
Style and style analysis from a practitioner's perspective: What is it and what does it mean for European Equity investors?

Received (in revised form): 15th March, 2000

Robert Schwob*

is the founding Chief Executive of Style Research Limited, an independent provider of global equity Style research, portfolio analysis software, and Internet-based online equity research facilities. He is also Director of INQUIRE UK, Chairman of the INQUIRE UK Research Committee, a member of the Advisory Council of the Scottish Institute for Research in Investment and Finance (SIRIF), and a member of the Editorial Board for the *Journal of Asset Management*. He was educated in Canada, France and the UK and holds Masters Degrees in Mathematics and International Economics.

*Style Research Limited, 10–12 Perrin's Court, London NW3 1QS.

Tel: +44 (0) 20 7431 6633; Fax: +44 (0) 20 7431 6037; e-mail: Robert.Schwob@StyleResearch.com; website: www.StyleResearch.com

Abstract Style concepts and style practices are currently becoming popular in the UK as well as across Europe and the Eurozone. Yet, within these markets, the relevance and usefulness of style techniques has yet to be demonstrated. This paper reviews the generic range of style techniques available to practitioners and describes the various, basically commercial, reasons for their recent surge in popularity. In an effort to support current practices (or to put them in doubt), the paper proceeds to develop a general framework, and a set of criteria, for determining the validity of these style practices within a working environment. This leads to the formulation of a practical definition of what it means to suggest that style exists within a market.

Based on this definition and formal framework, the paper examines and generally supports the relevance of style practices across the Eurozone and within a number of major European markets. Style-based techniques are also adapted to consider the 'market allocation vs sector allocation' question that is currently confronting many top-down Eurozone equity managers.

Keywords: *style; Eurozone investment; equity management; market analysis; portfolio analysis*

Introduction

Style has achieved wide popularity both among investment professionals and within the academic community. The simplicity of the basic principle underlying style — that only a few things matter, or, more sensibly, that

there are only a few things that really matter most — has received a welcome reception in both camps; and style concepts have inspired a broad array of style-based practices and commercial services.

Style has, in fact, become associated

with such a wide range of analysis ideas and techniques, ranging from simple factor analysis of security returns to the characterisation of portfolio structure through the analysis of historic returns, that it is now quite understandable to question, more formally, what style really means.

And these are not idle musings. Although style concepts have been usefully applied in the United States for several years,¹ it is not at all clear that the same, or even similar, style principles can be justifiably applied within other markets. Despite the attractions of the simple approach that style offers, and it certainly is appealing to European investors struggling with the challenges of investing across the newly formed Eurozone, Eurozone style enthusiasm is being met with understandable Eurostyle scepticism. Practical investors, as well as academics need a more formal understanding of the basis of the style approach, both to substantiate (or reject) the use of various style-based techniques in international markets, as well as to appreciate and to develop the position style occupies in the field of financial theory.

The paper begins with some background, endeavouring to explain the popularity of style in its various current applications and offering a theoretical perspective of the position the style approach occupies within financial theory as an equity research philosophy. But the main effort begins in the section on 'Validating style practices', where we begin to establish the ground rules for evaluating the use of various style applications in equity markets. In order to focus directly on substantiating (or rejecting) the use of style techniques within and across the Eurozone markets, we proceed to consider a number of key principles and associated statistical tests that can be applied to validate the use of

style-based practices. These principles lead to an operational definition of style, identifying what it means to suggest that style 'exists' within markets and that, consequently, style practices can be usefully applied.

The empirical section puts the definition and the range of style criteria to work, examining the relevance of style in the US and the UK, across the Eurozone, and within three individual European markets. The results provide interesting insights into the style structures within the US and UK equity markets and offer formal support to the popular and widespread use of style techniques in these markets. The results also support the use of style techniques across the Eurozone (on a sector-adjusted and country-adjusted basis, defined), but the style effects are less strong than within the US or the UK. And style is less relevant within even the larger of the individual markets of the Eurozone. In the final part of the empirical section, we use style principles to cast more light on the 'market allocation vs sector allocation' question that is currently vexing many European investment managers.

