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Quantitative or Momentum Based Multi-Style Rotation? UK Experience

Authors:

Andrew Clare (a.clare@city.ac.uk)[1]

Svetlana Sapuric (s.sapuric@city.ac.uk)[2]

Natasa Todorovic (n.todorovic@city.ac.uk)[3]

Address all authors: Faculty of Finance, Cass Business School, 106 Bunhill Row, London EC1Y 8TZ, United Kingdom

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

[1] Before taking up his Chair in Finance at Cass Business School in September 2004, Andrew worked as a strategist at Legal & General Investment Management (LGIM), where he was responsible for the investment process at LGIM and also for asset allocation. Prior to this Andrew worked as a Senior Research Manager in the Monetary Analysis wing of the Bank of England. He has published extensively in both academic and practitioner journals on a wide range of economic and financial market issues. His publication record is such that in a recent survey of Europe's most influential finance academics Andrew was ranked 14th

[2] Svetlana holds a BSc degree in Business and Economics from Kent University at Canterbury. Currently, she is a Ph.D student in Finance at Cass Business School London, where she has also has received an MSc degree in Investment Management in 2004. Her research interests are in the area of fund management and style rotation. Her teaching experience includes a number of undergraduate level modules in the area of finance and econometrics.

[3] Corresponding Author, Natasa is a Senior Lecturer in Investment Management at Cass Business School. She holds a PhD in Finance from the same institution and her current research interests include assessment of trading strategies based on style investing, investment sentiment and assessment of fund managers' performance. Natasa is also a Chief examiner for fund management in Securities Institute (London) and was a member of the Supervisory Board of MP Asset Management (Slovenia) for four years. She publishes in both academic and practiotioners journals.

INTRODUCTION

Consistent style approach is often the preferred investment strategy with mutual funds and traditional asset managers. 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 better performance can be generated by applying 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 large cap stocks are expected to perform better that both value and growth style. In other words, we believe that more profit potential lies in the multi-style rotation which is enabling investors 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 by means of quantitative or momentum multi-style rotation strategies. Particularly, 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 and present the first results of this kind for the UK. 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.

REVIEW OF THE LITERATURE

The key to success of short-term 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 spread through the spread in valuation multiples between a value and a growth portfolio and the spread in expected earnings growth between the two portfolios (the earnings growth spread). They show that the impact of firm-specific characteristics, such as size and book-to-price, on future excess stock returns varies over time. Linking the impact of macroeconomic conditions, using the term structure variable and the business cycle indicator, Lucas et al. (2002) find excess returns to style rotating investment strategies. Arshanapalli et al. (1998) implement 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 based on fundamental characteristics of individual equities, outperform the Russell 3000 index. In the UK, Levis and Liodakis (1999) 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) 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. Results in support of multi-style rotation are also found in Ahmed et al. (2002).

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 MacKinley (1990) and Jegadeesh and Titman (1993) for example. Lewellen (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. In the UK, Ellis and Thomas (2004) find that momentum profits prevail for holding periods greater than five months when five percent of transaction costs[4] are incorporated to their momentum strategies on the FTSE 350 index.

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.

DATA

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. Our monthly data sample covers the period from February 1987 to April 2006[5].

[4] see Carhart (1997) for the impact of transaction costs on profitability of momentum strategies
[5] UK Style indexes and FTSE Small cap only became available in 1986 and 1987 respectively.

Potential Forecasting Variables for the Quantitative Model

For this study we have selected a collection of variables based on macroeconomic, market and fundamental factors that we believe have a forecasting potential. 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.

- 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. 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. Predictive power of dividend yield for stock returns is documented in Fama and French (1988). 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. Not all of these variables will be used for the prediction of performance of all styles. In the methodology section we show the choice of variables with most significant predictive power for anticipating the ranking of performance for each of our style and size indexes.

METHODOLOGY

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. 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 (see for example Arshanapalli, Switzer and Panju (2005) or Levis and Liodakis

(1999)). 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 the most suitable. 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. To the best of our knowledge, this is the first study that uses this methodology for the style-timing analysis for the UK market.

In an ordered logit model, the observed dependent variable (y_t) represents 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.

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

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:

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

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 of observing each value of y_t, the following calculations are required:

$$\Pr(y_t = 1 | x_t, \beta, \gamma) = F(\gamma_1 - x_t'\beta)$$

$$\Pr(y_t = 2 | x_t, \beta, \gamma) = F(\gamma_2 - x_t'\beta) - F(\gamma_1 - x_t'\beta)$$

$$\Pr(y_t = 3 | x_t, \beta, \gamma) = F(\gamma_3 - x_t'\beta) - F(\gamma_2 - x_t'\beta) \qquad (3)$$

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$$\Pr(y_t = J | x_t, \beta, \gamma) = 1 - F(\gamma_J - x_t'\beta)$$

For all the probabilities to be positive, each gamma needs to be smaller in value than the previous one.

Therefore, 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.

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 first in-sample period contains 120 monthly observations, from February 1987 to January 1997. As a result, we obtain the set of 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 is presented in Table 3, 4 and 5 in Appendix 1[6].

