The Profitability of Style Rotation Strategies in the United Kingdom

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The Profitability of Style Rotation Strategies in the United Kingdom

Depends on temporal volatility of underlying return spread between styles.

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Performance differentials between small/large and value/growth stocks are not exclusively characteristics of the U.S. market. Capaul, Rowley, and Sharpe [1993], Arshanapalli, Coggin, and Doukas [1998], and Fama and French [1998] report that value stocks, defined in terms of book-to-market, have outperformed growth stocks in different countries over relatively long time periods. Hawawini and Keim [1999], in their review of international evidence, suggest broadly similar results for small-capitalization stocks.[1]

Style consistency, however, is not necessarily an optimal strategy. As the asset mix drift creates a need for active asset allocation, the apparent style drift creates a need for style rotation strategies. For the active portfolio manager, rotation among different style segments, may provide opportunities for portfolio performance enhancement. Kahn [1996], for example, reports that most funds do not systematically follow a value or growth stock orientation, but instead tend to either shift between one and the other, or adopt a blend. In addition, although half of the equity funds studied stayed within their target size category, a few moved across portfolios of small and large stocks. At the same time, Indro et al. [1998] report that funds that instituted both a change in their value/growth as well as small/large-capitalization stock allocation strategy were the worst-performing group of actively managed funds.

We assess the potential profitability of style rotation strategies based on value/growth and small/large-cap segments of the market. First, we explore the potential of such strategies in the U.K. during the period 1968-1997 assuming both perfect forecasting and a range of intermediate levels of forecasting ability. Using a Monte Carlo simulation, we assess the average gains from rotation after adjusting for transaction costs. Second, we develop and test a style rotation model based on a set of macroeconomic factors selected for their ability to predict the direction of the style spread at a given month. Our out-of-sample tests provide strong support for small versus large but not value versus growth style rotation strategies.

Sharpe [1975] was the first to examine the efficacy of market timing between cash and equities and to highlight the potential benefits of such strategies. Jeffrey [1984], using the same framework, casts some doubt on the benefits of market timing. He argues that the incremental rewards from such strategies do not necessarily match the associated incremental risks.

Kester [1990] expands the scope of market-timing strategies by including small firms, while Case and Cusimano [1995] apply the same principles on value and growth indexes. They report some profit enhancement depending on transaction costs and the frequency of portfolio revision. Unfortunately, however, they offer very limited guidance in terms of the level of forecasting ability required and the potential of achieving this level.

Coggin [1998] tests the random walk and the long-term memory hypothesis for a number of U.S. equity style indexes and style spreads, and finds evidence in support of the former. He concludes that style indexes cannot be predicted using only the time series of returns as information variables; rather, forecasts should be conditioned on outside information, such as the business cycle and interest rates.

A number of studies have indeed attempted to link the performance of style portfolios to various macroeconomic factors. Fama and French [1993] suggest that book-to-market and size are proxies for distress, and that distressed firms may be more sensitive to certain business cycle factors. Jensen, Johnson, and Mercer [1998], for example, find that size and book-to-market depend on the monetary environment. Sorensen and Lazzara [1995] find a positive relationship between the growth in industrial production and interest rates and the value/growth return spread.

Anderson [1997] reports that small stocks benefit from inflation, perhaps because small companies find it relatively easier to pass along price increases in inflationary times. He also shows that the yield curve is positively related to the relative performance of small over large stocks.

Ragsdale, Rao, and Fochtman [1995] argue that future earnings growth is the decisive factor in predicting the performance of small- versus large-cap stocks. One of the factors that is likely to affect earnings is exposure to foreign markets. Thus, large stocks are penalized when the exchange rate is highly volatile.

At a more general level, Macedo [1995] maintains that the equity risk premium is the strongest discriminator for future style performance. A high equity risk premium favors riskier portfolios. Value stocks are perceived to be more risky, and so tend to do well when the equity risk premium is high.

In short, there are good fundamental reasons and considerable empirical evidence to suggest that both the size and value spreads are associated with economic fundamentals.

DATA AND INDEX CONSTRUCTION

Our customized style indexes cover the period 1968 through 1997, and use a total of 3,868 firms that were listed on the Exchange at some point during the period under consideration, ensuring a wide stock coverage.[2] To construct the size and value portfolios we independently rank companies based on their end-of-June market value (MV) and book-to-market ratio (BM).[3]

We then assign stocks to nine portfolios according to criteria as follows. We divide stocks into three market value and three book-to-market groups. Companies whose MV makes up the bottom 10% of the equity capitalization in our sample constitute the small-size portfolio, while companies in the top 80% of the total MV are allocated to the large portfolio. All the other stocks belong to the midcap segment.

Stocks are also divided into three BM categories. The top 30% of the companies with the highest B/M are in the value portfolio, the middle 40% the middle portfolio, and the bottom 30% the growth portfolio. Nine size-BM portfolios are then created from the intersection of the three MV and the three BM groups.

Companies with low MV and a high BM ratio constitute the small-value segment, while companies with low MV and a low BM ratio are in the small-growth portfolio. This ranking procedure is repeated every year (twenty-nine times), and the portfolios' composition changes annually. Following Fama and French [1995], we estimate portfolio returns starting in July of each sample year. We use total simple monthly returns from the London Share Price Database (LSPD) and accounting data from Datastream.[4]

FUNDAMENTALS AND PERFORMANCE OF SIZE AND VALUE PORTFOLIOS

For each one of the nine portfolios and for every year in the sample period, we calculate the average market value and median market-to-book ratio, dividend yield, price-earnings, cash flow yield, and total debt-to-equity ratio. We also estimate the values of these ratios for the aggregate small-cap, large-cap, value, and growth portfolios.

In Exhibit 1, we report descriptive statistics for all portfolios. The first two columns show the market value and market-to-book ratio for every style portfolio. Given our portfolio formation procedure, small- and large-cap portfolios have substantially different MV but the same MB ratios on average, while value and growth portfolios differ significantly on MB but not so much on their MV.