Style applications and the attractions of style

Style analysis and style management practices have been popularised through the application of a number of style-based analysis practices:

1. Market style analysis based on monitoring and interpreting the performance of a limited number of style-based paradigm portfolios ('attribute-sorted portfolios');
2. Portfolio style analysis based on the analysis of a limited number of style factor tilts of individual security holdings ('compositional style analysis');

3. Portfolio style analysis based on the comparison of the historic returns of the actual portfolio against the historic returns of style-based paradigm portfolios ('top-down returns-based style analysis').
4. Portfolio style analysis based on combining the results of individual returns-based analyses of all securities currently held within the portfolio ('bottom-up returns-based style analysis').

From a practitioner's perspective, style is a very appealing prospect. It offers the potential to describe, analyse and represent: individual securities, market trends, investment funds, client portfolios, fund managers and investment companies themselves, simply according to a small number of intuitive criteria.

And, partly owing to this simplicity, it is perceived to provide useful information and business opportunities to investment managers, marketing and client relationship professionals, investment consultants and investment sponsors alike.

- *It is intelligible and accessible:* Style classifications enable a dramatic reduction in the dimension (and, presumably, the complexity) of the problems associated with equity management. If style determines over 90 per cent of performance,² and styles basically encompass only value vs growth and large vs small, then investors need only find answers to two key questions. Even if the good answers are difficult, the reduced scale of decisions makes investment, particularly mutual fund investment, easier to understand and, so, accessible to a broader audience. A marketer's dream.
- *It focuses effort efficiently:* Properly defined styles offer a shortlist of key issues that matter most for performance. Using

these criteria, professionals are able to focus on critical investment issues and concentrate on those decisions which will have the greatest impact on investment performance. It can stop time-wasting.

- *An effective division of responsibility:* Style classifications justify and encourage the separation of manager responsibilities within distinct areas of expertise. If, as occurs with genuine styles, the performance of securities within each style cluster together, in some meaningful way, and respond to different specific influences, then not only can we manage each style against other styles (style rotation), but we must also consider managing within each style according to style-specific investment criteria, as well. Style management concentrates managers on what they do best.
- *A multi-purpose management tool:* Style offers a set of criteria for monitoring the activities of internal and external managers. Portfolio style analysis provides a simple tool for senior investment directors, consultants and investment sponsors that enables them to direct and to manage investment managers in a consistent manner. It helps managers manage managers.

However, despite its popularity, there is still considerable ambiguity about what style actually means and where, and possibly when, investment professionals can conscientiously apply style practices and justifiably enjoy its benefits. Indeed, the style concept is in danger of being enthusiastically applied, in each of the above manifestations, within international markets and the Eurozone, before its relevance and suitability have been recognised — and even before the criteria needed to demonstrate relevance and suitability have themselves been established. Even as ease of use and

commercial interests continue to promote the application of style techniques, a formal, comprehensive and critical understanding of style, and where its various services may be responsibly applied, has remained absent.³

Style as an investment philosophy: A challenge to multivariate securities analysis

The growing popularity of style analysis (of markets and of portfolios) and style management is also threatening to obscure the importance of the principles underlying the concept. Despite its undeniable commercial appeal, style also has a deeper intellectual side. Style concepts offer a framework for the analysis of markets, portfolios and securities that differs markedly from the popular multivariate analysis techniques. It is important to explore the nature of these differences and to understand the conditions (and situations) which justify and support choosing to do things differently.

The, now traditional, multivariate securities analysis offers a method to model securities returns based on the influences of fundamental factors. Usually, a model similar to the following generalised outline is used; first the return model:

$$r_i(t) = f_j(t)b_{i,j}(t) + \dots + f_n(t)b_{i,n}(t) + \varepsilon_i(t)$$

where $r_i(t)$ is the return of stock i at time t , $b_{i,j}(t)$ is the j th factor load of stock i at time t , $f_j(t)$ is the reward to factor j at time t , and $\varepsilon_i(t)$ is the error term at time t .

The analysis then proceeds to describe a model of risk, usually defined as tracking error, or something close to it. In the case of an individual security, this can be defined as:⁴

$$\text{Risk } i = \mathbf{b}_i^T \Omega \mathbf{b}_i$$

where \mathbf{b}_i is the column vector of factor tilts of security i , and Ω is the covariance matrix of the factor reward histories, $\text{Cov}(f_j(t), f_k(t))$.

And the process goes on to find linear combinations of factor criteria which, when used to characterise securities, result in a systematic breakdown of risk into separable components.⁵ The independent components of the risk decomposition (if principal components analysis is used, these are the eigenvalues which make up the diagonal of the diagonalised covariance matrix) provide a measure of the relative importance of each of the 'risk factors' (corresponding to the orthogonal eigenvectors of a principal components decomposition) in contributing to total risk within the market being analysed.

