Style factor timing: An application to the portfolio holdings of U.S. fund managers

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Abstract

This study develops a style rotation model based on quarterly forecasts of style factor returns, across four style categories, generated using market and macroeconomic data. The prescriptions from this model are tested on a sample of U.S. active equity mutual funds' portfolio holdings. An annual buy-and-hold style timing strategy investing in the factor with the highest forecast return each quarter achieves an average annual excess return of 7.26%, significant at the 1% level over 1981-2011. However, a fund-of-fund timing strategy investing in the funds with the greatest exposure (i.e., the preferred funds) to the style predicted to outperform over the following year does not generate statistically significant DGTW-adjusted performance. The lack of performance is primarily because the long-only funds are by nature unable to fully exploit the long-short style factor returns. This highlights the issue of using long-short portfolio returns, particularly when evaluating fund performance.

Keywords
Mutual funds, style timing, macroeconomic data, investment performance, stock holdings

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Background

Since the seminal papers on market timing by Treynor and Mazuy (1966) and Henriksson and Merton (1981) a number of studies investigate whether investment styles can be timed (Bird and Casavecchia, 2011; Chen and De Bondt, 2004; Copeland and Copeland, 1999; Desrosiers, L'Her and Plante, 2004; Kao and Shumaker, 1999; Knewtson et al., 2010; Levis and Liodakis, 1999). The emphasis has been on the popularised four factors; Market, Size, Value and/or (to a lesser extent) Momentum (Carhart, 1997; Fama and French, 1993; Jegadeesh and Titman, 1993). Recently, industry participants have been focusing on timing the underlying style factors i.e., 'Factor Timing', using fundamental and/or macroeconomic information. The results indicate that style rotation strategies can exhibit significant timing ability, which translates into better performance when incorporated into the strategies of their mutual fund portfolios (Luo et al., 2010; Smith and Malin, 2010). Moreover, Levis and Liodakis (1999) determine that style consistency is not ideal with style rotation able to improve fund returns. Similarly, Wermers (2002) finds that style-consistent managers often underperform their more style-cavalier counterparts.

The motivation of this paper is two-fold. Firstly, we develop a style rotation model based on market and macroeconomic variables at the stock level over the period 1981-2011. Secondly, our paper extends academic research in this area by testing the prescriptions from the model on the portfolio holdings of a large sample comprising 1,856 US active equity mutual funds from 1981-2010. As a result, information as to whether a mutual fund-of-funds (FoF) timing strategy is implementable is provided. We define a FoF as a fund which invests in other mutual funds.

The academic literature focuses on determining whether individual styles can be timed and whether fund managers (in the US and globally) exhibit market and/or style timing skill (Bollen and Busse, 2005; Daniel, Grinblatt, Titman and Wermers (DGTW), 1997; Glassman and Riddick, 2006; Kacperczyk, Van Nieuwerburgh and Veldkamp 2011; Kao, Cheng and Chan, 1998; Shukla and Singh, 1997; Swinkels and Tjong-A-Tjoe, 2007). This paper contributes to the style timing literature by analysing a broader range of investment styles than previously, across seven style categories; Value, Growth, Quality Growth, Quality Stability, Momentum, Size and Low Volatility. Previous research supports the extension of the opportunity set of style factors[1]. A representative underlying style factor is selected for analysis from each category. The style timing strategy developed analyses the style factors simultaneously, which contrasts to previous literature in this area which tests timing strategies for each style separately. In addition, this paper contributes to the mutual fund literature by analysing whether the portfolio holdings of US mutual funds may be used to implement a long-only FoF timing strategy. In the portfolio holdings literature, DGTW (1997) use the stock holdings of funds to investigate whether managers have style timing skill, on average. However, the FoF literature has not been linked to the portfolio holdings literature in order to test the efficacy of a fund timing strategy[2]. Thus, this paper provides information relating to portfolio construction which is particularly relevant to industry parties such as investment managers, advisors and consultants.

[1] Ang et al. (2006); Bali et al. (2008); Barbee et al. (1996); Basu (1983); Bird and Casavecchia (2007); Chan et al. (1991); Chan et al. (1998); Chen and Zhang (2007); Clarke et al. (2010); Davis (1994); Dechow and Dichev (2002); Dichev and Tang (2009); Fairfield and Whisenant (2000); Fama and French (1988); Gallagher et al. (2012); George and Hwang (2010); Lakonishok et al. (1994); Lie and Lie (2002); Lockwood and Prombutr (2010); Lui et al. (2007); Mercer (2012); Mohanram (2005); Piotroski (2000); Zhang (2000).

[2] Extant mutual FoF research focuses on diversification benefits (Brands and Gallagher, 2005), style characteristics (Stein and Rachev, 2009) and performance (Bertin and Prather, 2009).

The style factors selected for analysis are; Book-to-Market (B/M), Dividend-to-Price (D/P), Net Profit Margin (NPM), Return-on-Equity (ROE), Return-on-Asset Variability (ROA VAR), Momentum (MOM), Size and Stable-minus-Volatile (SMV)[3]. A multivariate forecasting model is developed and the independent market/macroeconomic variables[4] included are updated every five years i.e., there are six forecasting models used over the sample period, and these are unique to each style factor. As a result, a time-series of forecast style factor returns is developed for each style factor over 1981-2011. The forecasts are made each quarter, for the return on a 12-month buy-and-hold investment in the style factor commencing in two quarters' time. The structure of the strategy is designed to be exploitable by an investor in real time, therefore only data which are publicly available at each point in time, over the sample period are used.

Investing in the style factor which has the maximum forecast each quarter, generates an average annual excess return of 7.26%, which is statistically significant at the 1% level. The timing strategy's average return is greater than the return to the B/M, ROE and SIZE factors; however MOM achieves a slightly higher average return of 7.90%. However, investing in MOM alone incurs a higher level of risk and as a result the Sharpe Ratio is 17% lower than the timing strategy. In the interests of reducing turnover, an annual strategy based on the quarterly forecasts is also tested. It involves rebalancing once a year in Q_i (where $1 \leq i \leq 4$), e.g. to invest in each calendar year the Q_3 forecasts are used. Investing in any of the four annual investment options yields a statistically significant, average annual excess return over the sample period, which ranges from 6.59% to 9.01%. In summary, a style timing strategy

[3] The forecasts generated for Dividend-to-Price, Net Profit Margin, ROA Variability and Stable-minus-Volatile are not statistically significant when compared to the actual returns. Therefore, these factors are omitted from the stock and fund timing strategy tests.
[4] A set of 25 potential market/macroeconomic variables to include in the forecasting models is selected following an in-depth review of the literature. Refer to Appendix A.

using a range of style factors based on market and macroeconomic data is profitable over the sample period.

Given that a stock selection strategy using the style factor forecasts generates outperformance, our study tests whether a similar timing strategy using the mutual funds based on the style forecasts also generates outperformance. In Q_3 of each year *t*,[5] a weighted-average quintile rank ($WRank_{j,t}$) is computed for each fund *j* based on its stock holdings, in order to identify the funds which have the greatest exposure to the style factor which has the highest forecast. Funds are sorted into quintiles based on their exposure to the preferred style as indicated by $WRank_{j,t}$ in Q_3 of each year *t*. The first year for which holdings data is available is 1980 thus portfolio formation occurs from 1980-2009. The average returns to the quintiles are examined over year *t+1* i.e., over 1981-2010. Quintile 5 (1) contains funds with the greatest (lowest) exposure to the preferred style i.e., the preferred (unpreferred/out-of-favour) funds. The average annual market-adjusted and DGTW-adjusted returns are all statistically insignificant. Thus, a style timing strategy at the aggregate fund level (i.e., from a FoF management perspective) does not generate statistically significant outperformance over the sample period. Furthermore, this result is consistent when broken down by style category.

Further investigations as to why the performance identified at the stock level does not translate to the fund level are conducted. The preferred funds' exposures to the preferred style factor decrease over the investment horizon and the funds are also highly exposed to the other factors. Moreover, alternative implementation methods do not improve the fund level results. However as the funds in our sample are long-only in nature, we modify our factor timing strategy using long-only style factor forecasts. After the long-only constraint is applied at the

[5] Thus, an annual strategy is tested using the Q_3 forecasts which cover the following calendar year.

factor level, the earlier significance disappears. We therefore conclude that the result is primarily due to the fact that the funds are long-only in nature and thus unable to attain the long-short style factor return. It follows that the use of long-short style factor portfolios in relation to long-only mutual funds in order to undertake tasks such as performance evaluation may not be appropriate.

The remainder of this paper is organised as follows; the subsequent two sections outline the data used and the relevant summary statistics, respectively. Methodology describes the research methodology developed and then the results are discussed. Finally, concluding remarks are provided.

Data

Style factor data

The style factors considered for inclusion in this study are selected following a review of the academic literature. Table 1 outlines the 19 variables considered- within the value, growth, quality, momentum, size and low volatility categories- and how each variable is calculated. The required stock price and accounting data are sourced from CRSP and Compustat, respectively via Wharton Research Data Services (WRDS).

INSERT TABLE 1

The style factors are constructed in a similar fashion to the Factor Mimicking Portfolios of Chan, Karceski and Lakonishok (1998), which are inspired by the work of Fama and French (1993). All common stocks listed on the NYSE, AMEX and NASDAQ are included; however stocks are assigned to portfolios based on the breakpoints for NYSE stocks only.

The style factors which are constructed using accounting metrics are calculated as follows; in June of each year *t*, firms are sorted into quintiles based on the value of the metric in question for the fiscal year ending in year *t-1*. Returns are then computed from July of year *t* to June of year *t+1*. For the value metrics, firms with zero or negative values of the numerator are excluded. Size is measured as the value of market equity as at June of each year *t*. The value/growth (size) factors are constructed as the difference between the value-weighted average return of firms in the top (bottom) quintile and the value-weighted average return of those in the bottom (top) quintile. The quality factors may be considered as two distinct groups; quality growth factors; Return-on-Equity (ROE), Return-on-Assets (ROA) and Operating Cash Flow (OCF) and quality stability factors; Leverage (LEV), Sales Growth Variability (SG VAR) and ROA Variability (ROA VAR). Financial firms (SIC 6000-6999) are excluded from the quality portfolios as metrics such as leverage may have a different meaning than those for nonfinancial firms (Kisgen, 2009). The quality growth factors are calculated as per the value and growth factors. Whereas, the quality stability factors are calculated as the difference between the value-weighted average return of firms in quintiles one to four and the value-weighted average return of those in the top quintile. This method is used for these stocks as the performance relationship is one-sided with firms in the top quintile experiencing poor performance; however stocks in the bottom quintile do not experience strong performance.

The momentum factor is calculated in a similar vein to the Carhart (1997) PR1YR factor. It is constructed as the value-weighted average of firms with the highest 20 percent 11-month returns lagged one month minus the value-weighted average of firms with the lowest 20 percent 11-month returns lagged one month. Portfolios are rebalanced monthly.

Recently, the academic literature emphasises that portfolios created from stocks with low idiosyncratic volatility have higher returns than those comprising stocks with high idiosyncratic volatility (Ang et al., 2006). The low volatility factor; stable-minus-volatile (SMV) is thus created as the value-weighted average return to the lowest quintile of stocks based on historical idiosyncratic volatility minus the value-weighted average return to the highest quintile of stocks based on historical idiosyncratic volatility. Quintiles are formed at the end of each month and weighted by market-capitalisation at the portfolio formation date. Historical idiosyncratic volatility is calculated each month as the standard deviation of the error term, over the prior 60-months, from an OLS regression of the stock's return in excess of the risk-free rate on the market return in excess of the risk-free rate, consistent with Clarke et al. (2010).

Market and macroeconomic data

The academic literature emphasises a myriad of market and macroeconomic variables as relevant for stock and fund returns. A comprehensive list of 25 potential variables to include as independent variables in the forecasting models is provided in Appendix A. Furthermore, Appendix B provides summary statistics for the variables.

The Bureau of Economic Analysis (BEA) has made a number of ex-post revisions to the export and import data used to compute the Balance of Trade (BOT). Given that the ex-post data is not available ex-ante to investors the original data are collected from the historical Survey of Current Business publications. The unemployment rate data are original data. The output gap is computed following Cooper and Priestley (2009) who collect original industrial production data in order to calculate the output gap. The authors state that the results are not affected when using either the revised or original data. Therefore, use of the revised data for industrial production to compute the output gap in this paper is not considered an issue. In order to minimise the impact of revisions for the other variables the approach Pesaran and Timmerman (1995) use is followed. Specifically, for the remaining economic variables a moving average over the prior 4 quarters is first computed for each quarter, and then the year-on-year change is calculated.