Value portfolios have higher dividend and cash flow yields and lower price-earnings ratios than growth portfolios. Size portfolios show no clear differences on any of these measures. Large-value stocks appear to have the highest dividend yield (5.99), while middle-growth have the lowest (3.62). Large-growth is the portfolio with the highest P/E ratio (21.01) and small-value the portfolio with the highest cash flow yield (0.38).

The last column shows the debt-to-equity ratio. Note the substantial difference in leverage between size portfolios with the same MB. It is also worth noting that value stocks appear to be more leveraged than their growth counterparts. The average debt-to-equity ratio for value stocks is 0.24, slightly higher than that of growth stocks.

Exhibit 2 reports average annual equal- and value-weighted returns for the entire sample period (July 1968-June 1997) and for three subsample periods (July 1968-June 1978, July 1978-June 1988, and July 1988-June 1997). The average annual return of the value index is 23.58% (22.31% on a value-weighted basis), over 11 percentage points higher than the returns of the growth index.

What is even more striking, however, is that this difference seems to persist for all three subperiods and across different size categories. The average annual value-growth spread (in percentage points) is 12.46 (15.30) for the first decade; 12.37 (10.39) for the second; and 9.80 (7.12) for the third, indicating a high persistence in performance for value stocks.

It is interesting that this difference in performance is apparent whether we focus on the small-cap, midcap, or large-cap segment. These results confirm the findings of previous studies, which document a positive relation between book-to-market and stock returns.

The average annual return on an equally weighted basis for the small-cap index is 17.51% for the whole

EXHIBIT 1
FUNDAMENTAL CHARACTERISTICS OF SIZE AND VALUE PORTFOLIOS

	Market Value) (million £	Market-to-Book	Dividend Yield	Price-Earnings	Cash Flow Yield	Debt/ Equity
Small-Cap Value	12.17	0.63	5.55	15.11	0.38	0.10
Small-Cap Medium	20.24	1.32	5.44	14.69	0.31	0.07
Small-Cap Growth	24.67	4.41	4.14	18.40	0.21	0.07
Midcap Value	168.95	0.68	5.71	18.83	0.32	0.27
Midcap Medium	164.79	1.36	5.37	14.12	0.28	0.20
Midcap Growth	163.84	4.30	3.62	18.25	0.19	0.16
Large-Cap Value	1142.92	0.70	5.99	16.88	0.29	0.35
Large-Cap Medium	1346.31	1.36	5.37	14.66	0.28	0.32
Large-Cap Growth	1317.13	4.21	5.71	21.01	0.18	0.30
Small-Cap	19.03	2.12	5.04	16.07	0.30	0.08
Large-Cap	1268.78	2.09	5.09	15.73	0.25	0.32
Value	441.34	0.67	5.75	15.60	0.33	0.24
Growth	501.88	4.31	3.89	19.22	0.19	0.18

EXHIBIT 2
AVERAGE ANNUAL PORTFOLIO RETURNS (%)

	1968-1997		1968-1977		1978-1987		1988-1997	
	E.W.	V.W.	E.W.	V.W.	E.W.	V.W.	E.W.	V.W.
Small-Cap Value	25.75	21.83	24.44	22.90	35.91	29.58	15.92	12.03
Small-Cap Medium	16.51	14.98	14.59	13.76	25.63	22.85	8.52	7.59
Small-Cap Growth	10.25	10.07	9.68	8.29	17.78	16.84	2.52	4.53
Midcap Value	24.41	23.68	25.58	24.69	30.31	29.95	16.57	15.59
Midcap Medium	15.94	15.95	12.59	13.64	23.16	22.24	11.65	11.53
Midcap Growth	12.15	11.74	10.48	9.87	19.50	18.44	5.85	6.37
Large-Cap Value	20.58	21.41	18.37	22.45	26.03	24.28	16.99	17.06
Large-Cap Medium	15.92	15.90	13.20	11.97	22.96	21.90	11.11	13.58
Large-Cap Growth	13.54	11.90	10.83	5.98	17.87	17.38	11.74	12.40
Small-Cap	17.51	15.63	16.24	14.98	26.44	23.09	8.98	8.05
Large-Cap	16.68	16.40	14.13	13.47	22.29	21.18	13.28	14.35
Value	23.58	22.31	22.79	23.35	30.75	27.94	16.50	14.89
Growth	11.98	11.24	10.33	8.05	18.38	17.55	6.70	7.77

E.W. stands for equal-weighted returns and V.W. for value-weighted returns.

sample period, which is just 83 basis points higher than the return of the large-cap index.[5] Although this result may appear surprising at first, given the size effect that has been observed in the U.K. market for many years, it can be explained by looking at the last subperiod. From July 1988 to June 1997, the large-cap index earned an average equal-weighted return of 13.28%, while the small-cap index had an average annual performance of 8.98%.

The size spread, however, is not consistent across different subportfolios. Comparing the performance of small-cap and large-cap indexes of the same MB category, it is worth noting that small-caps with low MB ratios perform better than large-caps with low MB ratios. Conversely, we observe a monotonic increasing pattern in performance as we move from small-cap growth to large-cap growth.

LIKELY GAINS FROM STYLE ROTATION

Exhibit 3 shows the twelve-month moving average of the return spread (on an equally weighted basis) between the small- and large-cap index and between value and growth portfolios. It is clear that different times favor different types of stocks. The small-cap investment strategy, for example, has two good cycles in the first half of our sample, each one lasting about 2.5 to 3.0 years (1971-1973 and 1977-1980). Large-caps, on the other hand, are more profitable from 1988 to 1992.