The undeniable attraction of the multifactor approach is that it offers a smooth transition from a returns model to a risk model. It proceeds to define statistics that describe how good the model is (or has been); and it also reveals which combinations of factors contribute most towards explaining historic patterns of securities risk. Multifactor models offer simple, unambiguous decompositions of portfolio risk and carry with them integrated measures describing their relevance. They offer a sophisticated and authoritative methodology.

Unfortunately the multifactor approach also has a few drawbacks:

1. The analysis leading to the calculations of the key coefficients and the covariance matrices is period specific, prone to specification and estimation errors; and the resulting models are notoriously unstable.
2. Increasing sophistication generally leads to greater disparity between in-sample estimation success and out-of-sample reliability.
3. Many of the estimated coefficients and

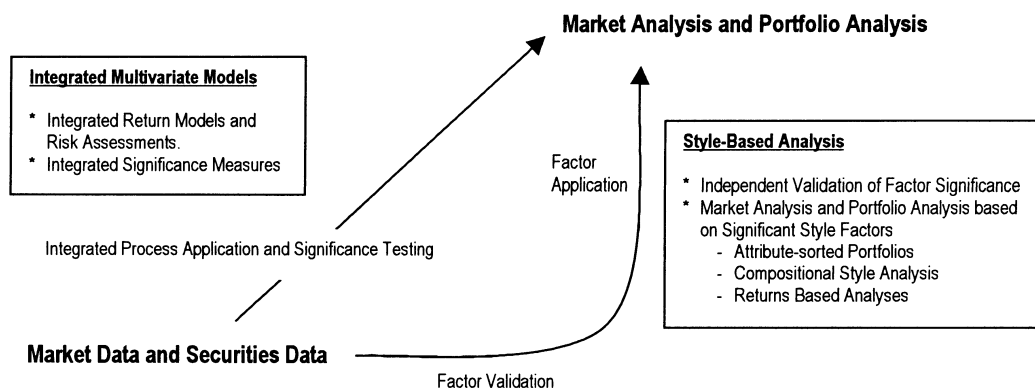


Figure 1 Representation of the difference between multivariate securities analysis and style analysis

the resulting risk factor groupings are extremely difficult to interpret and to explain in a professional investment environment. Neither portfolio managers nor clients naturally warm towards descriptions of themselves, or their investment portfolios, in terms of opaque and changeable combinations of investment criteria.

Style, at its most basic, can be seen as a cut-down simplification of the multivariate approach. As in much of the early work in the field of systematic stock selection, individual factors, such as market capitalisation and book to price, are chosen to represent basic styles, such as size and value vs growth, and market analyses and portfolio analyses generally proceed from there.

Unlike the popular multifactor analysis, no relevance statistics are immediately available to support the analysis and aid interpretation. These must be determined separately.

Instead of describing the continuous path from fundamental data to developed models of return and risk, style analysis requires a two-stage procedure. Please see Figure 1. First, the various candidate style factors must be validated as relevant and suitable for the purposes to which they will be applied, and only then may they be applied to the tasks of

constructing models of return and risk, or towards the various style-based portfolio analysis practices. This is particularly important, and is the subject of the following section of the paper.

Validating style practices

In the US, style has developed naturally over a period stretching back to, at least, the mid-1920s,⁶ where the application of style techniques has been validated by evolution, practice and academic pedigree. However, the situations within Europe and in other areas of the global equity market are strikingly different.

Foreign markets are different from those in North America. Their industrial sector decompositions are generally different; they are driven by different investor concerns and savings patterns; structural and regulatory environments differ; and reporting and accounting standards are also different. And, so far, only a relatively small number of managers or funds are described or marketed according to a dominant style. Managers in European markets are rightfully suspicious and require the case for style to be properly established.

Validation of the significance and relevance of the various candidate factors considered in style characterisations takes various forms,

each serving to underpin its use within different manifestations of the various forms of style analysis (listed earlier). And there are a number of key tests that can be used to establish relevance across these various applications of style methodologies. First, however, some background is needed.