Mutual fund holdings data

The dataset used is created by merging the Thomson Reuters Mutual Fund Common Stock Holdings[6] (s12) Database with the CRSP Mutual Fund Database (CMFD), using MFLINKS. Refer to Appendix C for a detailed description of the dataset construction. The s12, CMFD and MFLINKS tables which facilitate the data merge are all sourced from WRDS. The s12 data is sourced from the SEC N-30D filings which funds are required to file semi-annually with the SEC. Up until 1985 funds were required by the SEC to file this data on a quarterly basis (WRDS, 2008). Although, about 60% of funds continue to provide this data quarterly (WRDS, 2012). The s12 database contains quarterly stock holdings data for US mutual funds and the CMFD contains monthly fund returns as well as fund characteristics. This study is interested in US active equity fund managers thus various exclusions are made to both datasets.

Firstly, only funds with the following self-stated investment objective classifications are included: Aggressive Growth (IOC=1), Growth (IOC=2) and Growth and Income (IOC=3). Following Kacperczyk, Sialm and Zheng (2008), funds which held less than 10 stocks and with portfolio assets less than $5m as at the end of the month prior are also removed.

[6]Also known as the CDA/Spectrum s12 database.

The s12 dataset contained 2409 unique funds prior to the merge with the CMFD, after merging the datasets 2047 unique funds remain. Subsequent to merging the two databases a manual check of the funds' names was undertaken to ensure misclassified funds are not included (Ali, Chen, Yao and Yu, 2008)[7]. Following removal of the misclassified funds, of which there are 191 in total, the final sample contains 1856 funds over 1980-2010.

Descriptive statistics

Style factors

Table 2 provides a summary of the annualised average monthly returns to the style factors over the complete sample period and various subset periods. The associated annualised standard deviations are also provided in parentheses.

INSERT TABLE 2

In summary, the various style factors perform differently to an extent within the style categories but clearly over time and in differing market conditions. Therefore, employing a time-series forecasting model based on these style factors is warranted given that their performance exhibits time-varying characteristics which may be exploited. In order to narrow down the 19 possible factors listed in Table 2, a representative factor is selected from the Value, Growth, Quality Growth and Quality Stability categories. Chan et al. (1998) emphasise that the importance of a style factor is directly proportional to the standard deviation of its returns. Thus, the representative style factors selected are those which have the greatest standard deviation over the forecast period (1981-2011). The chosen factors are

[7] Funds in the following categories are removed from the sample; Passive funds (n=72), Foreign-based and US-based international funds (n=62), real estate funds (n=29), balanced funds (n=15), variable annuity funds (n=10), convertible funds (n=1) and options funds (n=2).

as follows; D/P for Value, NPM for Growth, ROE for Quality Growth and ROA VAR for Quality Stability. Furthermore, B/M is included in the Value category given its prominence in the academic literature. Therefore, the eight style factors' returns which are forecast are: D/P, B/M, NPM, ROE, ROA VAR, MOM, Size and SMV.

Mutual fund sample

Table 3 reports summary statistics for our sample of US active equity mutual funds over 1980-2010. Average values of fund characteristic variables and returns are provided, the median is in parentheses. The average number of stocks held by the funds has increased from about 70 stocks over 1980-1990 to 111 over 2001-2010. The average age of the funds is 15 years over the complete sample period. 'Turnover' is an annual variable which represents the minimum of aggregated purchases and sales, divided by the average 12-month Total Net Assets of the Fund. Turnover remained relatively stable over the sample period with the average oscillating around 80%.

INSERT TABLE 3

'Expenses' represents the annual expense ratio, which is approximately 1% over 1980-1990 increasing to about 1.25% over 1991-2000 and 2001-2010. 'Equity Prop.' is the average proportion of the fund that is invested in common equity and it's calculated over the life of the fund. The majority of the funds' assets are invested in common equity, i.e., 87% over 1980-2010, which is not surprising given the data screens applied. 'TNA' is the fund's month end Total Net Asset Value, in millions. TNA grew over the sample period with the most dramatic increase, of approximately 150%, between 1980-1990 and 1991-2000.

'Total Load' is the sum of the front and rear loads, reported annually. The average Total Load fell from 3.5% over 1980-1990 to 0.87%, a decrease of 300%. It decreased further, settling at an average of 0.34% over 2001-2010. Management Fee (Mgt Fee) is only available from 1998-2010 and is the ratio of Management Fee ($) divided by Average Total Net Assets ($) reported as a percentage. Management Fees are very stable with the same mean and median reported over 1998-2001 and 2001-2010.

'CRSP Raw Ret' is the annual CRSP fund return including distributions (dividends and capital gains) *before* total expenses. 'CRSP Net Ret' is the annual CRSP fund return from CRSP including distributions (dividends and capital gains) *after* total expenses. The annual mean is the simple compound of the 12 monthly means for all funds existing in each month. 'Raw Holdings Ret' is the annual raw fund return calculated using the quarterly stock holdings from the s12 database. The annual mean is the simple compound of the four quarterly means for all funds existing in each quarter. 'DGTW-adj. Ret' is the annual excess fund return whereby the return of each stock in the portfolio has been adjusted by the return on a portfolio of stocks with similar book-to-market, size and momentum characteristics. Value-weighted[8] returns are provided.

The raw/net average returns are comparable in magnitude and follow a similar pattern over the three sub-periods. There is a clear fall in returns over 2001-2010, which is not surprising given that this period encompasses the tech wreck and GFC. Overall, the sample of mutual funds did not generate outperformance with an average DGTW-adjusted return over the complete period of -0.04%. Small positive excess returns of 0.69% and 0.77% are reported

[8] The returns are similar when equal-weighting is used.

over 1980-1990 and 1991-2000, respectively. However, over 2001-2010 funds incurred an average annual excess return of -1.66%.

Methodology

Selecting independent variables

In order to identify the market/macroeconomic variables with the greatest predictive ability a series of univariate regressions of each style factor on each market/macroeconomic variable are run in a similar manner to Kao and Shumaker (1999). Specifically, the annual return for each style factor (SF) is regressed on the quarterly value of each market/macroeconomic variable (EV) lagged two quarters. The use of the second lag is to ensure that the economic data is available prior to the start of the investment horizon being forecast, which is consistent with Cooper and Priestley (2009). The annual SF returns are calculated as the simple compound of the relevant monthly SF returns, using value-weighted portfolios of stocks, based on market-capitalisation as at the end of the month prior.

$$SF_{i,t-t+4} = \propto_{j,t} + \beta_{j,t} EV_{j,t-2} + \varepsilon_{j,t} \tag{1}$$

Fama and French (1992) emphasise that the pre-1962 data on Compustat suffer from a serious selection bias as they are tilted toward big historically successful firms. Furthermore, the Book Value of Shareholders' Equity is not available before 1962, which is an input for the computation of ROE. Therefore, the start of the historical period ensures the sample is not affected by this bias and that data for all of the SFs is available.

The approach used to generate quarterly forecasts of the performance of each SF, for the following 12 months, over 1981-2011 involves first segregating the data into six subsets.

Therefore, six unique forecasting models are used to forecast the return of each SF over the next five years (six years for Subset 6). Within these subsets, regressions are run over six separate rolling historical periods for each SF, in order to select the EVs to be used in the forecasting model for each SF, for the six associated forecasting periods. The periods associated with Subset 1 are explained in detail.

Firstly, univariate regressions are run on a rolling basis with the first regression using five years of data i.e., Q1 1964 – Q3 1968 and then the historical period increases iteratively by one quarter, with the final regression using 15 years of data i.e., Q1 1964 – Q3 1978. Therefore, the historical period ends with the EV for Q3 1978 forecasting the SF return over Q1-Q4 1979, which ensures there is no overlap with the period for which the forecasts are generated i.e., Q1 1981- Q4 1985.

The EVs included in the forecasting model are selected based on the results of these univariate regressions. Selection is based on a frequency count of the number of significant *t*-statistics (at a 5% confidence level) for beta, for each EV. Firstly, all EVs with a significant beta count of at least 40% of the total are identified. Secondly, the correlations between these EVs over the complete historical period are computed. Starting at the lowest count end, if the correlation between two EVs is 0.60 or greater, then only the EV with the higher count is retained. If two EVs have the same count, then the EV with the more favourable correlations with the other EVs selected for inclusion in the forecasting model is retained. Favourability is determined as follows. The two correlated EVs are compared in relation to each EV selected for inclusion in the forecasting model. The EV which has the smallest positive/largest negative correlation with each EV is given a score of 1 and the other EV a score of 0. The most favourable EV is the one with the greatest total score based on these comparisons. If their scores are even, then the EV with the smallest average positive or largest average negative correlation, across the EVs selected for inclusion in the forecasting model is selected. Furthermore, if all three spread variables are selected: book-to-market spread, market-to-book spread and value spread then only the one with the higher count is retained. If two spread variables have the same count then the same process detailed above is followed to select the one to include in the model.

Forecasting style factor returns

In order to obtain a forecast return for each style factor, an econometric forecasting model is used. It is adapted from the forecasting model used by Bird and Casavecchia (2011) to forecast the value premium for European stocks.

$$E_t(F_{t+2}) = \alpha_t + \varphi_t F_t + \sum_{j=1}^{N} \beta_{j,t} Z_{j,t} \qquad (2)$$

where $E_t(F_{t+2})$ is the expected value in quarter *t* of the factor return for the 12 months commencing at the start of quarter *t+2*, α_t is the intercept in quarter *t*, $\varphi_t F_t$ represents the sensitivity to the SF return for the 12 months ending in quarter *t* and $\sum_{j=1}^{N} \beta_{j,t} Z_{j,t}$ represents the sum of the sensitivity in quarter *t* to the *jth* lagged market/macroeconomic variable *Z*.

The forecasting regression model is run on a rolling basis initially using the previous 15 years of data. In relation to Subset 1, the first regression is run using the EVs selected for inclusion and the associated SF returns from Q3 1964 – Q2 1979 (the dependent variable associated with the Q2 1979 EV's is the SF return from Q4 1979-Q3 1980). To ensure there is no hindsight bias, the parameter estimates obtained are then applied to the SF return for the 12 months ending with Q3 1980 and EV values for Q3 1980. As a result, the forecast for Q1

1981, which is for the 12 month return from Q1-Q4 1981 is obtained. The last regression is run using the selected EVs and the associated SF returns from Q3 1964-Q1 1984. The parameter estimates obtained are applied to the EV values for Q2 1985 to obtain the forecast for Q4 1985.

Table 4 provides a summary of the model fit statistics for a regression of the forecast SF returns generated using the model above versus the actual SF returns over 1981-2011.

INSERT TABLE 4

The forecasts generated for B/M[9] and SIZE are the strongest over the complete sample period. Specifically, the forecasts for these two styles are statistically significant at the 1% level and the adjusted R^2 values are moderate[10] at 10.78% and 8.69%, respectively. The forecasts for MOM and ROE are also statistically significant at the 5% level with adjusted R^2 values of 4.63% and 4.26%, respectively. Therefore, all further tests will only use these four style factors which have statistically significant forecasts.

The Mean Absolute Error (MAE) for these four style factors ranges from 15% for B/M to 22% for ROE. Furthermore, the Root Mean Squared Error (RMSE) ranges from 22% for B/M to 28% for ROE. This indicates the difficulty to forecast the magnitude of the style factor returns with a high level of precision. However, Size, MOM and B/M are characterised by the highest success rates, which are 67.77%, 61.98% and 60.33%, respectively. Thus, the style factor forecast return predicts the direction correctly more often than not. In contrast, the success rate for ROE is lower at 48.76%. However, it is included to represent the quality

[9] Five outlier observations (Q3 1999- Q3 2000) which include returns during the technology crash (i.e., Q1 2000- Q4 2001) which commenced in March 2000 have been excluded from the B/M model fit tests.
[10] Pesaran and Timmerman (1995) state that an adjusted R^2 in this context of 20% is high.

category in the interests of completeness. Please refer to Appendix D for a summary of the EVs which are included in the forecasting model in each of the six forecasting periods for B/M, ROE, MOM and Size.

Figure 1 provides a graphical representation of the quarterly forecast SF returns generated, versus the actual SF returns, over 1981-2011 for the four SFs.

INSERT FIGURE 1

Panel A shows that the forecasts for B/M are similar to the actuals over the majority of time period subsets except for during the technology boom and bust and over 2005-2010. The forecasts fall short of the actual returns which soared over the late 1990s during the time of the technology boom, which is not surprising given this period was an anomalous market bubble. Panel B shows that the ROE forecasts over 1995-2000 are well aligned with the period; however there are a series of spikes in the forecasts over the complete period. These are due to large changes in the EVs which the parameter estimates have not yet adjusted to. Panel C shows that the MOM forecasts are closest to the actuals over the latter two time period subsets. Panel D demonstrates that the Size forecasts show a similar pattern to the actuals overall despite disparity between the two over the late 1990's and early 2000's.