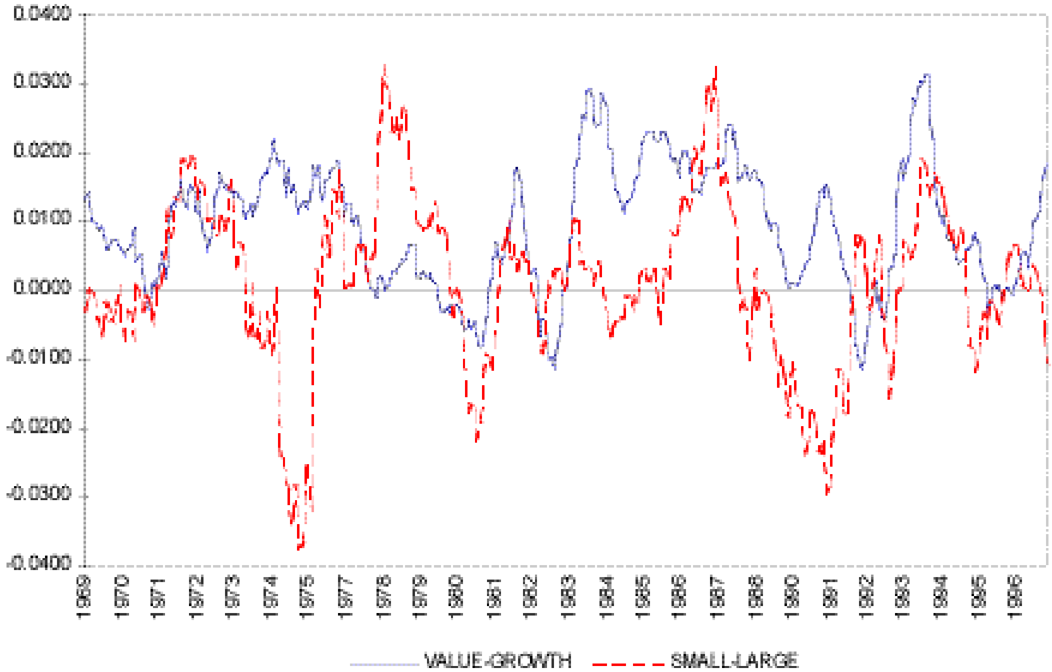
Apart from the cyclical movements of the size spread, the rationale for style rotation is also evident from higher frequency variations. Out of 348 months in our sample, small-caps performed better in 183 months or 53% of the time, while large-caps were better off the rest of the 348 months (47% of the time).

Although the sign variation in the case of the value/growth spread is not as apparent as in the case of size spread, there are still some periods when growth stocks give better returns compared to value stocks. In 232 months (67% of the total period), the value/growth spread was positive; in 116 (33%), it was negative. It is clear therefore that, even in this case, an investor who could predict the reversals between value and growth could outperform a passive buy-and-hold strategy.

Effective implementation of style rotation strategy requires a realistic assessment of the manager's degree of forecasting ability. Exhibit 4 shows the maximum and minimum possible profit for investors with different levels of forecasting skills, rotating between small and large stocks. The allocation decision is assumed to occur at monthly intervals on the basis of the corresponding index performance. A month is assumed to have been predicted correctly when the hypothetical investor has chosen to allocate all its funds in the best-performing index.

Exhibit 4 first illustrates the two extreme paths of style rotation results that connect the ultimate points of being totally right (at the top left) and totally wrong (at

EXHIBIT 3
TWELVE-MONTH MOVING AVERAGE OF STYLE SPREADS



the lower right). There are 348 months in our sample, from July 1968 to June 1997. Someone who is able to predict every single one of the 348 months correctly and choose the right style to invest in could have earned a 33.81% average annual return, or 17.47 percentage points above the average total return of the FT All Share during the past thirty years. Assuming 100 basis points transaction costs for every switch, the perfect foresight strategy results in 160 switches, which reduces the average returns to 28.29%. At the other extreme, an investor who is consistently wrong on the direction of the spread would generate an average gross annual return of 0.38% or –5.14% after deducting transaction costs.

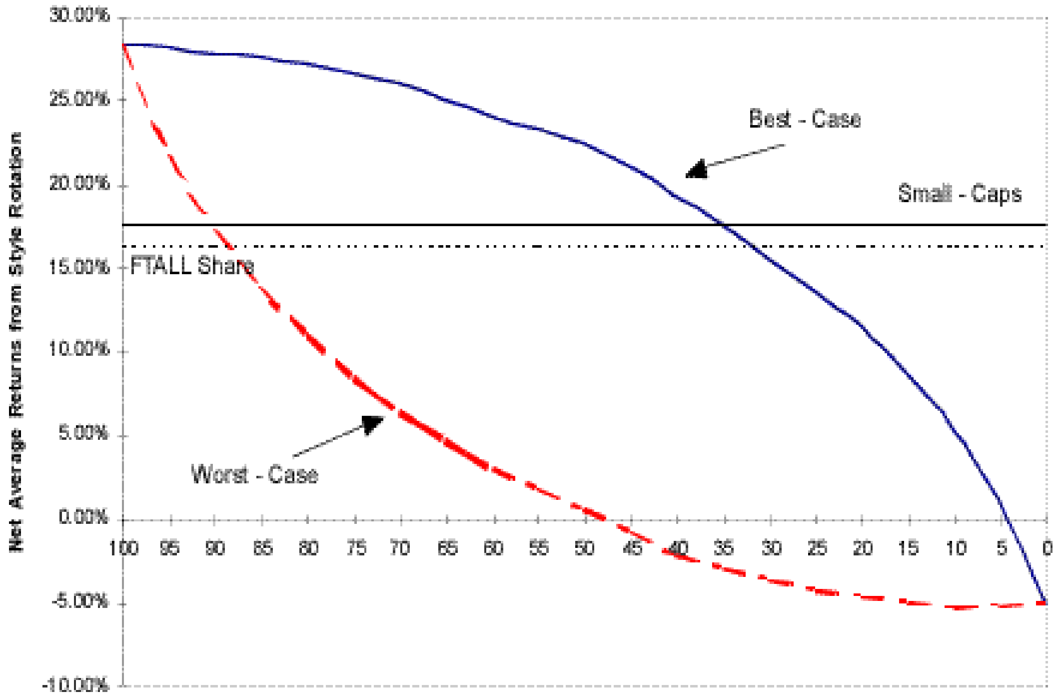
We assume that an investor can succeed in forecasting only a given percentage of these 348 months. To assess the robustness of style rotation, we calculate the highest and the lowest possible profits under different forecasting accuracy levels starting from 5% to 95%. The best case scenario for a 60% accuracy rate, for example, corresponds to the case when an investor manages to capture the best 209 (60%) months with the highest absolute return spread. The worst case scenario on the other hand is when an investor misses the 139 best months (40%). In this case, of course, the transaction costs exceed the potential benefits of rotation.