We need to define what we mean by the returns series relating to attribute-sorted portfolios. These can be defined in a variety of ways. But for simplicity we have used the following:

Attribute-sorted factor returns

Attribute-sorted factor returns are the market-relative total returns (including dividend income) that an investor would achieve using the following investment strategy:

- Portfolios are constructed, and rebalanced every six months, from the top half of the market, by market capitalisation, of securities exhibiting the highest scores with respect to the factor under review.
- Portfolios are constructed using market weights to establish the portfolio proportions.
- Dealing costs are not included.

Now it is possible to begin to define some of the criteria that can validate individual factors for use within the various style applications.

It is first necessary to consider a statistic that identifies and measures the individualistic performance characteristics of attribute-sorted portfolios. This is done by the identity statistic,⁷ which assesses the likelihood that the performance of a particular attribute-sorted factor return series cannot be explained simply by chance. This measure addresses the concern that an investment style could very easily be defined according to nonsense criteria

such as, say, the intensity of the dominant colour in the company logo. A true investment style must be distinguishable from such nonsense criteria.

Identity

The statistic is defined from a Monte Carlo simulation as follows:

- We calculate the tracking error comparing the absolute (not market-relative!) monthly total returns of the portfolio of securities from the top half of the market and the portfolio of securities from the bottom half of the market, ranked according to the factor criteria under review (see attribute-sorted factor returns, above).
- We calculate the tracking errors comparing the absolute (not market-relative!) total returns of two exhaustive randomly selected (from the market) equal-sized portfolios of securities, constructed according to market capitalisation (in a manner analogous to the process described in attribute-sorted factor returns, above).
- We repeat the random portfolio construction process 500 times and determine the proportion of calculated tracking errors (from the randomisation process) which are less than the tracking error relating to the attribute-sorted factor return history.

A number of 100 per cent would indicate that all of the randomly selected portfolios resulted in tracking errors below that relating to the portfolio constructed with reference to the factor criteria under review. This would indicate that the systematic performance characteristics of the portfolio constructed with reference to

that factor can be regarded as distinct and very significant. Nonsense criteria, on the other hand, score very low on this measure and can quickly be recognised as irrelevant as investment styles.

Although the Identity statistic gives evidence of the individualistic nature of attribute-sorted portfolios, it is not sufficient to provide the support needed to substantiate style factors across the full range of style applications.

1. It does not distinguish between the importance of sector performance and style performance in establishing the individual identity of a style factor.
2. It does not identify clustering. While a style factor may define a portfolio with a clear identity (based on the returns history), Identity statistics offer no information showing whether the performance of securities of a particular type cluster together. This is particularly important in returns-based style portfolio analysis. Without evidence of performance clustering among stocks within the same style category, it is difficult to find a useful interpretation of the style-based paradigm portfolios.
3. Related to 2, above, it would be useful to know whether or not the individual factors are important in explaining the performance of individual securities in a linear fashion.

More analysis is clearly necessary. Sector adjustment and the attribution statistic respond to these concerns.

Sector adjustment

A company's score for any particular factor can be measured either in absolute terms (such as 'the book to price of ABC Limited is 0.70') or in relative, sector adjusted, terms (such as,

ABC Limited is a chemical company and the book to price of the industrial sector which includes chemical companies is 0.50. Therefore, the sector adjusted book-to-price score of ABC Limited is +0.2 against a neutral 0 score.).

Sector adjusted analysis reviews all security factor scores relative to the relevant sector average for each security. In the case of the attribute-sorted portfolios and their corresponding return series, these industry concerns result in return series constructed from the top 50 per cent (other ranges are also possible), by market capitalisation, of a particular factor, within each industrial sector. We use the FTSE economic sector classifications.

These relative assessments reduce the influence of sector distortions on the appraisal of factor influences.

Attribution

The average of the absolute values of the t -statistics of the estimate of the β in the cross-sectional regressions:

$$\text{Security three month return} = \alpha + \beta^* \text{ security factor exposure} + \text{random error.}$$

The statistics quoted are the averages, over ten years, of the absolute values of the t -statistics from the quarterly (non-overlapping) regressions. A figure over 2 is very significant, and figures between 1.5 and 2 are also worthy of serious consideration.⁸

From a practitioner's perspective, there is another criterion of particular interest: predictability. Although it is notoriously difficult to forecast the performance of attribute-sorted portfolios (see, for

example, Levis and Liodakis, 1999), investment practitioners will invariably attempt to predict style rewards using techniques ranging from the intuitive and heuristic to leading-edge formal estimation and forecasting models.