Results

Stock selection strategy

Table 5 reports average excess return results for investment strategies based on the four style factor forecasts over 1981-2011.

INSERT TABLE 5

The results for univariate strategies investing in either the style factor with the maximum (Max FC) or minimum forecast (Min FC) and a strategy which is long (short) the Max FC (Min FC) are provided. The 'All Quarters' return is the average actual annual return that is earned if the investment is made each quarter and held for the following 12 months. The results for annual strategies developed in the interest of reducing turnover are also provided. The 'Annual (Q_i)' returns are for strategies which invest based on the forecasts made only in each Q_i where $1 \leq i \leq 4$ over the sample period. E.g. to invest in each calendar year the Q_3 forecasts are used.

A strategy which involves investing in the style which has the maximum forecast each quarter generates an average annual return of 7.26%, significant at the 1% level. In addition, using any of the four annual investment options produces a statistically significant average annual excess return ranging from 6.59% to 9.01%. Conversely, investing in the style factor which has the minimum forecast generates small negative returns on average, none of which are statistically significant. A long/short strategy based on the maximum and minimum forecasts generates average excess returns ranging from 7.13% to 10.14% across the investment options, all of which are statistically significant except for the Annual Q_4 strategy.

The MAE indicates that the difference between the actual SF return and the forecast SF return is 24% on average for the All Quarters strategy. The RMSE is 29% which further reflects the difficulty to forecast the magnitude of the SF returns included in the strategy with a high level of accuracy. However, the direction of the return for the preferred SF is predicted correctly in more than two-thirds of the quarters. The results for the annual strategies are similar.

Table 6 provides portfolio characteristics for the individual SFs upon which the timing strategy is based as well as the timing strategy.

INSERT TABLE 6

The timing strategy generates an average annual return for ‘All Quarters’ which is higher than the mean for B/M, ROE and SIZE yet slightly lower than the average return for MOM. However, given the lower risk associated with the timing strategy, the Sharpe Ratio is 17% higher than that for MOM alone. The return difference is strongest upon comparison with Size and ROE. In particular, the average return to the timing strategy is about 2% higher on average and this difference is statistically significant at the 5% level. The Annual Q_i strategies show a similar pattern,- the timing strategy generates the highest Sharpe Ratio when investing only in Q_1, Q_2 and Q_3 and an equal Sharpe Ratio to MOM for Q_4 is identified. Therefore, depending on an investor’s combined risk/return objectives a stock return timing strategy based on macroeconomic information is fruitful.

Fund selection strategy

Given that a stock selection strategy using the SF forecasts generates outperformance, an extension is to determine whether a timing strategy using the mutual funds based on the style forecasts generates outperformance. The annual strategy using Q_3 forecasts is selected for adaptation to the funds as it is the most intuitive given that the forecast periods encompassed are for calendar year returns over the sample period[11].

In order to identify the funds, which have the greatest exposure to the style factor, which has the highest forecast in Q_3 of each year *t*, a weighted-average quintile rank is computed for each fund based on its stock holdings.

$$\text{WRank}_{j,t} = \sum_{i=1}^{N} Quintile\ Rank_{i,t} * W_{i,j,t} \tag{3}$$

where $\text{WRank}_{j,t}$ is the weighted-average quintile rank for fund *j* in Q_3 of year *t*, Quintile $\text{Rank}_{i,t}$ represents the quintile rank for stock *i* in year *t* for the preferred style factor and $W_{i,j,t}$ is the weight of stock *i* in fund *j* for Q_3 of year *t*.

The quintile ranks applied to each stock are essentially consistent with the quintile ranks used to create the SF portfolios, which the SF returns are based on. Specifically, quintiles for the accounting metrics (B/M and ROE) are formed in June of year *t* using the value of the metric in question, for the fiscal year ending in year *t-1*. The Size quintiles are formed based on the stocks' market capitalisation values as at the end of June of year *t*. Given that the MOM portfolios are rebalanced monthly, the quintile ranks applied are for the same month as the holdings i.e., July, August or September of year *t*. The only difference is that the quintile ranks are assigned so that quintile 5 always contains the preferred stocks. In relation to Size, the preferred stocks are those with the smallest market capitalisations- these stocks are in quintile 1 for the SF portfolios. In order to ensure that the construction of the $\text{WRank}_{j,t}$ is

[11] The results are also generated for a strategy based on the Q_2 year *t* stock holdings and these are quantitatively similar to those presented in the body of this paper. Use of the Q_1 year *t* holdings is not feasible given that the stock quintile allocations does not occur until June of year *t* and then use of the Q_4 year *t* holdings is not considered relevant given that the fund returns for this strategy occur into year *t+2* which is considered too far ahead relative to the stock quintile assignments.

consistent across the styles, the quintile ranks are now re-assigned so that the small stocks are located in quintile 5.

The weight applied to each stock is the stock's holding value, relative to the total holding value of all stocks in the portfolio, as at the end of the prior quarter, following Wermers (2000). Therefore;

$$W_{i,j,t} = \frac{HVALUE_{i,j,t}}{\sum_{i=1}^{N} HVALUE_{i,j,t}} \tag{4}$$

where $HVALUE_{i,j,t}$ is the number of adjusted shares held of stock *i* in fund *j* in Q_3 year *t* multiplied by the price of stock *i* as at the end of the prior quarter i.e., Q_2 year *t*.

Funds are sorted into quintiles based on their exposure to the preferred style as indicated by $WRank_{j,t}$ in Q_3 of each year *t*. The first year for which holdings data is available is 1980 thus, portfolio formation occurs from 1980-2009. The average returns to the quintiles are examined over year *t+1* i.e., over 1981-2010. Table 7 presents average annual returns to the quintiles of funds- quintile 5 (1) contains funds with the greatest (lowest) exposure to the preferred style, hence; they are the 'preferred' ('unpreferred') funds.

INSERT TABLE 7

The average annual raw returns are all statistically significant at the 1% level and they do not differ substantially across the quintiles[12]. The average annual raw return for quintile 5 is less than the raw return for quintile 1 at 9.80% compared to 12.71%. However, a *t*-test of the difference in the annual raw returns for the preferred and unpreferred funds is not statistically significant. The raw returns are adjusted using the CRSP value-weighted index including dividends. The average market-adj. return for the preferred funds is -1.93% compared to 0.98% for the unpreferred funds; however these returns are not statistically distinguishable from 0 (nor are those for the other quintiles). The average annual DGTW-adjusted return is -1.08% (0.72%) for quintile 5 (1), although the DGTW-adjusted returns are also all statistically insignificant.

Thus, a style timing strategy at the aggregate fund level does not generate statistically significant outperformance over the sample period[13]. We also investigate the performance of the strategy depending on which style factor is selected as the preferred factor. Specifically, Table 8 provides asset-weighted average returns and quintile ranks for the $WRank_{j,t}$ sorted quintiles broken down by style.

[INSERT TABLE 8]

Overall, the results do not differ substantially when broken down by style group. Interestingly, the actual average SF return for ROE is negative over the selected years

[12] Given that the average raw CRSP and raw holdings based returns in Table 3 are consistent only the holdings based raw returns are included in Table 7.
[13] A 'test of perfect information' is also conducted which involves using the actual SF returns instead of the forecast SF returns to generate the fund application strategy results. The spread of raw returns across the quintiles is clearer, with the highest (lowest) raw returns to funds in quintile 5 (1). The DGTW-adjusted returns are all statistically insignificant except for a weakly significant return of 1.31%, at the 10% level, for funds in quintile 5. Thus, even with perfect information the FoF strategy does not generate strong results.

therefore the lack of performance for this group is not surprising[14]. In unreported results (in the interests of brevity) the average market-adjusted return for SIZE is positive at 5.15% for the preferred funds, which is some weak evidence that the strategy is successful at beating the market for this style category. Table 8 shows that funds in quintile 5 are not exposed enough to the preferred style with the asset-weighted average $WRank_{j,t}$, i.e., the QRank for quintile 5 funds, falling well below five on average at 3.88. Furthermore, the funds in quintile 1 are much more exposed than expected for their quintile assignment group with an average QRank of 2.13 on average. Evidently, the funds identified as the preferred and unpreferred funds do not have the desired characteristics of these two groups (quintile 5 contains essentially quintile 4 funds and quintile 1 contains essentially quintile 3 funds). The SFs are calculated as the difference between quintiles 5 and 1; therefore the fund application does not reflect this construction.

Figure 2 shows the change in exposure to the preferred style factor over the investment horizon for funds in quintile 1 (out-of-favour funds) and quintile 5 (preferred funds). The change in exposure is calculated relative to the exposure as at quintile formation in Q_3 of year *t*. Specifically, the change in exposure is calculated for each quarter over the investment horizon i.e.,, as at Q_1, Q_2, Q_3 and Q_4 of year *t+1*. Over the investment horizon the preferred (out-of-favour) funds tend to decrease (increase) their exposure to the preferred style.

[14] Given that ROE contributes negatively to the timing strategy and in light of the evidence in Table 4, which shows that the forecasts for ROE are negatively correlated with the actual returns and the success rate for ROE is less than 50%, we test a timing strategy which excludes ROE. Overall, the stock and fund level results are qualitatively consistent with the results presented. More specifically, the stock level results improve with an average DGTW-adjusted return over 1981-2011 of 10.52%, which is significant at the 1% level. Furthermore, no statistically significant outperformance is detected for the fund level strategy with average DGTW-adjusted returns of 0.91% and -1.11% determined for quintiles 1 and 5, respectively.

Robustness tests

Given that the performance identified at the stock level did not translate to the fund level further investigations are warranted. In addition to the use of the $WRank_{j,t}$ to sort funds into quintiles three alternative methods of fund selection are discussed in order to determine whether the results are specific to this approach.

Net exposure rank. Given that the SF returns are generated as the excess of the return to the preferred stocks relative to the unpreferred stocks a method of fund selection is developed in a similar vein. Specifically, a $Q5\_Q1WRank_{j,t}$ is calculated, which involves calculating each fund's exposure to the preferred stocks net of their exposure to stocks least characterised by the preferred style.

$$Q5\_Q1WRank_{j,t} = Q5\ Weight_{j,t} - Q1\ Weight_{j,t} \tag{5}$$

where $Q5\ Weight_{j,t} = \frac{\sum_{i=1}^{N} Adjusted\ Shares\ Held\ for\ Stocks\ in\ Quintile\ 5_{i,j,t}}{\sum_{i=1}^{N} Adjusted\ Shares\ Held_{i,j,t}}$ and

$Q1\ Weight_{j,t} = \frac{\sum_{i=1}^{N} Adjusted\ Shares\ Held\ for\ Stocks\ in\ Quintile\ 1_{i,j,t}}{\sum_{i=1}^{N} Adjusted\ Shares\ Held_{i,j,t}}$

The return results for funds sorted into quintiles based on the $Q5\_Q1WRank_{j,t}$ are consistent with the $WRank_{j,t}$ results. The results for this approach are omitted in the interest of brevity.

Correlation approach. In order to determine whether the use of the holdings is not adequate[15] to identify funds with an affinity to the preferred SF in each period, funds are selected based

[15] Similarly, in order to determine that the result is not due to a 'Return Gap' type influence the results are also generated using a subset of funds for which the number of stocks used to calculate the $WRank_{j,t}$ is within 80-110% of the number of stocks used to calculate the fund's return (Kacperczyk et al. 2008). The results are indeed consistent.

on the correlation of their monthly raw return from CRSP with the preferred SF portfolio. For example, if B/M is the preferred style based on the Q_3 forecast in 1980 then the correlation of a fund's returns with value stocks i.e., Quintile 5 stocks, is computed over the 24 months ending with September 1980. Similarly, if MOM is the preferred style based on the Q_3 forecast in 1981, then the correlation of a fund's returns with high price momentum stocks i.e., Quintile 5 stocks, is computed over the 24 months ending with September 1981. The funds are sorted into quintiles in Q_3 of each year *t* based on the value of this correlation. The results are consistent with the $WRank_{j,t}$ results.

*Optimisation approach***.** In unreported analysis the preferred funds are found to be highly exposed to factors other than the preferred factor. Given that mutual funds are exposed to a number of SFs in any period, a strategy which isolates funds which are highly exposed to the preferred factor and *not* to the other factors is also investigated. In particular, a FoF portfolio is developed using funds in quintile 5. The weights to apply to each of these funds in order to maximise the exposure to the preferred factor are determined by solving for the global optimum, subject to a number of constraints, in each quarter. It is required that the weights sum to one, that the average quintile exposures to the seven other SFs are between 2.5 to 3.5 and the maximum weight for each individual fund is less than or equal to 5%[16]. The average number of funds in this optimal portfolio is 19 and the average DGTW-adjusted return to this strategy is 0.07% over 1981 to 2011[17]. Therefore, the poor results are not a reflection of the implementation method[18].