Exhibit 4 shows the impact of forecasting accuracy rates on the net average annual returns. The upper curve corresponds to the best case scenario, the lower curve to the worst case scenario for the same accuracy level. The slope of the upper best case curve falls gradually at the top but becomes steeper as the timing accuracy rate diminishes. Exactly the reverse applies to the lower worst case curve; the downward slope is steepest at the beginning and flattens at the end.

It is interesting to note that even with a modest 35% forecasting ability the highest possible profits from rotation exceed the profits of the FT All Share index and break even with the performance of the small-cap index. An investor who picks the wrong months (worst case scenario) needs more than a 90% accuracy rate to have an advantage over passive strategies.

We also experiment with transaction costs of 200 basis points for every switch. The higher costs obviously have a negative effect on the rotation profits. The net average annual return for a perfect foresight strategy is now reduced to 22.77%. In addition, at least a 55% accuracy rate is required to outperform the small-cap passive benchmark.

EXHIBIT 4
IMPACT OF STYLE TIMING ACCURACY RATES ON NET ANNUAL RETURNS
(SMALL VERSUS LARGE ROTATION)



Consider the same type of analysis in the case of value/growth rotation. A perfect foresight rotation strategy earns a 29.10% gross average annual return or 24.51% net of 100 bp transaction costs; this is just 93 bp more than the return of a value buy-and-hold strategy. The downside risk, however, is also less than in the case of small/large rotation. The gross returns of a rotation strategy that has been totally wrong in forecasting the sign of the value/growth spread are 6.47%, or 1.88% after adjusting for transaction costs. It is obvious that the smaller variation of the value spread makes rotation less profitable but less risky as well.

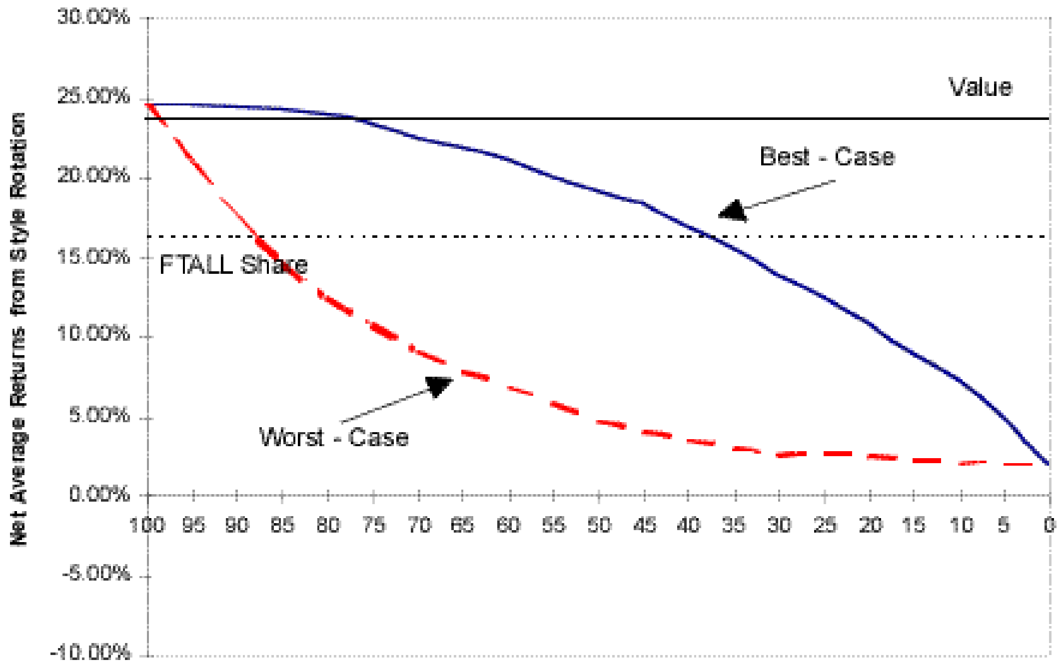
Exhibit 5 shows the minimum and maximum possible gains for value/growth rotations corresponding to different levels of forecasting accuracy. The shapes of the curves look the same as in Exhibit 4, but the distance between them is now narrower, indicating the lower risk that is involved with value/growth rotation. In this case, however, even if investors always pick the right month, they need a minimum of 75% accuracy to exceed the value buy-and-hold strategy.

The results for the value/growth rotation strategy are even more disappointing when applying a 200 bp transaction cost. Even if someone could forecast the sign of the style spread in all months correctly, the investor would not be able to outperform the value buy-and-hold strategy.

The analysis shows that being generally accurate in style rotation is important, but not as important as being accurate at certain periods in time. Jeffrey [1984] shows that high forecasting accuracy may not necessarily correspond to high returns if one misses some of the few months when the absolute spread is very wide. A skillful market timer, therefore, is the one who not only manages to forecast with high accuracy rate but also can be right on the months that count most.

So far, we have assumed that an investor makes either the best or the worst possible choice for a given level of forecasting accuracy. For each accuracy rate, however, there is a whole distribution of profits. To assess the *average* profitability of a style rotation strategy, one has to estimate the entire distribution of the profit/loss function at different levels of forecasting skill. Thus, we conduct a simulation experiment in which

EXHIBIT 5
IMPACT OF STYLE TIMING ACCURACY RATES ON NET ANNUAL RETURNS
(VALUE VERSUS GROWTH ROTATION)



each iteration corresponds to a different combination of months assumed to be correctly predicted for a certain probability rate, and consequently produces a different gross average annual profit and loss schedule. We run a simulation with 10,000 iterations and estimate the distribution of the resulting profits for four different forecasting accuracy levels — 50%, 60%, 70%, and 80%.

Exhibit 6 shows the simulated cumulative distributions of the net annual returns that result from a monthly rotation strategy with small- and large-cap stocks. Each curve corresponds to a different level of forecasting accuracy. The straight line denotes the average annual return performance of the small-cap index, which is the target threshold.