In view of this, it would be very useful if a statistic were available that could indicate whether or not particular style reward series were likely to be predictable. Although the link is not perfect, a good guide to predictability is the Regularity statistic, which measures the smoothness of the evolution of the returns histories. A smooth pattern would be more likely to be characterisable in terms of other intelligible series. The Regularity statistic measures that smoothness as it assesses the mean averting and mean reverting tendencies of the series.

Regularity

The Regularity statistics measure the regularity, or smoothness, of the deviations of each particular return series from their longer-term trends.

- The statistics measure the likelihood that deviations from the long-term trend can persist within 3, 6 or 12 month horizons.
- Positive figures indicate a positive likelihood that short- or medium-term trends can deviate from the longer-term trend. The larger the number, the more likely it is that such deviations might occur and persist with some regularity.
- Negative figures indicate that trends can only deviate from the long-term trend for short periods. The more negative the number, the more likely it is that any deviation will quickly be corrected and that the series will soon return to its long-term trend.

The Regularity statistics are simply defined as $VR(q) - 1$, where $VR(q) \equiv Var[r_i(q)]/qVar[r_i]$ and $r_i(k)$ is the series of multiple period compound return; ie $r_i(2) = r_i + r_{i-1}$.

Following Campbell *et al.* (1997), it can be shown that, $VR(q)$ is a declining combination of autocorrelation statistics and that, for a sample of $nq + 1$ observations and a very standard formulation of an estimator of $VR(q)$, $\frac{VR(q)}{\sqrt{nq(VR(q) - 1)/\sqrt{2(q - 1)}}$ is normally distributed with zero mean and a standard deviation of 1.

Consequently, for our regularity statistics, the confidence ranges can be calculated as:

	1 SD	2 SD
Reg (3)	0.183	0.365
Reg (6)	0.289	0.577
Reg (12)	0.428	0.856

With each of these criteria defined and described, we can now more accurately represent the importance of each in supporting current style practices.

For each of the popular style techniques for market analysis and portfolio analysis, listed as headings in Table 1, we describe the importance of each of the criteria and statistics introduced in this section, in supporting the useful application of that particular style method.

The Identity and Attribution criteria and sector independence are necessary conditions for the 'existence' of style in markets and the justifiable application of style-based techniques for market analysis and portfolio analysis. While significant Regularity would be desirable if one were attempting to structure a formal mathematical forecasting process to predict short-term turning points, this is rarely available. As will be seen, in most situations the Regularity statistics indicate

Table 1 Validating style practices

Criteria	Market analysis	Portfolio analysis	
	Attribute-sorted portfolios	Compositional style analysis	Top-down returns-based style analysis and bottom-up returns-based style analysis
<p>Identity Establishing that the style displays independent performance characteristics.</p>	<p>To demonstrate the independent character of stocks displaying the factor attribute prominently. If these portfolios did not have an independent performance record their significance as styles would be very doubtful.</p>	<p>Demonstrates that it is worthwhile reviewing portfolios using this factor. It offers an insight onto the distinctiveness of the performance implications of factor-tilted holdings.</p>	<p>Without a clear identity in the performance of the paradigm portfolios, returns-based analysis is irrelevant.</p>
<p>Attribution Establishing that the style factor is associated with the performance of individual securities and portfolios of securities.</p>	<p>Required to establish performance clustering with respect to style factors. Were this not the case, the performance of attribute-sorted portfolios might give misleading information about the significance of the style factor and its relationship with the performance of securities.</p>	<p>Supports the investigation of simple weighted average portfolio factor scores in the analysis of portfolio style tilts. Without the support of a significant attribution measure, a portfolio's weighted factor scores may not be associated with the performance of the identified style tilts.</p>	<p>Even if the identities of the paradigm portfolios are significant, it is important that the individual securities within these explanatory portfolios behave as members of their style. Otherwise, it is difficult to see the usefulness of the returns-based analysis ... characterisation of portfolios in terms of what?</p>
<p>Sector independence Establishing that the observed style characteristics are not solely the result of sector influences.</p>	<p>It is important to demonstrate that the distinctive performance characteristics of attribute-sorted portfolios are not due only to industrial sector tilts and divergent performance between these sectors.</p>	<p>Compositional portfolio analysis must differentiate between factor tilts resulting from sector positions and tilts identified within industrial sectors.</p>	<p>Depending on the decision structure of individual managers, either standard style paradigm portfolios or sector adjusted style paradigm portfolios give the most appropriate indication of deliberate style postures. However, when a common standard is required, local practice should serve as a guide.⁹ Where the sector adjusted data are to be used, it is important to establish the statistical significance of the relevant attribute-sorted sector adjusted style factor portfolio.</p>
<p>Regularity Providing a useful statistic to determine how best to interpret and use style returns information and to understand how style returns might best be forecast.</p>	<p>From a style user's perspective it would be very convenient if style reward patterns were regular. It would then be relatively easy to construct predictive models, and the returns of style-based portfolios would provide few unwelcome shocks. Conversely, it would be useful to know where traditional analytical research is most likely to fail, owing to erratic style performance over the time interval being analysed.</p>	<p>The Regularity statistic is important in revealing the likely performance characteristics of portfolios from an analysis of their factor exposures. In particular, since the statistic is similar to the variance ratio, it provides a simple measure that indicates the direction and scale of the bias in tracking error estimates based on standard annualisation practices. High positive Regularity indicates strong mean averting autoregressive behaviour and will be associated with underestimation of annual tracking error from standard annualisation techniques.</p>	<p>The Regularity of the time series of returns has no direct significance in supporting the use of returns-based style analysis. However, it is paradoxical that the more variation in the returns series used (both the dependent series of portfolio/stock returns and the independent series of returns of the paradigm portfolios) the more 'confidence' we may have in the significance of the fit. This will, of course, be incorporated in both the in sample and out of sample R^2 statistics.</p>