[16] Although, in order to determine a solution in which the sum of the weights equals one the maximum weight constraint is relaxed in 25% of the quarters. As such the maximum weight for these quarters ranges from 6% to 36% and in one case there is no weight constraint.
[17] The year 1992 is not included as solutions are not obtainable for the four quarters of this year.
[18] In addition, a subset of funds which are in quintile 5 for the preferred factor and in quintile 4 or less for all of the other SFs is created. There are 27 funds in this portfolio on average over the sample period and the average annual DGTW-adjusted return to these funds is -0.87% and not statistically significant. This is consistent with the main results presented for the preferred funds. Furthermore, by requiring that funds fall in quintile 5 for the

Long-only style factor forecasts. The investigations above confirm that timing the mutual funds using their stock holdings, and the SF forecasts as signals, does not generate outperformance. This section seeks to explain why the stock level performance does not translate to the FoF level.

Given that the sample consists of long-only funds, a set of long-only SF forecasts is generated, in order to determine whether a timing strategy using long-only forecasts is better able to reflect the stock level performance obtainable by the funds. Long-only SFs are constructed by subtracting the return to the CRSP VW Index from the Top performing portfolio as defined in the sub-section Style Factor Data of the Data section. Table 9 shows that the average returns to all style factors are muted relative to the long-short portfolios, which highlights the outperformance attributable to the short side. The same process is followed to develop the time-series of SF return forecasts over 1981-2011. The eight SFs selected based on their standard deviations over 1981-2011 are B/M, D/P, Trailing Sales Growth (TRSG), Operating Cash Flow (OCF), ROA VAR, Size, MOM and SMV. Table 10 reports the model fit statistics for a regression of the long-only forecast SF returns versus the actual SF returns over 1981-2011.

[INSERT TABLE 9]

Evidently the long-only SF forecast returns are only statistically significant for Size. Therefore, we were not able to develop a stock level or fund level timing strategy using these forecasts. Furthermore, the correlations between the forecast and actual returns, for all SFs

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preferred factor and quintile 3 or less for all other SFs a complete time series of returns is not able to be generated over the sample period as there are not enough funds which meet these criteria.

other than Size, are close to zero. Although, the success rates are greater than 50% for all of the SFs, except D/P.

Overall, this is an interesting result given that the extant literature focuses on long-short SF returns, particularly to evaluate the performance of long-only mutual funds. Although, there is a growing body of academic literature which investigates the suitability of style factor returns as benchmarks. Cremers et al. (2012) use the standard Fama-French and Carhart factor return portfolios to evaluate the performance of passive benchmark indices such as the S&P 500 and the Russell 2000. Statistically significant non-zero alphas are determined for the indices and small methodological changes to the factors are proposed to eliminate the non-zero alphas. Furthermore, Blitz and Huij (2012) evaluate the performance of actively managed equity funds against a set of passively managed index funds to determine whether investors are better off investing in index funds given the high level of performance attributable to systematic style factors. However, the active funds generate returns that are 3% to 5% p.a. higher than the passive fund portfolio. Therefore, given the significance of the long-short factor returns does not translate to long-only returns, this paper contributes to the academic literature which questions the suitability of factor returns as benchmarks for mutual funds. Essentially, the benchmarking approach used needs to be a fair indication of what managers can actually implement in practice.

In addition, the role that methodological choices play in the determination of results is highlighted. In this case the use of a long-only constraint proves problematic, whilst other studies show that decisions such as incorporation of transaction costs, equal versus value weighting and the treatment of outliers can lead to differing outcomes. Bettman et al. (2011) examine the asset-growth effect in Australia and emphasise that their results differ when using equal versus value weighting of returns. Similarly, Bettman et al. (2009) show how the returns to a momentum strategy in Australia change when short-sale constraints are imposed and bid-ask spreads are included. Furthermore, Taylor and Wong (2012) demonstrate how the returns to an accruals factor vary given a variety of methodological decisions. Hence, researchers need to be careful developing style factors that are unable to be implemented by long-only fund managers and then judging the performance of fund-managers against these factors.

Conclusion

This paper develops a model which successfully predicts style factor returns using market and macroeconomic variables. The US mutual funds which are most exposed to the predicted "preferred" style factor do not significantly outperform. Furthermore, this result does not differ when broken down by style. The preferred funds also exhibit decreasing exposures to the preferred style over the investment horizon and are found to be highly exposed to factors other than the preferred SF. Alternative portfolio construction methods yield similar results. Long-only SFs are also constructed which highlight that the poor performance of the strategy is primarily due to the majority of the outperformance of the SFs being attributable to the short-side, which the long-only funds are by structure unable to take advantage of. Furthermore, generation of long-only SF forecasts is unsuccessful. This raises the question as to the appropriateness of the use of long-short SF returns to assess the performance of long-only mutual funds.

Overall, developing a FoF portfolio purely designed to take advantage of style cycles is not a profitable strategy. The evidence in this paper suggests that the benefits of a timing strategy are best exploited alternatively. For example, by including a fund implementing a style timing strategy within a FoF portfolio to augment performance; however verification of this approach is best left to further research. Developing a base portfolio with specific style characteristics and then augmenting/adjusting the structure and characteristics of the portfolio to take advantage of movements in style cycles e.g. by adding a value manager when value is expected to outperform is an alternative approach also worthy of further research. Moreover, a FoF could use factor ETFs or futures to gain exposure to different styles more effectively than by switching managers. Thus, the fund could obtain alpha from their manager in one style; whilst being exposed to the beta from another style and the factor timing.

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Table 1. Style factor measurement

This table indicates how each of the style factors across the various style categories is measured.

Style Category	Signal	Measurement
Value	Book-to-Market Ratio[a] (B/M)	Book $Equity_t$/Market Equity as at $December_{t-1}$ (ME) N.B. Book Equity is measured as per Davis, Fama and French (2000)
	Dividend-to-Price Ratio[b] (D/P)	Common $Dividends_t$/ME
	Earnings-to-Price[c] (E/P)	Income before Extraordinary $Items_t$ (IB)/ME
	Sales-to-Price Ratio[d] (S/P)	$Sales_t$/ME
	Cash Flow-to-Price Ratio[e] (C/P)	Cash $Flow_t$/ME N.B. Cash Flow is measured following the definition on Ken French's website 2012
	EBITDA-to-Enterprise Value Ratio[f] (EBITDA/EV)	$EBITDA_t$/Enterprise $Value_t$ N.B. Enterprise Value is measured following the definition on Ken French's website 2012
Growth	Trailing Earnings Growth[g] (TREG)	Average Earnings Growth (EG) over prior 3 years *Where* EG = $(IB_t - IB_{t-1})/IB_{t-1}$
	Net Profit Margin[h] (NPM)	$IB_t/Sales_t$
	Trailing Sales Growth[i] (TRSG)	Average Sales Growth (SG) over prior 3 years *Where* SG = $(Sales_t - Sales_{t-1}) / Sales_{t-1}$
	Sustainable Growth Rate[j] (SGR)	Return-on-Equity (ROE)*(1 – Dividend Payout Ratio (DPR)) *Where* ROE = see below and DPR = Total $Dividends_t/IB_t$
Quality-Growth	ROE[k]	IB_t/Shareholders' $Equity_{t-1}$ (SEQ)
	Return-on-Assets[l] (ROA)	IB_t/Total $Assets_{t-1}$ (AT)
	Operating Cash Flow[m] (OCF)	$\frac{\text{Operating Income before Depreciation}_t - \text{Capital Expenditures}_t}{((AT + AT_{t-1})*0.5)}$
Quality- Stable	Leverage[n] (LEV)	Long Term $Debt_t$ /SEQ_t
	SG Variability[o] (SG VAR)	Variance of SG over prior four years
	Earnings Growth Variability[p] (ROA VAR)	Variance of ROA over prior four years
Momentum	Momentum[q] (MOM)	Prior 11-month return lagged 1 month measured as the simple compound of the component monthly returns
Size	Size[r]	Market Equity as at $June_t$
Low Volatility	Historical Idiosyncratic Volatility[s]	Standard Deviation of ε_t over prior 60-months

	(VOL)	*Where* ε_t = (Stock Return$_t$ – Risk-Free Rate$_t$) - α – β*(CRSP Value-Weighted Index Return$_t$ – Risk-Free Rate$_t$) N.B. α and β estimated using the 60-month history of returns

[a] Fama and French (1992; 1993); Lakonishok et al. (1994); Davis (1994); Chan et al. (1998)
[b] Fama and French (1988); Chan et al. (1998)
[c] Basu (1983); Davis (1994); Lakonishok et al. (1994); Chan et al. (1998)
[d] Barbee et al. (1996)
[e] Chan et al. (1991); Lakonishok et al. (1994); Davis (1994); Chan et al. (1998)
[f] Lie and Lie (2002)
[g] Bali et al. (2008)
[h] Lockwood and Prombutr (2010)
[i] Lakonishok et al. (1994)
[j] Lockwood and Prombutr (2010)
[k] Gallagher et al. (2012); Taylor (2010, pers. comm., 10 Mar); Mercer (2012); Chen and Zhang (2007); Bird and Casavecchia (2007); Zhang (2000)
[l] Gallagher et al. (2012); Taylor (2010, pers. comm., 10 Mar); Chen and Zhang, (2007); Bird and Casavecchia (2007); Mohanram (2005); Fairfield and Whisenant (2000); Piotroski (2000)
[m] Gallagher et al. (2012); Bird and Casavecchia (2007); Mohanram (2005); Piotroski (2000), Dechow and Dichev (2002)
[n] Gallagher et al. (2012); George and Hwang (2010); Mercer (2012); Lui et al. (2007); Bird and Casavecchia (2007)
[o] Gallagher et al. (2012); Mercer (2012); Mohanram (2005)
[p] Gallagher et al. (2012); Mercer (2012); Dichev and Tang (2009); Mohanram (2005)
[q] Jegadeesh and Titman (1993); Carhart (1997)
[r] Banz (1981); Fama and French (1992; 1993); Chan et al. (1998)
[s] Ang et al. (2006); Clarke et al. (2010)

Table 2. Historical performance of style factors

This table presents a summary of the annualised percentage performance of the style factors included in this study. Furthermore, the annualised standard deviation of the monthly returns is provided in parentheses. The value factors are: book-to-market (B/M), dividend-to-price (D/P), earnings-to-price (E/P), cash flow-to-price (C/P), sales-to-price (S/P) and EBITDA-to-enterprise value (EBITDA/EV). The growth factors are: trailing 3-year earnings growth (TREG), net profit margin (NPM), trailing 3-year sales growth (TRSG) and the sustainable growth rate (SGR). The quality growth factors are: return-on-equity (ROE), return-on-assets (ROA) and operating cash-flow (OCF). The quality stability factors are leverage (LEV), sales-growth-variability (SG VAR) and ROA variability (ROA VAR). The factors based on accounting metrics are formed by sorting stocks into quintiles in June of each year t , based on the value of the metric in question for the fiscal year ending in year $t-1$. Size is the value of market equity as at June of each year t. Returns are computed from July of year t to June of year $t+1$. For the value, growth and quality growth (size) categories the monthly factor return is the average return to the highest (lowest) quintile of stocks minus the lowest (highest) quintiles of stocks. Whereas, the quality stability factors are calculated as the monthly difference between the average return of firms in quintiles one to four and the average return of those in the top quintile. Momentum is constructed as the average of firms with the highest 20 percent 11-month returns lagged one month minus the average of firms with the lowest 20 percent 11-month returns lagged one month. Portfolios are rebalanced monthly. The volatility factor is calculated each month as the average return to the lowest quintile of stocks based on historical idiosyncratic volatility minus the average return to the highest quintile of stocks based on historical idiosyncratic volatility. Average returns to the quintiles are value-weighted for all of the style factors. Up (Down)-market months are those in which the CRSP value-weighted index return is greater (less) than the T-Bill rate. There are 330 (240) up (down)-market months.