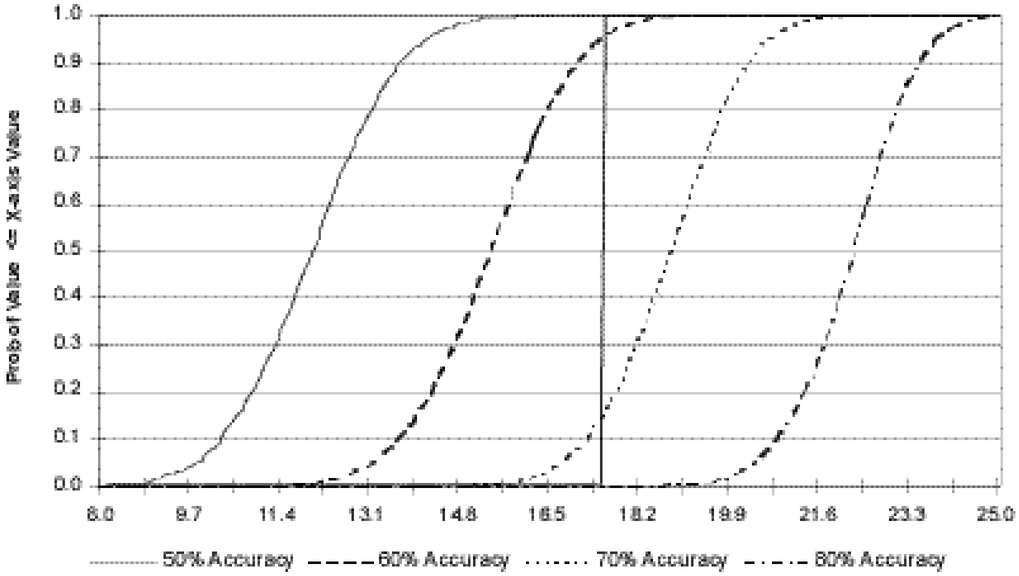
The impact of accuracy rates on the distribution of rotation profits is clear from the graph. The whole distribution is shifted to the right as the rate of forecasting accuracy increases. The simulated mean annual return after adjusting for 100 basis points transaction costs is 12.15% with a 50% accuracy rate; 15.51% with 60%; 18.90% with 70%; and 22.34% with 80%.

Applying 200 basis points every time a switch is made reduces the net annual returns about 4 percentage points. Even a 70% accuracy ratio this time is not very likely to outperform the small-cap index. The average net returns for a 70% accuracy rate is 14.03% when transaction costs of 200 basis points are assumed.

We again apply the same simulation exercise to the value/growth rotation scheme. Exhibit 7 gives the distributions of annual net returns from rotation for different accuracy rates. The means of the simulated distributions after the deduction of 100 basis points transaction costs are 12.85%, 15.17%, 17.61%, and 20.14% for the four accuracy rates. These results show that even with a rotation scheme with an 80% accuracy rate it is almost impossible to beat the value buy-and-hold strategy. The returns are significantly reduced when we repeat the simulations with 200 basis points transaction costs.

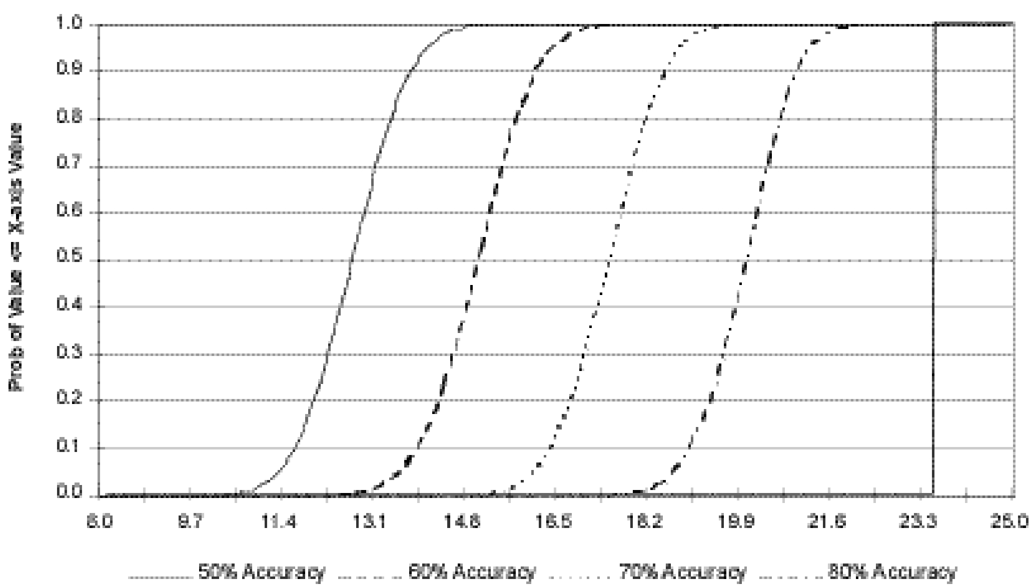
In short, our results suggest that a successful value/growth rotation strategy requires considerable levels of forecasting skill. More specifically, after controlling for transaction costs, one needs to be correct more than 80% of the time to exceed the performance of a buy-and-hold value strategy. Thus, the long-term consistency of value stocks makes any attempt to take

EXHIBIT 6
SIMULATED NET ANNUAL RETURN DISTRIBUTIONS (SMALL VERSUS LARGE ROTATION)



100 basis points are deducted every time a switch is made. The vertical line is the average annual return of the small-cap buy-and-hold strategy, which is the target threshold.

EXHIBIT 7
SIMULATED NET ANNUAL RETURN DISTRIBUTIONS (VALUE VERSUS GROWTH ROTATION)



100 basis points are deducted every time a switch is made. The vertical line is the average annual return of the small-cap buy-and-hold strategy, which is the target threshold.

advantage of its monthly variations rather risky with anything less than really superior forecasting skills.

The results are more promising for size style rotation. Further evidence suggests that a 65% to 70% accuracy rate is not beyond the scope of a relatively simple forecasting model based on economic fundamentals.