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. The same recursive procedure is carried out until the end of the sample, April 2006.

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 with second highest probability to be ranked first. **Strategy 3** follows the same approach as strategy 1,

[6] 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.

but in addition to probability of an index being ranked first, it uses empirical cut-off rates[7]. 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 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.

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 sample period as in the quantitative model.

We compute cumulative compound returns for each of the four style indices as:

$$r_t = \prod_{n=-2}^{j}((1+r_{t-1})....(1+r_{t-n}))-1 \qquad (4)$$

[7]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.

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 are long in the index with the highest positive momentum and short the index with the highest negative momentum.

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)[8]. We will use this level of transaction costs as a benchmark for our feasibility assessment.

ANALYSIS OF THE RESULTS

Quantitative multi-style rotation results

Table 6 provides the results based on the ordered logit forecasting model for our long-only and long/short multi-style rotation strategies as well as the buy and hold index strategies over the same sample period. According to these results, we choose FTSE 350 Value Index strategy as our benchmark buy-and-hold strategy as it has the highest Sharpe ratio (0.206) of our four indexes.

- Insert Table 6 –

[8] www.trustnet.com

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.

Looking at our quantitative rotation strategies, Strategy 1 to Strategy 5, the highest end of period wealth of £2,105,518.36 is generated by the long-only Strategy 1, which is also higher than end of period value obtained through any of the buy-and hold strategies. In addition, the strategy has the highest Sharpe ratio of 0.261. Nevertheless, given that the number of switches from one style to another in this strategy is 50, only a marginal level of transaction costs of 15bps per switch will allow this strategy to breakeven with the benchmark buy-and-hold, Value index strategy. 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. Further, Strategy 3, which is 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). Although this strategy has only 36 switches, its forecasting accuracy is lower than for Strategy 1. Strategy 2, which represents equally weighted portfolio of the two style indices with the highest probability of being ranked first, underperforms the benchmark buy-and-hold Value index strategy, but outperforms Large cap, Small cap and Growth buy-and-hold at small level of 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. The reason for this may be in the nature of the model we use: 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 leads 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.

Momentum based multi-style rotation results

1. Long-Only Momentum Strategies

Tables 7 and 8 show the results for the long only momentum strategies. In particular, Table 7 provides the results for the long only positive momentum strategies based on shorter, medium and longer term portfolio formation periods (J=1, 2, 3, 4, 5, 6, 9, 12 months) and the short term holding period of one month (K=1) only.

- 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 the best quantitative strategy, Strategy 1. 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 Value index strategy and quantitative Strategy 1. In addition, all mentioned strategies have greater level of break-even transaction costs than the quantitative Strategy 1. 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 Value index benchmark. The strategy also has the highest break-even transaction costs of 113 bps per switch which make it very feasible.

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 1 month to 2, 3, 4, 5 and 6 months. 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 feasible level of transaction costs for even smaller investors. In comparison to best performing quantitative strategy, Strategy 1, similarly, all momentum strategies form Table 8, with the exception of (*J*=6; *K*=5) strategy, outperform Strategy 1. Nevertheless, one should note that (J=6; K=5) momentum strategy only just marginally underperforms quantitative Strategy 1 with Sharpe ratio 0.229 (the Sharpe for Strategy 1 is 0.261).

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 consistent 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.

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. For comparison, we examine 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 lowest negative past compounded return (the lowest negative momentum). The results for all 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 formation periods and one month holding period. It is apparent that the 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, with Sharpe ratios 0.409 and 0.369. The two strategies outperform the buy-and-hold Value index strategy and quantitative Strategy 1. Although the break-even transaction costs for these two strategies are higher than that of Strategy 1, they are not sufficient enough to be considered realistic for smaller investors in the UK market. In comparison to the equivalent 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 the quantitative multi-style rotation.

To ensure comparability with long-only positive momentum strategies from Table 8, Table 10 focuses solely on the 6 months formation and 1-6 months holding periods. It can be seen that extending the holding period does not improve the profitability of the long-short momentum strategies. Although strategy (J=6; K=2), has higher Sharpe ratio (0.349) and end of period wealth (£2.27 million) than the quantitative Strategy 1, it has low level of break-even transaction costs and doesn't outperform the equivalent (J=6; K=2) 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 decrease when shorting is introduced into the portfolio.

Overall, we can conclude that negative momentum is not persistent and that adding a short position does not improve the profitability of the 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.

CONCLUSIONS

This study compares the profitability of quantitative and momentum multi-style rotation where we alternated the investment between four different style segments, Value, Growth, Small cap and Large cap, as suggested by the quantitative or the momentum trading signal. Our main findings suggest the following: Firstly, quantitative multi-style rotation strategies are not as profitable and as robust as the strategies based on momentum trading rules. Most of our momentum strategies generate higher end of period wealth and Sharpe ratios than the quantitative 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. This implies that a better and more robust performance can be obtained through a much simpler approach. Secondly, 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. Despite this reduction in profitability when shorting is introduced, momentum multi-style rotation still has 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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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