	All	**1981-1991**	**1992-2001**	**2002-2011**	**Up-Markets**	**Down-Markets**
Value						
B/M	5.43 (11.47)	5.91 (10.79)	5.50 (13.39)	4.83 (10.14)	-2.26 (10.07)	17.83 (12.63)
D/P	5.07 (13.94)	6.59 (13.98)	3.88 (15.30)	4.61 (12.50)	-11.32 (11.59)	34.47 (14.02)
E/P	6.45 (10.84)	5.69 (11.39)	9.61 (11.93)	4.20 (10.81)	-0.18 (9.30)	17.01 (12.30)
C/P	4.52 (12.69)	4.21 (12.75)	3.91 (15.21)	5.47 (9.57)	-8.56 (11.64)	27.05 (12.04)
S/P	6.48 (11.49)	3.68 (9.77)	8.11 (12.84)	8.00 (11.86)	7.65 (10.26)	4.78 (13.13)
EBITDA/EV	6.52 (10.20)	4.86 (9.31)	7.53 (11.99)	7.35 (9.21)	-1.09 (9.28)	18.76 (10.69)
Growth						
TREG	0.21 (7.00)	-0.14 (6.52)	-2.98 (7.61)	3.89 (6.78)	-1.13 (6.85)	2.23 (7.20)
NPM	1.59 (12.90)	2.40 (10.32)	3.43 (16.55)	-1.10 (11.25)	-12.44 (11.22)	26.14 (12.65)
TRSG	-1.02 (8.83)	-2.11 (9.44)	-0.98 (9.14)	0.14 (7.83)	4.91 (8.67)	-9.24 (8.51)
SGR	-0.41 (9.28)	0.33 (8.97)	0.72 (9.76)	-2.33 (9.15)	-3.08 (8.59)	3.68 (10.12)
Quality (Growth)						
ROE	2.85 (11.94)	4.26 (8.81)	3.34 (15.32)	0.86 (11.13)	-7.83 (10.58)	20.76 (12.32)
ROA	3.07 (11.34)	5.59 (8.53)	3.07 (13.49)	0.37 (11.72)	-6.63 (10.26)	19.14 (11.57)
OCF	4.80 (11.77)	9.19 (6.93)	5.02 (15.80)	-0.06 (11.23)	-5.53 (10.39)	21.98 (12.33)
Quality (Stability)						
LEV	0.55 (5.61)	3.03 (4.76)	0.15 (6.37)	-1.71 (5.61)	1.25 (5.51)	-0.47 (5.75)
SG VAR	1.68 (8.83)	6.38 (6.99)	-1.16 (9.89)	-0.49 (9.40)	-7.59 (8.18)	16.97 (8.16)
ROA VAR	2.42 (12.74)	6.38 (8.38)	-1.49 (18.30)	2.12 (9.57)	-11.69 (11.91)	27.13 (11.25)
Momentum	7.51 (19.45)	7.37 (13.89)	11.40 (21.62)	3.90 (22.30)	3.13 (20.57)	14.31 (17.58)
Size	1.20 (15.39)	-5.23 (11.36)	5.81 (21.12)	4.02 (11.99)	8.41 (16.16)	-8.66 (13.70)
Low Volatility	5.72 (24.85)	13.79 (14.57)	2.46 (34.86)	0.57 (21.65)	-22.07 (23.87)	63.77 (20.25)

Table 3. Summary statistics for the mutual fund sample

This table reports summary statistics for the sample of mutual funds obtained by linking the Thomson Reuters Common Stock Holdings Mutual Fund Data (s12) with the CRSP Mutual Fund Database (CMFD) using MFLINKS. There are 1,856 US Active Equity funds examined over the period 1980-2010. Only funds classified as 'Aggressive Growth', 'Growth' or 'Growth and Income' are included. Average values of fund characteristic variables and returns are provided, the median is in parentheses. No. Stocks is the number of stocks held by a fund as of the end of the month. Age is relative to the date the fund was first offered and is in years. Turnover is an annual variable which represents the minimum (of aggregated sales or aggregated purchases of securities), divided by the average 12-month Total Net Assets of the Fund. Expenses represents the annual expense ratio. Equity Prop. is the average proportion of the fund that is invested in common equity and it's calculated over the life of the fund. TNA is the fund's month end Total Net Asset Value, in millions. Total Load is the sum of the front and rear loads, reported annually. Management Fee (Mgt Fee) is only available from 1998-2010, it is the ratio of Management Fee ($) divided by Average Total Net Assets ($) reported as a percentage. CRSP Raw Ret is the annual fund return including distributions (dividends and capital gains) *before* total expenses and CRSP Net Ret is the annual fund return including distributions (dividends and capital gains) *after* total expenses, both sourced from the CMFD. Raw Holdings Ret is the annual raw fund return calculated using the quarterly stock holdings from the s12 database. The annual mean is the simple compound of the four quarterly means for all funds existing in each quarter. DGTW-adj. Ret is the annual excess fund return whereby the return of each stock in the portfolio has been adjusted by the return on a portfolio of stocks with similar book-to-market, size and momentum characteristics. Value-weighted (VW) returns are provided.

	All	**1980-1990**	**1991-2000**	**2001-2010**
No. Stocks	98.94 (69.00)	69.94 (53.00)	96.80 (68.00)	109.70 (76.00)
Age	15.01 (10.08)	20.11 (17.00)	12.41 (7.08)	16.54 (13.00)
Turnover (%)	81.91 (62.66)	76.43 (59.00)	82.29 (62.00)	85.23 (66.00)
Expenses (%)	1.20 (1.15)	1.02 (0.99)	1.24 (1.20)	1.25 (1.21)
Equity Proportion (%)	86.77 (91.09)	79.33 (86.81)	85.45 (90.01)	90.23 (93.12)
TNA	1242.41 (250.00)	371.72 (121.90)	935.20 (185.20)	1625.57 (367.30)
Total Load	1.41 (0.00)	3.50 (2.00)	0.87 (0.00)	0.34 (0.00)
Mgt Fee	0.73 (0.74)	-	-	0.73 (0.74)
CRSP Raw Ret (%)	13.85 (17.15)	17.04 (19.65)	18.85 (20.32)	5.35 (10.35)
CRSP Net Ret (%)	13.19 (16.60)	16.34 (18.94)	17.87 (19.17)	5.05 (9.99)
Raw Holdings Ret (%)	12.63 (15.98)	16.19 (20.18)	19.46 (19.26)	1.87 (5.55)
DGTW-adj. Ret (%)	-0.04 (-0.26)	0.69 (-0.26)	0.77 (0.71)	-1.66 (-0.52)

Table 4. Reliability of style factor forecast returns

This table provides a summary of model fit statistics and forecast accuracy measures for quarterly style factor forecast returns compared to the actual style factor returns over 1981-2011. The style factors included are Book-to-Market (B/M), Dividend-to-Price (D/P), Net Profit Margin (NPM), Return-on-Equity (ROE), Return-on-Asset Variability (ROA VAR), Momentum (MOM), Size and Stable-minus-Volatile (SMV). Correlation is the correlation between the time-series of quarterly forecast and actual style returns. Adj. R^2, F-stat and P-value are the model fit statistics from a regression of the forecast returns on the actual style factor returns. MAE is the Mean Absolute Error which is the average of the absolute value of the forecast error which is the difference between the actual and the forecast return in each quarter. SDAE is the Standard Deviation of the Absolute Error. RMSE is the Root Mean Squared Error which is the square root of the average of the squared difference between the actual and forecast return in each quarter. Success Rate is the proportion of quarters in which the direction of the forecast was accurate.

Factor	Correlation	Adj. R^2 (%)	F-stat	P-value	MAE	SDAE	RMSE	Success Rate (%)
B/M	0.34	10.78	14.90	0.00***	14.94	16.51	22.22	60.33
D/P	-0.12	0.62	1.74	0.19	18.08	16.10	24.17	51.24
NPM	-0.10	0.15	1.18	0.28	24.60	20.35	31.87	37.19
ROE	-0.23	4.26	6.35	0.01**	22.02	17.90	28.33	48.76
ROA VAR	-0.05	-0.63	0.24	0.62	15.71	14.40	21.27	56.20
MOM	0.23	4.63	6.83	0.01**	18.45	12.70	22.37	61.98
SIZE	0.31	8.69	12.41	0.00***	20.51	19.31	28.12	67.77
SMV	0.06	-0.53	0.36	0.55	29.35	25.90	39.07	55.37

***, ** and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.

Note: 5 outlier observations (Q3 1999- Q3 2000) which include returns during the technology crash (i.e. Q1 2000- Q4 2001) which commenced in March 2000 have been excluded from the B/M model fit tests.

Table 5. Characteristics of investment strategies based on the style factor forecasts over 1981-2011

This table presents average annual returns over 1981-2011 to investment strategies based on style factor forecasts generated using macroeconomic and market information. The forecasts are made each quarter for the 12 month return commencing in two quarters' time- the first forecast is in Q_3 1980 for the buy-and-hold return over Q1-Q4 1981. The results for univariate strategies investing in either the style factor with the maximum (Max FC) or minimum forecast (Min FC) and a strategy which is long (short) the Max FC (Min FC) are provided. The 'All Quarters' return is the average actual annual return that is earned if the investment is made each quarter and held for the following 12 months. The 'Annual (Q_i)' returns also presented are for strategies which invest based on the forecasts made only in each Q_i where $1<=i<=4$ over the sample period. E.g. to invest in each calendar year the Q_3 forecasts are used. t -statistics are provided in parentheses below the returns. Forecast accuracy measures are also provided for the Max FC investment strategy. Specifically, MAE is the Mean Absolute Error which is the average of the absolute value of the forecast error which is the difference between the actual and the forecast return in each quarter. SDAE is the Standard Deviation of the Absolute Error. RMSE is the Root Mean Squared Error which is the square root of the average of the squared difference between the actual and forecast return in each quarter. Success Rate is the proportion of quarters in which the direction of the forecast was accurate.

	Max FC	**Min FC**	**Long/Short**	**MAE**	**SDAE**	**RMSE**	**Success Rate (%)**
All Quarters	7.26***	-1.30	8.55***	23.90	17.11	29.35	65.29
	(5.04)	(-0.74)	(3.60)				
Annual (Q_1)	9.01**	-1.13	10.14*	28.29	19.28	34.05	66.67
	(2.68)	(-0.32)	(1.97)				
Annual (Q_2)	6.72**	-1.43	8.15*	22.14	13.76	25.95	63.33
	(2.65)	(-0.39)	(1.70)				
Annual (Q_3)	6.59**	-2.20	8.79**	20.76	16.41	26.29	66.67
	(2.50)	(-0.72)	(2.18)				
Annual (Q_4)	6.72**	-0.41	7.13	24.53	18.36	30.46	63.33
	(2.20)	(-0.10)	(1.36)				

***, ** and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.

Table 6. Portfolio characteristics for the individual style factors and the style timing strategy over 1981-2011

This table provides portfolio characteristics for the individual style factors upon which a style timing strategy is developed over 1981-2011. Book-to-Market (B/M), Return-on-Equity (ROE), Momentum (MOM) and Size are the style factors included. The 'All Quarters' return is the average actual annual return that is earned if the investment is made each quarter and held for the following 12 months. The 'Annual (Qi)' returns also presented are for strategies which invest based on the forecasts made only in each Qi where 1<=i<=4 over the sample period. Mean is the average annual return. *t* -statistic is the Student's *t*- statistic for a paired sample *t*- test of the difference in means between the timing strategy and the alternative of constant investment in each of the style factors. Std Dev. is the standard deviation of the annual returns and the Sharpe Ratio is the Mean divided by the Std Dev.

	B/M	**ROE**	**MOM**	**SIZE**	**Timing Strategy**
			All Quarters		
Mean	5.76	3.20	7.90	2.44	7.26
t- statistic	0.61	2.08**	-0.38	2.16**	
Std Dev.	17.69	14.68	20.21	17.62	15.84
Sharpe Ratio	0.33	0.22	0.39	0.14	0.46
			Annual (Q_1)		
Mean	5.78	3.10	8.17	2.97	9.01
t- statistic	0.59	1.67	0.30	1.11	
Std Dev.	18.51	13.84	22.63	19.38	18.44
Sharpe Ratio	0.31	0.22	0.36	0.15	0.49
			Annual (Q_2)		
Mean	4.98	3.41	8.64	2.00	6.72
t- statistic	0.41	0.96	-0.47	1.15	
Std Dev.	15.83	15.65	21.32	15.65	13.87
Sharpe Ratio	0.31	0.22	0.41	0.13	0.48
			Annual (Q_3)		
Mean	5.89	2.98	7.36	1.43	6.59
t- statistic	0.17	0.93	-0.21	1.30	
Std Dev.	16.27	13.17	19.19	15.57	14.69
Sharpe Ratio	0.36	0.23	0.38	0.09	0.45
			Annual (Q_4)		
Mean	6.37	3.32	7.46	3.41	6.72
t- statistic	0.06	0.72	-0.26	0.75	
Std Dev.	20.66	16.60	18.50	20.25	16.70
Sharpe Ratio	0.31	0.20	0.40	0.17	0.40

***, ** and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.

Table 7. Average returns to quintiles of funds formed based on their exposure to the preferred style factor

This table presents average annual returns to funds sorted into quintiles based on their exposure to the preferred style factor. The sample of mutual funds is based on a merged dataset of funds in both the Thomson Reuters Common Stock Holdings Database and the CRSP Mutual Fund Database linked using MFLINKS. Results are presented when fund holdings for Q3 year *t* are used over 1980-2009. The associated investment horizon is from Q1-Q4 year *t+1* i.e. from 1981-2010. The asset-weighted raw and DGTW-adjusted returns presented are calculated using the stock holdings of the funds. The asset-weight applied is based on fund assets as at the end of the prior quarter. The weight applied to each stock is its holding value as at the end of the prior quarter. The average quarterly returns are first computed for each quintile- the annual returns are the simple compound of these four quarterly values. The market-adjusted return is also provided this is based on the CRSP Value-Weighted Index incluing dividends. *t*- statistics are provided in parentheses below the returns.