DETERMINANTS OF SIZE AND VALUE SPREADS

An effective implementation of a style rotation strategy requires the development of some type of model to predict the relevant style spreads. We test the sensitivity of the size and value spreads to variables as follows: the annual percentage change in the coincident indicator; the monthly change in the three-month Treasury bill yield; a term structure variable defined as the monthly yield difference between the twenty-year government gilt and the three-month Treasury bill; and an inflation variable derived from the monthly logarithmic change in the consumer price index. We also test the monthly equity risk premium, the monthly change in the pound/dollar exchange rate, and a dividend yield ratio variable that corresponds to the average dividend yield of one index over the average dividend yield of the other. All the variables that are used are lagged one month to ensure that the tests are predictive in nature.[6]

Exhibit 8 reports results from univariate, multiple ordinary least squares, and logit estimation on the small/large spread for the whole sample period (July 1968-June 1997).[7] The first column shows the results of univariate OLS regression and the second of multiple OLS. All OLS regressions have been corrected for heteroscedasticity using the method suggested by White [1980]. The last column in Exhibit 8 gives coefficients and t-statistics from a logit regression estimation, which uses as a dependent variable a binary variable that takes the value of one if the spread is positive and zero if the spread is negative.

In the univariate regression, the inflation and the equity risk premium are highly significant, while the term structure and the dividend yield ratio only marginally pass the significance test. All the variables retain their sign in OLS and logit estimation, and some of them become more significant. The adjusted R^2 in the multiple OLS regressions is 12.33%, and the value of the log likelihood function 642.05. The particular selection of variables gives the highest adjusted R^2 and the lowest Akaike information criterion. The results of the regressions point out that small-cap returns benefit from rising interest rates and equity risk premium, widening of the yield curve, and lower rates of inflation.

Exhibit 9 shows the coefficients and the t-statistics from the regressions on the value/growth spread. In contrast to the size spread regressions, the term structure, the equity risk premium, and the dividend yield ratio are now insignificant in the univariate OLS regressions, and

EXHIBIT 8
DETERMINANTS OF SMALL/LARGE SPREAD

	Univariate OLS	OLS	Logit
Constant		–0.0140	–0.5839
		(–1.3578)	(0.8993)
Inflation	–1.1769	-1.4503	-51.4201
	(–2.6860)	(–2.9284)	(–2.3330)
Term Structure	0.0021	0.0008	0.1290
	(1.7828)	(0.7403)	(2.1570)
Annual Change in Coincident Indicator	0.0548	0.0461	2.2591
	(1.5102)	(1.2543)	(0.9720)
Change in Three-Month T-Bill Yield	0.0294	0.0411	2.3729
	(1.2440)	(2.1989)	(1.5426)
Small/Large Dividend Yield Ratio	0.0283	0.0238	0.9051
	(1.6927)	(1.9067)	(1.2059)
Equity Risk Premium	0.1996	0.0411	11.9202
	(2.9033)	(2.1989)	(3.7066)

Monthly difference between returns of low market value index and high market value index (equal-weighted and same market-to-book ratio). All independent variables are lagged one month. T-statistics are reported in parentheses.

are not included in the other estimation procedures. Instead, the one-month lagged value/growth spread together with the inflation variable seems to be the most important explanatory factors. The inflation sign is consistent with the U.S. findings and indicates that rising inflation hurts value stocks more than growth stocks, causing the next-month return spread to be negative.

The change in the short-term interest rate and the annual change in the coincident indicator that seem to be marginally significant in the univariate case become insignificant when they are regressed together with other variables. The monthly change in the £/$ exchange rate exceeds the 95% significance level in all estimation cases. The sign of the variable indicates that a rise in the monthly £/$ exchange rate benefits growth more than value securities. The adjusted R^2 of the model is lower than in the case of the small/large spread but still at a satisfactory level, 9.56%.

STYLE ROTATION BASED ON THE LOGIT REGRESSION MODEL

The logit regressions suggest that the sign of the style spreads is related to a number of economic and market characteristics. Thus, forecasting the sign of the style spread may be sufficient for a successful style rotation strategy. We classify each month as 1 or 0 based on the sign of the style spread. If in a particular month small-caps (value stocks) perform better than large-caps (growth stocks), we classify this month as 1; otherwise we set it to 0. We use the variables described previously as predictors.

Fitting the two logit models, we get the form:

$$\log \frac{\hat{P}_t}{1-\hat{P}_t} = \hat{a} + \hat{b}X_t$$

The conditional probability $\hat{P}_t$ gives the likelihood that the next month will be a value (growth) or a small-cap (large-cap) month and is clearly the focus of this exercise. We use a recursive forecasting technique and a holdout sample of 276 months for out-of-sample evaluation. An initial estimation period of seventy-two months from July 1968 through June 1974 is used to generate probabilities for the next twelve months starting from July 1974 through June 1975. Then the previous twelve months are added to the estimation peri-

EXHIBIT 9
DETERMINANTS OF VALUE/GROWTH SPREAD

	Univariate OLS	OLS	Logit
Constant		0.0111	0.8363
		(6.6317)	(4.9181)
[Value-Growth] (–1)	0.2140	0.2059	18.0020
	(3.7413)	(3.6142)	(3.1944)
Annual Change in Coincident Indicator	0.0404	0.0218	1.7330
	(1.9410)	(1.0520)	(0.7789)
Inflation	–0.5777	-0.5355	–42.6208
	(–3.3918)	(–3.1417)	(–2.5598)
Change in Three-Month T-Bill Yield	–0.0131	-0.0071	–0.7569
	(–1.9596)	(–0.5158)	(–0.5141)
Term Structure	0.0004		
	(0.9204)		
Monthly Change in £/$ Exchange Rate	–0.0850	-0.0926	–4.8142
	(–2.1185)	(–2.4233)	(–2.4177)
Equity Risk Premium	0.0298		
	(1.0776)		
Value/Growth Dividend Yield Ratio	–0.0001		
	(–0.0298)		

Monthly difference between returns of low MB index and high MB index (equal-weighted and same market value). All independent variables are lagged one month. T-statistics are reported in parentheses.

od, and the model is reestimated. Using the new coefficients, we generate probability estimates for the following twelve months, starting from July 1975 through June 1976. The procedure is repeated twenty-three times, and a time series of logit probabilities for both spreads is generated.

