foresight**	**Strategy 1**	**Strategy 2**	**Strategy 3**	**Strategy 4**	**Strategy 5**
Average Annual Returns	5.396%	7.494%	**8.778%**	4.304%	35.3%	**9.792%**	7.703%	**9.481%**	5.973%	4.694%
Standard Deviation	15.11%	18.443%	15.445%	15.635%	15.8%	16.098%	15.516%	16.136%	10.835%	14.738%
Sharpe Ratio	-0.012	0.103	**0.206**	-0.082	1.87	**0.261**	0.136	**0.241**	-0.471	-0.060
End of Period Wealth	£1,462,736.4	£1,663,214.4	**£1,949,434.74**	£1,318,756.9	£14,669,652.6	**£2,105,518.36**	£1,775,593.4	**£2,049,877.38**	£1,622,108.8	£1,384,481.4
Break-Even Transaction Costs (Benchmark: Value Index)						15 bps	negative	14bps	negative	negative
Recommended Switches						50	59	36		
Profit over Buy-and-Hold Strategies:										
Strategy 1	£642,781.93	£442,303.95	£156,083.62	£786,761.39						
Strategy 2	£312,856.97	£112,378.99	(£173,841.2)	£456,836.43						
Strategy 3	£587,140.95	£386,662.97	£100,442.64	£731,120.41						
Strategy 4	£159,372.37	(£41,105.61)	(£327,325.8)	£303,351.83						
Strategy 5	(£78,255.03)	(£278,733.01)	(£564,953.3)	£65,724.43						
Total Correct Predictions						33%		31%		

Table 7: Summary results for long-only momentum strategies based on 1-6, 9 and 12 months formation and 1 month holding

	Formation Period (*J*) – Holding Period(*K*)							
	1m-1m	**2m-1m**	**3m-1m**	**4m-1m**	**5m-1m**	**6m-1m**	**9m-1m**	**12m-1m**
Average Annual Returns	12.91%	13.50%	7.52%	6.56%	9.02%	13.86%	7.66%	9.35%
Standard Deviation	13.30%	12.26%	12.01%	12.35%	12.36%	12.15%	12.69%	12.28%
Sharpe Ratio	0.580	0.677	0.193	0.110	0.310	0.713	0.195	0.339
End of Period Wealth	£2,839,671.8	£3,015,528.4	£1,831,028.9	£1,678,897.1	£2,074,426.1	£3,108,790.9	£1,838,928.3	£2,135,280.4
Profit/Loss over best Buy-and-Hold Strategy	£890,236.9	£1,066,093.6	(£118,405.85)	(£270,537.67)	£124,991.4	£1,159,356.2	(£110,506.4)	£185,845.7
Break-Even Transaction Costs (Benchmark: Value350 Index)	46bps	73bps	-11bps	-26bps	13bps	113bps	-19bps	45bps
Recommended Switches	81	59	54	57	47	32	30	20

Table 8: Summary results for long-only momentum strategies based on 6 months formation and 2-6 months holding

Formation Period (*J*) – Holding Period (*K*)	6m-6m	6m-5m	6m-4m	6m-3m	6m-2m
Average Annual Returns	12.11%	8.63%	13.11%	12.16%	14.57%
Standard Deviation	15.37%	15.00%	13.36%	12.96%	12.08%
Sharpe Ratio	0.451	0.229	0.593	0.538	0.776
End of Period Wealth	£2,586,638.4	£2,297,952.5	£2,881,908.6	£2,679,947.9	£3,296,294.9
Profit/Loss over best Buy-and-Hold Strategy	£637,203.6	£348,517.7	£932,473.8	£730,513.1	£1,346,860.2
Break-Even Transaction Costs (Benchmark: Value350 Index)	215bps	96bps	257bps	137bps	235bps
Recommended Switches	13	17	15	23	22

Table 9: Summary results for long/short momentum strategies based on 1-6, 9 and 12 months formation and 1 month holding period

	Formation Period (*J*) – Holding Period (*K*)							
	1m-1m	**2m-1m**	**3m-1m**	**4m-1m**	**5m-1m**	**6m-1m**	**9m-1m**	**12m-1m**
Average Annual Returns	11.73%	8.79%	5.75%	7.49%	10.39%	11.24%	6.45%	7.26%
Standard Deviation	15.97%	16.68%	17.92%	17.40%	15.53%	16.39%	17.53%	16.29%
Sharpe Ratio	0.409	0.216	0.031	0.132	0.335	0.369	0.071	0.127
End of Period Wealth	£2,488,023.9	£1,925,709.7	£1,453,574.8	£1,703,115.6	£2,239,221.9	£2,373,552.3	£1,549,740.9	£1,693,336.6
Profit/Loss over best Buy-and-Hold Strategy	£538,589.2	(£23,724.9)	(£495,859.9)	(£246,319.1)	£289,787.2	£424,117.6	(£399,693.8)	(£256,098.1)
Break-Even Transaction Costs (Benchmark: Value350 Index)	14bps	-0.9bps	-25bps	-11bps	13bps	23bps	-30bps	-22bps
Recommended Switches	172	113	114	115	97	83	74	62

Table 10: Sharpe Ratios for Long/Short strategies based on six months past return only

	Formation Period (*J*) – Holding Period (*K*)				
	6m-6m	**6m-5m**	**6m-4m**	**6m-3m**	**6m-2m**
Average Annual Returns	8.13%	4.57%	5.60%	6.96%	10.57%
Standard Deviation	15.40%	13.31%	14.09%	14.89%	15.41%
Sharpe Ratio	0.191	-0.047	0.029	0.118	0.349
End of Period Wealth	£1,850,473.9	£1,392,872.9	£1,510,200.2	£1,682,224.5	£2,271,763.6
Profit/Loss over best Buy-and-Hold Strategy	(£98,960.7)	(£556,561.8)	(£439,234.5)	(£1,949,434.7)	£322,328.9
Break-Even Transaction Costs (Benchmark: Value350 Index)	-12bps	-71bps	-59bps	-22bps	25bps
Recommended Switches	39	45	41	63	58