Quintile	**N**	**Raw Return**	**Market-adj. Return**	**DGTW-adj. Return**
1	30	12.71***	0.98	0.72
		(3.89)	(0.59)	(1.09)
2	30	10.89***	-0.85	-0.42
		(3.36)	(-0.76)	(-0.55)
3	30	11.35***	-0.39	0.07
		(3.37)	(-0.34)	(0.09)
4	30	12.22***	0.48	0.16
		(3.24)	(0.33)	(0.15)
5	30	9.80***	-1.93	-1.08
		(2.66)	(-1.38)	(-1.26)

***, ** and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.

Table 8. Average returns and quintile ranks by style.

This table presents average annual returns over the years in which each style factor (SF) is selected as the preferred style i.e. the years in which it has the maximum forecast return. The styles included are Book-to-Market (B/M), Return-on-Equity (ROE), Momentum (MOM) and Size. Funds are sorted into quintiles based on their exposure to the preferred style factor in Q3 year *t* . The fund returns are examined over Q1-Q4 year *t+1* i.e. 1981-2010. The results are provided for the preferred (unpreferred) funds which are in quintile 5 (1) i.e. those with the greatest (lowest) exposure to the preferred style quintile. A fund's exposure to the preferred style is calculated as the weighted-average quintile rank of the stocks in its portfolio whereby each stock's quintile rank is weighted by its holding value. QRank is the asset-weighted average quintile rank ($WRank_{j,t}$) across all funds in the quintile. The asset-weight applied is based on fund assets as at the end of the prior quarter (Q2 year *t*). N.B. The SF quintile assignments for each stock are the same as those used to create the portfolios which the SF returns are based on. Raw Return is the annual raw fund return calculated using the quarterly stock holdings from the Thomson Reuters Common Stock Holdings database. The annual mean is the simple compound of the four quarterly means for all funds existing in each quarter. The DGTW-adj. Return is the annual excess fund return whereby the return of each stock in the portfolio has been adjusted by the return on a portfolio of stocks with similar book-to-market, size and momentum characteristics. The time-series means are also provided for all years, *t* -statistics are in parentheses below these means.

Factor	Q1 Raw Return	Q1 DGTW-adj. Return	Q1 QRank	Q5 Raw Return	Q5 DGTW-adj. Return	Q5 QRank	Q5-Q1 Raw Return	Q5 - Q1 DGTW-adj. Return	Q5 - Q1 Rank	Actual SF Return
B/M	7.67	1.74	1.47	5.56	-1.37	3.13	-2.11	-3.11	1.66	6.24
ROE	13.19	1.03	2.71	8.11	-1.36	4.12	-5.08	-2.39	1.41	-5.09
MOM	16.16	-0.22	2.68	11.72	-0.77	4.19	-4.44	-0.55	1.51	12.81
SIZE	13.06	0.85	1.14	18.21	-0.95	3.45	5.15	-1.80	2.31	15.40
All Years	12.71***	0.72	2.13***	9.80***	-1.08	3.88***	-2.91	-1.81	1.75***	7.52**
	(3.89)	(1.09)	(9.26)	(2.66)	(-1.26)	(-11.82)	(-1.18)	(1.67)	(25.81)	(2.57)

Years in which the forecast return indicates each factor is the preferred style (for year *t+1*):
- B/M = 1980, 1982, 1985, 1989, 1990, 1991, 2005, 2006, 2007
- ROE = 1986, 1987, 1992, 1993, 2004, 2008
- MOM = 1981, 1983, 1988, 1994, 1995, 1996, 1997, 1998, 1999, 2000, 2003, 2009
- SIZE = 1984, 2001, 2002

***, ** and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.

Table 9. Historical performance of long-only style factors

This table presents a summary of the annualised percentage performance of the style factors included in this study. Furthermore, the annualised standard deviation of the monthly returns is provided in parentheses. The value factors are: book-to-market (B/M), dividend-to-price (D/P), earnings-to-price (E/P), cash flow-to-price (C/P), sales-to-price (S/P) and EBITDA-to-enterprise value (EBITDA/EV). The growth factors are: trailing 3-year earnings growth (TREG), net profit margin (NPM), trailing 3-year sales growth (TRSG) and the sustainable growth rate (SGR). The quality growth factors are: return-on-equity (ROE), return-on-assets (ROA) and operating cash-flow (OCF). The quality stability factors are leverage (LEV), sales-growth-variability (SG VAR) and ROA variability (ROA VAR). The factors based on accounting metrics are formed by sorting stocks into quintiles in June of each year *t* , based on the value of the metric in question for the fiscal year ending in year *t-1*. Size is the value of market equity as at June of each year *t* . Returns are then computed from July of year *t* to June of year *t+1* . For the value, growth and quality growth (size) categories the monthly factor return is the average return to the highest (lowest) quintile of stocks minus the return to the CRSP value-weighted index including dividends (CRSP VWD). Whereas, the quality stability factors are calculated as the monthly difference between the average return of firms in quintiles one to four and the CRSP VWD. Momentum is constructed as the average of firms with the highest 20 percent 11-month returns lagged one month minus the CRSP VWD. Portfolios are rebalanced monthly. The volatility factor is calculated each month as the average return to the lowest quintile of stocks based on historical idiosyncratic volatility minus the CRSP VWD. Average returns to the quintiles are value-weighted for all of the style factors. Up (Down)-market months are those in which the CRSP VWD is greater (less) than the T-Bill rate. There are 330 (240) up (down)-market months.

	All	**1981-1991**	**1992-2001**	**2002-2011**	**Up-Markets**	**Down-Markets**
Value						
B/M	3.37 (8.79)	5.09 (6.80)	1.71 (10.36)	3.17 (9.50)	-2.09 (7.62)	11.97 (9.85)
D/P	2.88 (11.00)	3.89 (9.90)	2.11 (13.36)	2.56 (10.43)	-9.66 (7.62)	24.40 (11.22)
E/P	3.91 (8.28)	2.88 (6.55)	5.02 (10.89)	3.95 (6.92)	1.47 (7.30)	7.63 (9.48)
C/P	2.73 (9.45)	3.59 (7.23)	0.30 (13.04)	4.24 (7.09)	-6.60 (8.44)	18.10 (9.44)
S/P	3.94 (9.31)	1.81 (6.84)	4.23 (11.09)	6.02 (9.76)	5.79 (8.55)	1.25 (10.33)
EBITDA/EV	4.23 (7.87)	3.19 (5.13)	4.40 (10.60)	5.22 (7.18)	0.14 (7.02)	10.57 (8.73)
Growth						
TREG	-0.11 (5.21)	-0.58 (4.84)	-2.08 (4.90)	2.44 (5.84)	4.04 (4.47)	-5.97 (5.74)
NPM	-0.53 (5.22)	0.64 (4.62)	-0.85 (7.04)	-1.50 (3.40)	-4.88 (5.00)	6.23 (4.95)
TRSG	-0.39 (5.39)	-0.41 (5.36)	-1.27 (5.73)	0.53 (5.10)	4.82 (4.82)	-7.66 (5.47)
SGR	-1.17 (5.22)	-1.08 (5.82)	-1.33 (5.17)	-1.10 (4.58)	1.21 (4.90)	-4.59 (5.53)
Quality (Growth)						
ROE	-0.34 (5.31)	0.64 (5.09)	-1.88 (6.17)	0.14 (4.58)	-1.08 (5.09)	0.78 (5.61)
ROA	-0.33 (5.20)	1.16 (5.06)	-1.72 (5.91)	-0.55 (4.56)	-0.15 (5.18)	-0.59 (5.24)
OCF	1.46 (5.41)	4.08 (4.25)	-0.69 (7.00)	0.79 (4.59)	-0.82 (5.25)	4.93 (5.50)
Quality (Stability)						
LEV	-0.15 (2.43)	0.64 (1.59)	-1.85 (2.78)	0.72 (2.75)	-0.70 (2.26)	0.67 (2.65)
SG VAR	0.47 (3.82)	1.77 (1.83)	-1.33 (5.39)	0.86 (3.51)	-3.32 (3.39)	6.33 (3.84)
ROA VAR	0.64 (4.38)	1.55 (1.85)	-1.06 (6.58)	1.36 (3.52)	-3.88 (3.75)	7.68 (4.51)
Momentum	2.81 (7.77)	1.99 (6.27)	4.15 (8.17)	2.37 (8.81)	6.61 (7.55)	-2.59 (7.85)
Size	-0.75 (12.85)	5.03 (9.27)	-4.36 (17.58)	-3.26 (10.33)	-4.97 (13.54)	5.80 (11.57)
Low Volatility	0.73 (6.65)	2.78 (3.46)	0.31 (9.77)	-1.06 (5.34)	-6.95 (6.00)	13.17 (6.12)

Table 10. Reliability of style factor forecast returns for long-only factors

This table provides a summary of model fit statistics and forecast accuracy measures for quarterly style factor forecast returns compared to the actual style factor returns over 1981-2011. The style factors included are Book-to-Market (B/M), Dividend-to-Price (D/P), Trailing Sales Growth (TRSG), Operating Cash Flow (OCF), Return-on-Asset Variability (ROA VAR), Momentum (MOM), Size and Stable-minus-Volatile (SMV). Correlation is the correlation between the time-series of quarterly forecast and actual style returns. Adj. R2, F-stat and P-value are the model fit statistics from a regression of the forecast returns on the actual style factor returns. MAE is the Mean Absolute Error which is the average of the absolute value of the forecast error which is the difference between the actual and the forecast return in each quarter. SDAE is the Standard Deviation of the Absolute Error. RMSE is the Root Mean Squared Error which is the square root of the average of the squared difference between the actual and forecast return in each quarter. Success Rate is the proportion of quarters in which the direction of the forecast was accurate.

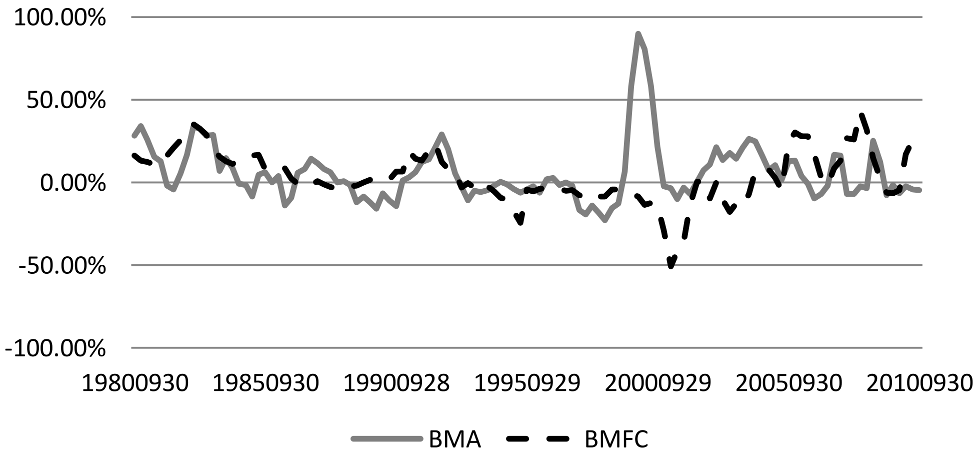
Factor	**Correlation**	**Adj. R^2 (%)**	**F-stat**	**P-value**	**MAE**	**SDAE**	**RMSE**	**Success Rate (%)**
B/M	0.09	-0.10	0.89	0.35	13.11	15.17	19.99	58.97
D/P	-0.02	-0.79	0.06	0.80	16.68	19.99	25.97	48.76
TRSG	0.00	-0.84	0.00	1.00	7.02	7.82	10.49	51.24
OCF	0.06	-0.47	0.44	0.51	8.63	7.08	11.14	60.33
ROA VAR	-0.04	-0.69	0.18	0.67	4.76	4.67	6.65	57.85
MOM	0.06	-0.45	0.47	0.50	7.20	6.09	9.41	66.12
SIZE	0.26	6.13	8.84	0.00***	22.52	26.90	34.99	63.64
SMV	0.01	-0.83	0.01	0.91	8.81	9.00	12.56	52.07