that style returns cannot be forecast over the short term by simple models.

Defining style

Because of the variety of style services, 'style' can mean different things to different users. Consequently, it might seem simplest and best to resort to a shallow contextual definition of style; something like 'Style is when you analyse markets by examining the performance of a range of portfolios constructed from simple security characteristics', or 'Style is when you analyse portfolios according to how they

perform and identify how this performance can best be approximated by the performance of combinations certain types of other portfolios'. However, these attempts are particularly unhelpful.

None of these contextual definitions offers any guidance about how, where or when style techniques might reasonably be applied. For that we need to consider whether or not a market itself is suitable for the application of the various style techniques on offer. In view of the above, the following seems to be a natural and serviceable definition.

Styles can be said to exist within markets when there are:

DEFINITION (by condition)

'Simply identifiable segments of the market with distinguishable patterns of returns, where the factors used to identify the various market segments reveal significant elements of security returns, where the patterns of returns are likely to be persistent or systematic and forecastable over a usable investment term, and where the distinguishable patterns of returns, relevance in terms of security performance and the usable characteristics of returns patterns are not due to the influence of other identifiable characteristics (such as industrial sector influences)'¹⁰

Purpose for each condition

(Identity, or something like it)

(Attribution, or something like it)

(Regularity, or something like it)

(Sector Independence)

Style within Europe

Although there are a number of UK and Continental European equity managers who describe themselves according to style characteristics, the style culture is not as pervasive as in North America. It is particularly interesting to see whether this results in significant differences in the relevance statistics across the regions.

In Tables 2–7 we show how the US, UK, Eurozone, France, Germany and the Netherlands compare with respect to the style relevance statistics described in the previous section. These relevance statistics indicate whether or not each market/region satisfies the requirements

of the style definition, above, and so provide evidence of the suitability of each market/region for the application of popular style practices.¹¹

The statistics confirm that, measured over the past ten years the US is an excellent example of a style market. Referring back to Table 1, and considering the criteria represented (and the reasons why each criteria is important in supporting various style practices):

From the Identity statistics, it is clear that each of the main style portfolios, constructed in sector adjusted terms (and so not influenced by industrial

Table 2 Style relevance statistics^a for the United States

	Large value ^b (sector adjusted)	Large growth (sector adjusted)	Small value (sector adjusted)	Small growth (sector adjusted)
Identity	100	100	100	100
Regularity				
3 month	0.10	0.13	0.28	0.18
6 month	-0.04	0.08	0.26	0.24
12 month	-0.17	0.50	0.72	0.21
	Univariate analysis ^c		Bivariate analysis	
Attribution	Market capitalisation (sector adjusted)	Book value per share to price (sector adjusted)	Market capitalisation (sector adjusted)	Book value per share to price (sector adjusted)
Std <i>t</i> -stat	5.0	3.7	5.0	3.8
Std <i>t</i> > 2	77%	69%	72%	64%
Wtd <i>t</i> -stat	7.5	5.2	7.2	4.6
Wtd <i>t</i> > 2	90%	79%	90%	72%

^aAll statistical analysis, throughout the paper, is based on ten years (to end November 1999) of monthly, at month end, data from the Worldscope database. The analysis covered 7,500 US securities, of which 5,712 were active as at the end of November 1999; 2,524 UK securities, of which 1,736 were active at end November 1999. Comparable figures for the Eurozone are: 3,610 and 2,800; France: 1,163 and 840; Germany: 1,039 and 935; the Netherlands: 263 and 212.