A probability value above 0.5 indicates that a month that favors small-caps is likely to occur, while a probability value below 0.5 indicates a preference for large-cap stocks. To evaluate the model, we assume that if in a particular month the spread is positive and the probability is above 0.5, or if the spread is negative and the probability is below 0.5, the forecast has been successful; otherwise, the forecast has failed. According to this criterion, we find that the first model results in 60.14% of correct predictions. The model for the small/large spread gives 175 months (63.41%) when the logit probability is higher than 0.5 and 101 months (36.59%) when the estimated probability is lower than 0.5.

The second model for the value/growth spread gives a 68.84% accuracy rate, when employing the 50% cutoff point criterion. According to the estimated probabilities, there are 228 months (82.61%) when the logit probability is higher than 0.5 and just 48 months (17.39%) when the probabilities signal a growth month ($\hat{P}_t < 0.5$).

Exhibit 10 provides the results of different trading strategies that can be developed based on the estimated logit probabilities, and compares their performance with the performance of various passive strategies. Strategy 1 invests 100% in small-cap securities whenever the logit model signals a small-cap month (probability greater than 0.5), and moves to 100% large stocks, whenever the logit model signals an upcoming large-cap month (probability less than 0.5).

The drawback of strategy 1 is that it classifies each month as either small-cap or large-cap favorite, regardless of the magnitude of the probability. To minimize this limitation and to make the allocation strategy more effective, we test two other trading rules.

Strategy 2 defines the probability range of 0.45–0.55 as neutral, and in this case simply allocates 100% of the funds to the same equity class as in the previous month. Strategy 3 assumes that a two-month trend (sequential signal) in the predicted probabilities will give a better indication of the likelihood of differences in equity class returns in subsequent time periods. Therefore, it requires the predicted probabilities to be higher (lower) than 0.5 not just for the current month

EXHIBIT 10
RESULTS OF LOGIT FORECASTING MODEL FOR SMALL/LARGE SPREAD (1974-1997)

	Strategy 1	Strategy 2	Strategy 3	Perfect Foresight	Small-Cap	Large-Cap	FTALL
Average Annual Returns (%)	25.20	25.02	24.634	37.46	20.58	20.21	20.07
net of trans costs (100 bp)	(23.24)	(23.93)	(23.40)	(32.11)			
net of trans costs (150 bp)	(22.26)	(23.39)	(22.79)	(29.44)			
net of trans costs (200 bp)	(21.28)	(22.85)	(22.18)	(26.76)			
End of Period Wealth	£ 21,405	£ 20,724	£ 18,698	£ 310,429	£ 7,795	£ 5,864	£ 5,848
net of trans costs (100 bp)	(£ 13,479)	(£ 16,068)	(£ 13,998)	(£ 93,311)			
net of trans costs (150 bp)	(£ 10,677)	(£ 14,135)	(£ 12,105)	(£ 50,932)			
net of trans costs (200 bp)	(£ 8,448)	(£ 12,426)	(£ 10,465)	(£ 27,716)			
Break-Even Transaction Costs (benchmark: small-cap index)	217 bp	379 bp	301 bp				
Standard Deviation	18.18	17.95	17.93	20.59	17.18	22.13	21.86
Sharpe Ratio	1.39	1.39	1.37	1.82	1.20	0.91	0.92
Recommended Switches	47	26	59	123			
% of Correct Predictions	60.14%	60.87%					
% of Small-Cap Predictions	63.41%	62.68%	54.71%	51.09%			
% of Large-Cap Predictions	36.59%	37.32%	27.90%	48.91%			
% of Neutral Positions			17.39%				

Break-even transaction costs for each strategy are transaction costs that give the same end-of-period wealth as the small-cap passive index.

but for the previous month as well, before it signals a 100% allocation of funds to small-caps (large-caps). If this condition is not met, then a 50/50 fixed allocation is preferred. Strategies 2 and 3 both result in reducing the amount of monthly switches and therefore the transaction costs.

In Exhibit 10 are the average annual returns and the end-of-period wealth that corresponds to an initial investment of £100 for each timing strategy, assuming different levels of transaction costs. Exhibit 10 also reports the annualized standard deviation and the Sharpe ratio as well as the number of recommended switches for each strategy. For comparison purposes, we also give the relevant figures for the perfect foresight strategy and three passive buy-and-hold strategies (small-cap, large-cap, and All Share).

It is clear that all three timing strategies perform much better than the buy-and-hold strategies even after adjusting for high levels of transaction costs. Strategy 1 seems to be the most profitable when no transaction costs are taken into account. When 100, 150, or 200 basis points are deducted every time a switch is made, the second strategy appears to be preferable.

It is interesting to note that although the three rotation strategies perform much better than the buy-and-hold strategies, they do not involve higher risk. The standard deviation is about 18% for all three rotation strategies, which results in Sharpe ratios before transaction costs between 1.39 and 1.37. Not surprisingly, the third rotation strategy is the one with the lowest historical volatility, 17.93%.

For each timing strategy, we calculate the level of transaction costs that gives the same end-of-period wealth with the small-cap buy-and-hold strategy. Rotation strategy 1 can be advantageous with transaction costs up to 217 basis points, while the second strategy gives a winning edge with transaction costs less than 379 basis points. Institutional investors that can switch from one equity class to another and pay less than 301 basis points every time can also make profits by following the last rotation strategy.

Although the model can predict with an accuracy rate of nearly 60%, the trading strategies developed from the model easily outperform the passive indexes. This may indicate the ability of the probability model to capture the "good" months in our sample period. The potential gains from a perfect foresight strategy remain far from reach, implying that there is room for further improvement.