***, ** and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.

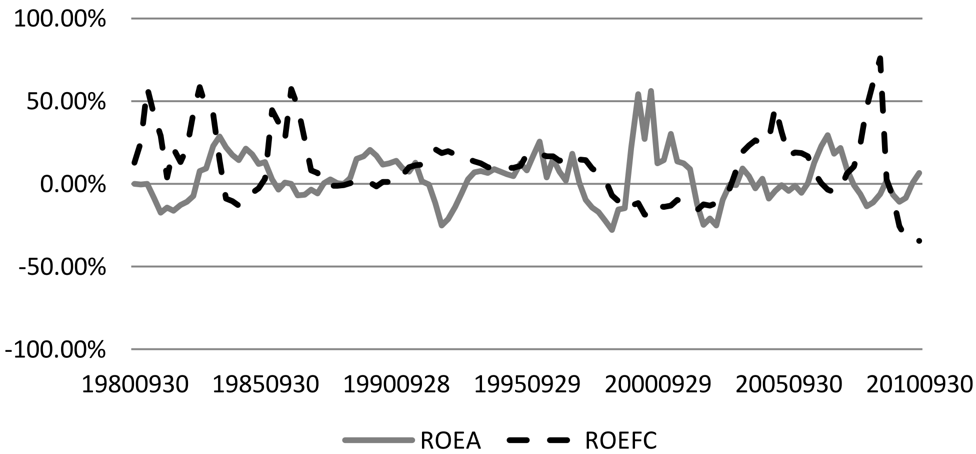
Note: 5 outlier observations (Q3 1999- Q3 2000) which include returns during the technology crash (i.e. Q1 2000- Q4 2001) which commenced in March 2000 have been excluded from the B/M model fit tests.

Figure 1. Style factor returns forecasts versus actuals

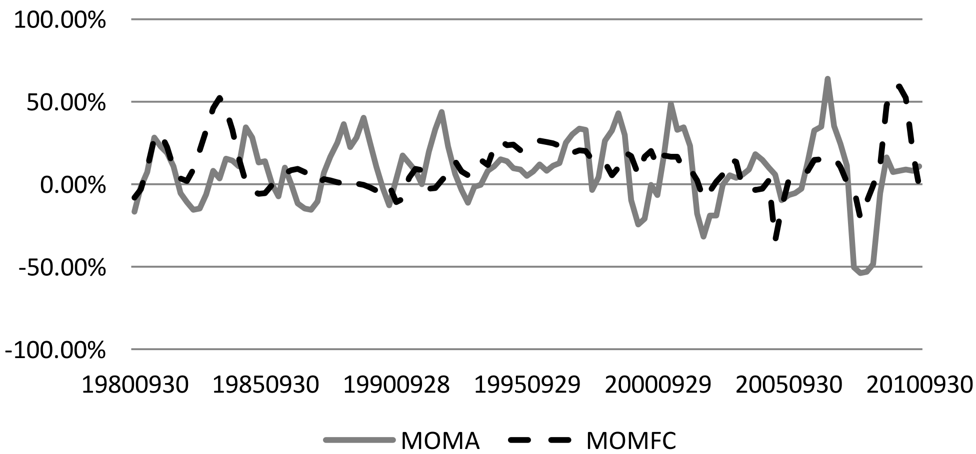
Panel A: Book-to-Market Forecast vs. Actual 1981-2011



Panel B: Return-on-Equity Forecast vs. Actual 1981-2011



Panel C: Momentum Forecast vs. Actual 1981-2011



Panel D: Size Forecast vs. Actual 1981-2011

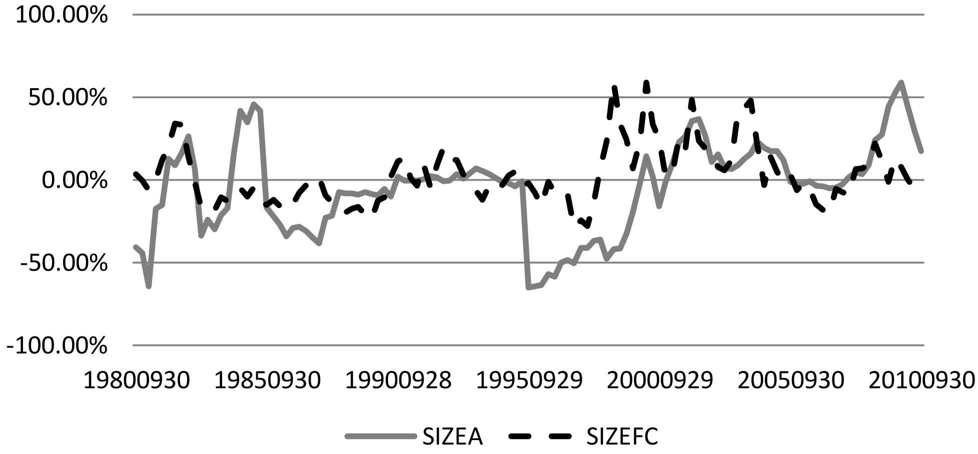


Figure 1 demonstrates the actual return and forecast return for the four style factors included in the style timing model over 1981-2011. The forecast for 1981 (2011) is determined at the end of September 1980 (2010). Panels A, B, C and D show the quarterly returns for Book-to-Market, Return-on-Equity, Momentum and Size, respectively.

Figure 2. Change in exposure to the preferred style factor over the investment horizon over Q1 1981 - Q3 2010

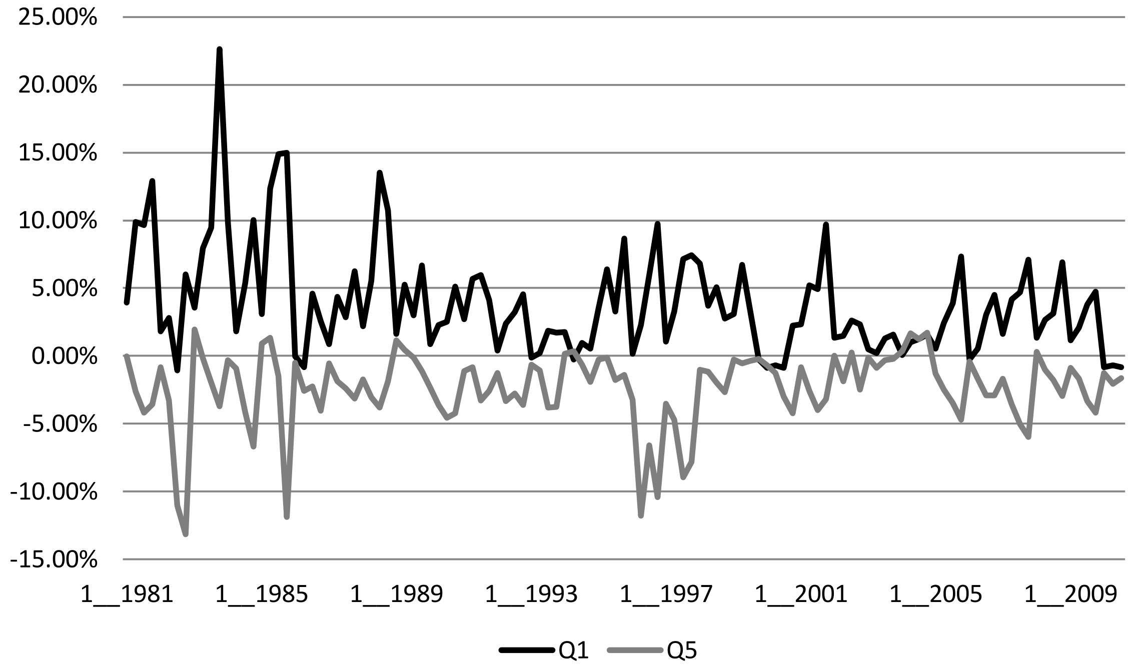


Figure 2 shows the change in exposure to the preferred style factor over the investment horizon for funds in quintile 1 (out-of-favour funds) and quintile 5 (preferred funds). The change in exposure is calculated relative to the exposure as at quintile formation in Q_3 of year *t*. Specifically, the change in exposure is calculated for each quarter over the investment horizon i.e.,, as at Q_1, Q_2, Q_3 and Q_4 of year *t+1*.

Appendix A. Market and macroeconomic variables

This table details the market and macroeconomic variables considered for selection for the style factor forecasting models.

Variable	Measurement	Source	A priori
	Conditioning Financial Variables		
T-Bill[a]	1-month Annualised Treasury Bill Yield	CRSP Fama T-Bill Structures via Wharton Research Data Services (WRDS)	Pesaran and Timmermann (1995) state the T-Bill is the only variable included in all versions of their dynamic model used to forecast the market return over 1960-1992.
CRSP Dividend Yield[b]	Dividend Yield for the CRSP Value-Weighted Index including dividends (CRSP VW) over the prior 12 months	CRSP via WRDS	Ferson and Schadt (1996) use the CRSP Dividend Yield as a conditioning information variable when evaluating fund performance.
Treasury Yield Spread[c]	Yield on a Constant Maturity 10-year Bond (CM10B) – the 3 month Treasury Bill Yield	Federal Reserve Bank of St Louis (FRB)	Kao and Shumaker (1999) found that the treasury yield spread is positively correlated with the value-growth spread.
Corporate Bond Yield Spread[d]	Moody's Seasoned BAA Corporate Bond Yield – Moody's AAA Corporate Bond Yield	FRB via WRDS	Kao and Shumaker (1999) determined that the credit spread is an important factor in explaining style spreads in a multivariate context.
Log of Market Value[e]	Log of combined value of NYSE, AMEX & NASDAQ securities used in CRSP VW Index	CRSP via WRDS	Flannery and Protopapadakis (2002) use the Log of Market Value as a conditioning information variable.
	Other Financial Variables		
Market Return[f]	Quarterly Return to the CRSP VW Index for NYSE, AMEX & NASDAQ stocks	CRSP via WRDS	Fama and French (1993) identify the market return as a common risk factor relevant to stock returns.
Market Turnover[g*]	Value-Weighted (by MC_{t-1}) Turnover of NYSE,AMEX & NASDAQ common stocks $Turnover_t$ = # Shares $Traded_t$ /Adj. Shares $Outstanding_{t-1}$	CRSP via WRDS	Baker and Stein (2004) determine that increases in liquidity e.g. higher turnover predict lower subsequent returns for firm-level and aggregate data and so liquidity acts like a sentiment index.