^bThe analysis is presented in sector adjusted (using the ten economic groups within the FTSE Actuaries Industry Classification system), and, for the Eurozone analysis, also in country-adjusted format, ie after having adjusted for industrial sector distortions and country to country distortions. In constructing each paradigm portfolio, size is the primary sort, where large is the top 80 per cent by capitalisation and small the bottom 20 per cent. Value is taken to be the top half, by capitalisation, of each size category, sorted by book value per share to share price, and rebalanced every six months; Growth is simplified as the other half within each size category.

The quoted identity and regularity statistics are calculated using the time series returns of paradigm portfolios constructed using these sort methods and employing the calculations described in the text.

^cThe univariate and the bivariate statistics quoted derive from the following quarterly cross-sectional regressions:

Security 3 month return = $\alpha + \beta^*$ security factor exposure + random error; in the univariate case

or Security 3 month return = $\alpha + \beta^*$ security factor1 exposure + γ^* security factor2 exposure + random error, for the bivariate analysis

The non-overlapping regressions are both unweighted and market capitalisation weighted (to be relevant to portfolio construction), and the statistics quoted are: the ten-year averages of the absolute values of the *t*-statistics for the estimates of the β (from the first equation, in the univariate cases) or for the estimates for the β and γ (from the second equation, in the bivariate cases); and the percentage of the time (assessed quarterly, over ten years) that the absolute value of these *t*-statistics are over 2.00.

Security factor exposures, both with respect to book to price and market capitalisation, are normalized and limited to 2 standard deviations from the mean so as to limit the distorting impact of outliers.

sector imbalances within the paradigm portfolios), exhibits a clearly distinct performance identity.

- The high Attribution statistics confirm that the main style criteria are important, both individually and together, in ‘explaining’ security returns.
- The Regularity statistics indicate

that trend patterns can be observed in a number of situations. In four of the 12 possibilities, the Regularity statistic is significant at 1 standard deviation. There are, however, no situations where the Regularity statistics are significant at 2 standard deviations. It is interesting to speculate how this may be related to market efficiency.

Table 3 Style relevance statistics for the United Kingdom

	Large value (sector adjusted)	Large growth (sector adjusted)	Small value (sector adjusted)	Small growth (sector adjusted)
Identity	99	100	100	100
Regularity				
3 month	0.03	0.44	0.52	0.06
6 month	-0.11	0.37	0.65	-0.07
12 month	-0.12	-0.06	0.57	-0.38
	Univariate analysis		Bivariate analysis	
	Market capitalisation (sector adjusted)	Book value per share to price (sector adjusted)	Market capitalisation (sector adjusted)	Book value per share to price (sector adjusted)
Attribution				
Std <i>t</i> -stat	1.3	2.4	1.2	2.4
Std $ t > 2$	15%	49%	18%	49%
Wtd <i>t</i> -stat	4.1	4.5	3.9	4.3
Wtd $ t > 2$	69%	74%	62%	69%

Table 4 Style relevance statistics for the Eurozone^a

	Large value (sector adjusted)	Large growth (sector adjusted)	Small value (sector adjusted)	Small growth (sector adjusted)
Identity	99	100	99	98
Regularity				
3 month	-0.09	0.33	-0.08	-0.19
6 month	-0.06	0.36	-0.21	-0.33
12 month	-0.22	0.29	-0.21	-0.44
	Univariate analysis		Bivariate analysis	
	Market capitalisation (sector adjusted)	Book value per share to price (sector adjusted)	Market capitalisation (sector adjusted)	Book value per share to price (sector adjusted)
Attribution				
Std <i>t</i> -stat	3.6	2.7	3.6	2.6
Std $ t > 2$	64%	54%	67%	51%
Wtd <i>t</i> -stat	3.8	3.7	3.7	3.6
Wtd $ t > 2$	62%	62%	64%	64%

^aIncludes the 11 markets within the initial formation of the Euro (Germany, France, the Netherlands, Belgium, Luxembourg, Italy, Ireland, Spain, Portugal, Austria, Finland). The analysis is presented in country-adjusted and sector-adjusted format, where country-adjusted is defined analogously to sector adjusted, ie security factor scores are calculated with respect to the factor scores of other securities within their industrial sector and country. The total sample comprises 3,610 securities, of which 2,800 were active as at the end of November 1999.