The results of the value/growth spread model

EXHIBIT 11
RESULTS OF LOGIT FORECASTING MODEL FOR VALUE/GROWTH SPREAD (1974-1997)

	Strategy 1	Strategy 2	Strategy 3	Perfect Foresight	Value	Growth	FTALL
Average Annual Returns (%)	27.47	27.12	26.84	32.28	26.67	15.27	20.07
net of trans costs (100 bp)	(26.18)	(26.29)	(25.47)	(27.84)			
net of trans costs (150 bp)	(25.53)	(25.87)	(24.84)	(25.63)			
net of trans costs (200 bp)	(24.89)	(25.454)	(24.18)	(23.41)			
End of Period Wealth	£ 33,128	£ 30,651	£ 28,859	£ 98,271	£ 27,506	£ 2,122	£ 5,848
net of trans costs (100 bp)	(£ 24,411)	(£ 25,085)	(£ 24,494)	(£ 36,330)			
net of trans costs (150 bp)	(£ 20,931)	(£ 22,676)	(£ 22,750)	(£ 22,008)			
net of trans costs (200 bp)	(£ 17,933)	(£ 20,487)	(£ 21,007)	(£ 13,299)			
Break-Even Transaction Costs (benchmark: value index)	61 bp	54 bp	29 bp				
Standard Deviation	20.15	20.13	20.07	20.04	20.32	19.66	21.86
Sharpe Ratio	1.36	1.35	1.34	1.61	1.31	0.78	0.92
No. of Recommended Switches	31	20	33	102			
% of correct predictions	68.84%	67.39%					
% of Value predictions	82.61%	85.28%	83.33%				
% of Growth predictions	17.39%	14.72%	5.43%				
% of neutral positions			11.23%				

Break-even transaction costs for each strategy are transaction costs that give the same end-of-period wealth as the value passive index.

confirm the message of our simulation experiment and are in line with the notion that the value buy-and-hold strategy is superior to value/growth rotation. We evaluate three value/growth strategies following the same principles as in Exhibit 10, and present the results in Exhibit 11. Ignoring transaction costs, all three strategies perform slightly better than the passive value buy-and-hold index. When transaction costs are taken into account, the profits from the rotation strategies are significantly reduced. Increasing the level of transaction costs and calculating the end-of-period wealth net of 100, 150, and 200 basis points, we cannot find any rotation strategy that is superior to the value buy-and-hold.

The volatilities and the Sharpe ratios indicate that almost all the strategies have the same volatility, but their Sharpe ratios are slightly better than the value index — between 1.36 and 1.34, compared to 1.31 for the passive value buy-and-hold strategy.

The solution to the linear programming problem to calculate the amount of transaction costs to break even leads to the same conclusion. The first trading rule can be advantageous for institutional investors that can make trades without losing more than 61 basis points, while the two neutral strategies can make profits relative to the value index with transaction costs of up to 54 and 29 basis points, respectively. The actual transaction costs of the rotation strategies, however, are very unlikely to be that low as the specific trades (move from 100% value to 100% growth) impose very high turnover rates.

These results suggest that our model for the value/growth rotation can only marginally outperform the passive index alternative, and when transaction costs are assumed no real benefits can be gained. Even though the model can predict the monthly style trend more accurately than the size spread, the relative advantage that it offers is much more modest. A very high accuracy rate and precision is needed for a market timer to outperform the value buy-and-hold strategy.

CONCLUSION

During the thirty-year period 1968 through 1997, value and small-cap stocks in the U.K. outperformed their growth and large-cap counterparts by an average of 1,160 and 80 bp per year. Our simulation results suggest that forecasting the size spread with a 65%-70% accuracy rate may be sufficient to outperform a long-term small-cap strategy. Beating a long-term value strategy, however, is markedly more difficult; it requires more than an 80% forecasting ability.

We identify a number of macroeconomic and market factors that appear to predict the direction of the next month's style spread. More specifically, our logit regressions suggest a significant relation between economic activity, or more generally the stage of the business cycle, and the equity style spread dummy. Using the fitted logit probabilities, we develop and test three alternative trading rules. Our results suggest that while style rotation strategies based on small and large firms can be highly rewarding, they are only marginally successful in the case of value and growth stocks.

The fundamental implication of our findings is that the profitability of style rotation strategies depends entirely on the temporal volatility of the underlying return spread between the styles that the manager is following. Thus, the ongoing debate among professional fund managers about style consistency and market performance is fundamentally an empirical question.

Style consistency is a prudent strategy for investors with very long investment horizons and strong views on the performance of the targeted style. In all other cases, controlled style rotation strategies based on the underlying fundamental characteristics of the relevant style indexes can be value-enhancing.

ENDNOTES

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[1]For early evidence on the size effect in the U.K. see Levis [1985], and for recent European evidence see Levis and Steliaros [1999].

[2]To avoid the problems of accounting definitions we exclude from our sample banks, insurance companies, investment trusts, and property companies.

[3]We calculate the ratio as follows:

$$\frac{BV}{MV} = \frac{\text{(Equity Capital + Reserves)} - \text{(Good Will and Other Intangibles)}}{\text{Market Value of Equity}}$$

We deduct the goodwill and the other intangibles from the numerator to make the ratio less subject to manipulation. Some companies write intangibles in their balance sheets and therefore report high book values of equity, while others exclude them and report lower book values. To ensure that companies calculate the book value of equity in the same way, we deduct this term from the numerator.

We confine the analysis to companies with positive BM ratios. The companies in our sample with negative book values range from thirteen in 1968 to 101 in 1996.

4Most companies in the U.K. have fiscal year-ends of December 31, but a number of firms use the last day of March. Practically all companies, however, publish their financial statements within three months of the end of the fiscal year. For this reason, we decide to form portfolios and measure their performance at the end of June, so that our tests would be predictive in nature both for companies with December and March fiscal year-ends, and so that we do not use accounting information that is not actually available to the investor at the time of portfolio formation. We thus avoid a possible look-ahead bias (see Banz and Breen [1986]).

5Our results are consistent with the average annual returns of Hoare Govett, the well-established U.K. small-cap index, over the same period. The total returns of the Hoare Govett Smaller Companies index from 1968 through 1997 was 17.9% (see Dimson and Marsh [1998]).

6There is no severe multicollinearity problem in using all these variables in the regression. The highest correlation is 0.31 between the term structure variable and the dividend yield ratio.

7We also use a GMM (generalized method of moments) estimation that yields results that are robust to both heteroscedasticity and serial correlation, but the results were not different, and are not reported.

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