Market Volatility[h]	Standard Deviation of return on CRSP VW Index over prior 12 months	CRSP via WRDS	Ang et al. (2006) show that market volatility is a significant cross-sectional asset pricing factor.
Earnings Yield Gap[i]	Earnings-to-Price Ratio of the S&P 500 – CM10B	Shiller data	Kao and Shumaker (1999) find that the Earnings Yield Gap had the highest R^2 of the six variables they examined and it was the only one that had a negative relationship with the value-growth spread.
Book-to-Market (B/M) Spread[j]	Average B/M Ratio Decile 10 – Average B/M Ratio Decile 1 *where* average B/M Ratio = Sum Book Value/Sum Market Equity for all stocks in the decile	Ken French data	Lu and Zhang (2008) state it is a counter-cyclical variable which tends to predict aggregate stock returns positively
Market-to-Book Spread[k]	Average M/B Ratio Decile 1 – Average M/B Ratio Decile 10 *where* average M/B Ratio = Sum Market Equity/Sum Book Value for all stocks in the decile	Ken French data	Lu and Zhang (2008) state it is a pro-cyclical variable which tends to predict aggregate stock returns negatively
Value Spread[l]	Log of B/M Ratio Decile 10 – Log of B/M Ratio Decile 1	Ken French data	Cohen, Polk and Vuolteenaho (2003) show that the expected return on value minus growth strategies is atypically high at times when their spread in book-to-market ratios is wide
Macroeconomic Variables			
Actual CPI[m]	YoY** Change CPI, All Items, Seasonally Adjusted (SA), 2005 = base year	Bureau of Labour Statistics (BLS)	Flannery and Protopapadakis (2002) state that CPI affects the level of the market portfolio's returns.
Actual GDP[n]	YoY** Change in GDP, Current Prices, SA	US Bureau of Economic Analysis (BEA)	Kao and Shumaker (1999) state that "GDP growth reflects corporate profit cycles. During expansionary periods when corporate profit growth is high, operating leverage contributes disproportionately to value stocks' profitability; hence, value stocks are likely to outperform during those periods" (p.42).
Output Gap[o]	Estimated from a regression of the log of	FRB	Cooper and Priestley (2009) emphasise that

	industrial production on a linear & a quadratic time trend- the output gap is the error term from this regression		the output gap is a strong predictor of US stock returns.
Growth in Industrial Production[p]	YoY** Change in Volume Index, SA	FRB	Pesaran and Timmermann (2000) state that industrial production is linked to company earnings and earnings are an important determinant of stock returns.
Change in Consumption[q]	YoY** Change in Total Personal Consumption Expenditures , CP, SA	BEA	Baker and Wurgler (2006) orthogonalise the Sentiment Index they created on a few relevant economic variables of which one is consumption.
Change in Manufacturing Index[r]	YoY** Change in Manufacturing Index, SA	Institute for Supply Management (ISM)	Cevik et al. (2012) find that developments in the ISM manufacturing index affect regime switching probabilities in both bull and bear stock market periods.
Change in Oil Prices[s]	YoY** Change in Producer Price Index (PPI)- Crude Petroleum, Not SA	BLS	Chen, Roll and Ross (1986) state that it is often argued that oil prices must be included in any list of the systematic factors that influence stock market returns and pricing.
PPI[t]	YoY** Change in PPI- Finished Goods, SA	FRB	Flannery and Protopapadakis (2002) state that PPI affects the market portfolio's returns.
Balance of Trade[u]	Total Exports – Total Imports, CP, SA (original data)	BEA	Flannery and Protopapadakis (2002) find that the Balance of Trade affects the market returns' conditional volatility.
Growth in Employment[v]	YoY** Change in Total Non-Farm Employees, SA (in thousands)	BLS	Flannery and Protopapadakis (2002) find that Employment affects the market returns' conditional volatility.
Unemployment Rate[w]	Unemployed Persons aged 16 and over, SA (original data)	BLS	Flannery and Protopapadakis (2002) find that Unemployment affects the market returns' conditional volatility.
Housing Starts[x]	YoY** Change in Total: New Privately Owned Housing Units Started, SA, Annual Rate	US Department of Commerce: Census	Housing starts are commonly used as leading indicators of changes in macroeconomic

	(thousands of units)	Bureau	activity (OECD, 1987)
Monetary Aggregate [y] (M1)	YoY** Change in M1, CP, SA	US Banking Survey, IMF	Flannery and Protopapadakis (2002) find that M1 affects the level of market returns and its conditional volatility.

[*]MTO has been included as a sentiment proxy. The Baker and Wurgler (2006) sentiment index was considered as an alternative; however there is a one year lag in its release. Various industry generated indices were also considered (e.g. State Street Confidence Index); however they don't have adequate data history and/or aren't publicly available.

[**]A moving average over the prior 4 quarters is first computed for each quarter, the YoY change is based on these averages.

[a] Chen, Roll and Ross (1986); Ferson and Schadt (1996); Pesaran and Timmermann (1995)

[b] Bird and Casavecchia (2011); Ferson and Schadt (1996)

[c] Bird and Casavecchia (2011); Chan et al. (1998); Chen, Roll and Ross (1986); Elton, Gruber and Blake (1995); Ferson and Schadt (1996); Kao and Shumaker (1999)

[d] Bird and Casavecchia (2011); Chan et al. (1998); Chen, Roll and Ross (1986); Elton et al. (1995); Ferson and Schadt (1996); Kao and Shumaker (1999);

[e] Flannery and Protopapadakis (2002)

[f] Chen, Roll and Ross (1986); Elton et al. (1995); Ferson and Schadt (1996)

[g] Baker and Stein (2004); Statman, Thorley and Vorkink (2006)

[h] Ang et al. (2006)

[i] Kao and Shumaker (1999)

[j] Lu and Zhang (2008)

[k] Lu and Zhang (2008)

[l] Campbell and Vuolteenaho (2004); Cohen, Polk and Vuolteenaho (2003)

[m] Chen, Roll and Ross (1986); Flannery and Protopapadakis (2002); Kao and Shumaker (1999)

[n] Kao and Shumaker (1999)

[o] Cooper and Priestley (2009)

[p] Baker and Wurgler (2006); Chan et al. (1998); Chen, Roll and Ross (1986); Pesaran and Timmermann (2000);

[q] Baker and Wurgler (2006); Chen, Roll and Ross (1986)

[r] Cevik, Korkmaz and Atukeren (2012)

[s] Chen, Roll and Ross (1986)

[t] Flannery and Protopapadakis (2002)

[u] Flannery and Protopapadakis (2002)

[v] Flannery and Protopapadakis (2002)

[w] Flannery and Protopapadakis (2002)

[x] Flannery and Protopapadakis (2002); OECD (1987)

[y]Flannery and Protopapadakis (2002)

Appendix B. Summary statistics for market/macroeconomic variables

This table presents summary statistics for 25 market and macroeconomic variables used in this study. The summary statistics are based on the quarterly values of the variables over Q3 1980 to Q3 2010, which are used forecast style factor returns from Q1 1981 - Q4 2011. All macroeconomic variables indicating a percentage change are measured as the year-on-year change, using a moving average over the prior 4 quarters as the value for each quarter, to decrease the impact of historical data revisions. Appendix A provides specific measurement details for each variable.

Variable	**Mean**	**Median**	**Std Dev.**	**Min**	**Max.**
T-Bill (%)	0.36	0.39	0.31	0.00	1.22
CRSP Dividend Yield (%)	2.63	2.46	1.08	1.06	5.55
Treasury Yield Spread (%)	1.84	2.06	1.26	-2.65	4.42
Corp. Bond Yield Spread (%)	1.11	0.95	0.50	0.55	3.09
Log Market Value	12.77	12.79	0.40	12.06	13.33
Market Return (%)	2.99	3.70	8.77	-23.81	21.29
Market Turnover (%)	32.58	24.50	25.14	3.65	150.98
Market Volatility (%)	4.24	4.09	1.68	1.53	9.45
Earnings Yield Gap (%)	-1.24	-1.50	1.46	-4.44	3.75
B/M Spread	1.82	1.23	2.59	0.28	22.62
M/B Spread	6.72	5.74	3.89	1.93	23.29
Value Spread	2.33	2.21	0.70	0.82	4.67
Δ CPI (%)	3.61	3.04	2.37	-0.77	13.71
Δ GDP (%)	5.80	5.91	2.54	-2.77	12.22
Output Gap	-0.01	0.00	0.06	-0.20	0.10
Δ Industrial Production (%)	1.83	2.46	3.99	-12.31	10.04
Δ Consumption (%)	6.25	6.24	2.35	-2.22	11.22
Δ Manufacturing (%)	1.28	-1.24	14.46	-23.60	55.58
Δ Oil Prices (%)	7.94	5.06	28.87	-49.40	101.98
Δ PPI (%)	2.67	2.21	2.89	-3.36	13.60
Balance of Trade ($bn)	-78.23	-44.63	66.27	-218.61	-2.83
Δ Employment (%)	1.23	1.67	1.82	-4.44	4.62
Unemployment Rate (%)	6.27	5.80	1.64	3.90	10.80
Housing Starts (%)	-1.43	1.42	17.91	-45.40	59.99
Δ Monetary Aggregate: M1 (%)	5.19	5.18	4.78	-4.25	15.61

Appendix C. Mutual fund dataset construction

The dataset used is created by merging the Thomson Reuters Mutual Fund Common Stock Holdings[19] (s12) Database with the CRSP Mutual Fund Database (CMFD), using MFLinks. The s12, CMFD and MFLinks tables which facilitate the data merge are all sourced from Wharton Research Data Services (WRDS). The s12 data is sourced from the SEC N-30D filings which funds are required to file semi-annually with the SEC. Up until 1985 funds were required by the SEC to file this data on a quarterly basis (WRDS, 2008).About 60% of funds continue to provide this data quarterly (WRDS, 2012). The s12 database contains quarterly stock holdings data for US mutual funds and the CMFD contains monthly fund returns as well as fund characteristics such as Total Net Assets (TNA), Date the Fund was First Offered, Turnover, Expense Ratios, Management Fees and Loads. This study is interested in US Active Equity Fund Managers so in order to identify only these funds various exclusions are made to both datasets.

Prior to the database merge, funds in the CMFD with the following Policy classifications were excluded: Canadian and International ('C & I'), Balanced ('Bal'), Bonds ('Bonds'), Preferred Stocks ('Pfd'), Bond and Preferred Stocks ('B & P'), Government Securities ('GS'), Money Market ('MM') and Tax-Free Money Market ('TFM') funds are excluded. The universe of US Active Equity Managers from the CMFD is further refined by including only those funds with the following classification codes:

- Wiesenberger Fund Type Codes- Growth (G), Growth and Current Income (GCI), Growth-Income (G-I), Long-Term Growth (LTG), Maximum Capital Gains (MCG) and Small-Capitalisation Growth (SCG).
- Strategic Insight Objective Code- Equity USA Aggressive Growth (AGG), Equity USA Midcaps (GMC), Equity USA Growth & Income (GRI),Equity USA Growth (GRO), Equity USA Income & Growth (ING), and Equity USA Small Companies (SCG).
- Lipper Classification Code-Equity Income (EIEI), Growth (G), Large-Cap Core (LCCE), Large-Cap Growth (LCGE), Large-Cap Value (LCVE), Mid-Cap Core (MCCE), Mid-Cap Growth Funds (MCGE), Mid-Cap Value (MCVE), Multi-Cap Core (MLCE), Multi-Cap Growth (MLGE), Multi-Cap Value (MLVE), Small-Cap Core (SCCE), Small-Cap Growth (SCGE), Small-Cap Value (SCVE)

[19] Also known as the CDA/Spectrum s12 database.

If a fund is missing a Policy classification, Wiesenberger Fund Type Codes, Strategic Insight Objective Code and Lipper Classification Code but between 80%-105% of the fund's assets are invested in equity then it is included.

A single wficn identifier may be linked to a number of funds in the CMFD; however this is due to the fact that the same wficn identifier is used for funds which have a number of share classes. Multiple share classes for the same fund are aggregated using the TNA for the month prior as the weight applied to all variables for each share class.

The s12 dataset contained 2,409 unique funds prior to the merge with the CMFD, after merging the datasets there are 2,047 unique funds, thus 85% of the funds are linked. Subsequent to merging the two databases a manual check of the funds' names was undertaken to ensure misclassified funds are not included (Ali, Chen, Yao and Yu, 2008). There are 2,047 unique funds in the merged dataset after removing the misclassified funds, of which there are 191 in total, the final sample contains 1,856 funds over 1980-2010.

Appendix D. Economic variables used to forecast each style factor

This table shows which economic variables (EVs) are included in the forecasting models used for each style factor in each of the six forecasting periods. Please refer to Table 5 for a detailed breakdown of the dates covered by Forecast Periods 1 to 6.

	Book-to-Market						**Return-on-Equity**						**Momentum**						**Size**					
Economic Variable	P1	P2	P3	P4	P5	P6	P1	P2	P3	P4	P5	P6	P1	P2	P3	P4	P5	P6	P1	P2	P3	P4	P5	P6
T-Bill			X				X	X	X				X								X			X
CRSP Div. Yield													X							X				
Treasury Yield Spread			X		$	$							X	X								X	X	
Corp. Bond Yield Spread										X					X									
Log Market Value										X	X			X								X	X	
Market Return																X								
Market Turnover							X	X			X				X		X		X					
Market Volatility			X						X	X	X													X
Earnings Yield Gap				X	X	X	X					X							X	X			X	X
B/M Spread										$		X										X		
M/B Spread									$										X	X				X
Value Spread			X	X											$	X								
Δ CPI											X			#			X		X					
Δ GDP	X		X				X				X					X								
Output Gap				X												$							X	
Δ Industrial Prod.			$						X	X					X		X							
Δ Consumption		X						X							X					X				
Δ Manufacturing					X	X	X					X	X		X				X					X
Δ Oil Prices							X								#							X		
Δ PPI		X			X	X		X				X						X			X			
Balance of Trade ($bn)			X			X			$										X	X				
Δ Employment	X				$	X	X					X							$				#	
Unemployment Rate	X	X	X	X								X				X								X
Δ Housing Starts			X	X			X		X	X		X	X	X					X	X		X		
Δ Monetary Aggregate: M1			X							X	#					X	X		X		#	X		

X, # and * indicate that the average parameter estimate is signifciant at the 1%, 5% and 10% level, respectively. If the EV is included in the forecasting model for a given period however the average parameter estimate is not statistically significant this is denoted by a $.