Looking back to Table 1, it is apparent that the application of each of the various popular style practices is supported by the statistical evidence.

The UK is also a good example of a market in which style concepts may be sensibly applied. Over the past ten years:

- The high Identity statistics indicate that each of the main sector adjusted style portfolios displays a distinctive performance identity.
- Individually and together, both size and book to price are very important in 'explaining' the performance of

Table 5 Style relevance statistics for France

	Large value (sector adjusted)	Large growth (sector adjusted)	Small value (sector adjusted)	Small growth (sector adjusted)
Identity	100	100	87	57
Regularity				
3 month	-0.02	0.14	-0.02	-0.13
6 month	-0.07	0.07	-0.16	-0.15
12 month	0.16	0.12	-0.21	-0.15
	Univariate analysis		Bivariate analysis	
	Market capitalisation (sector adjusted)	Book value per share to price (sector adjusted)	Market capitalisation (sector adjusted)	Book value per share to price (sector adjusted)
Attribution				
Std <i>t</i> -stat	1.4	1.6	1.4	1.6
Std $ t > 2$	23%	31%	23%	31%
Wtd <i>t</i> -stat	2.9	3.5	3.0	3.5
Wtd $ t > 2$	67%	74%	69%	74%

Table 6 Style relevance statistics for Germany

	Large value (sector adjusted)	Large growth (sector adjusted)	Small value (sector adjusted)	Small growth (sector adjusted)
Identity	90	61	64	70
Regularity				
3 month	-0.19	-0.03	-0.22	-0.19
6 month	0.05	-0.10	-0.26	-0.30
12 month	0.30	-0.02	-0.22	-0.38
	Univariate analysis		Bivariate analysis	
	Market capitalisation (sector adjusted)	Book value per share to price (sector adjusted)	Market capitalisation (sector adjusted)	Book value per share to price (sector adjusted)
Attribution				
Std <i>t</i> -stat	1.3	2.0	1.3	2.0
Std $ t > 2$	23%	44%	26%	44%
Wtd <i>t</i> -stat	3.0	3.3	3.0	3.2
Wtd $ t > 2$	56%	69%	54%	67%

diversified portfolios. The low numbers for the average of the standard cross-sectional *t*-statistics reveal that, among smaller companies, size is not a strong feature of returns.¹² The *t*-statistics from the weighted regressions give a better indication of the relevance of individual factors for portfolio management practices (where there is a greater concern, on average, to reducing error terms relating to the

performances of larger companies than to smaller companies). On this reckoning, both book to price and size become more important in being able to interpret the returns of institutional-type portfolios of securities (where security holdings more closely reflect market capitalisations).

— Trend patterns, in some styles, are observable over particular assessment periods. There are five situations (of a

Table 7 Style relevance statistics for the Netherlands

	Large value (sector adjusted)	Large growth (sector adjusted)	Small value (sector adjusted)	Small growth (sector adjusted)
Identity	31	78	58	55
Regularity				
3 month	-0.07	0.14	0.10	-0.12
6 month	0.13	0.41	0.04	-0.04
12 month	0.13	0.37	-0.04	0.07
	Univariate analysis		Bivariate analysis	
	Market capitalisation (sector adjusted)	Book value per share to price (sector adjusted)	Market capitalisation (sector adjusted)	Book value per share to price (sector adjusted)
Attribution				
Std <i>t</i> -stat	1.2	1.5	1.2	1.6
Std <i>t</i> > 2	23%	33%	23%	33%
Wtd <i>t</i> -stat	2.2	2.0	2.1	1.9
Wtd <i>t</i> > 2	49%	38%	49%	36%

possible 12) where the Regularity statistic is significant at 1 standard deviation and, of these, three are significant at 2 standard deviations.

As in the US, a review of the importance of each of these statistics in validating the use of popular style practices (Table 1), confirms that the structure of the UK equity market will support the useful application of popular style techniques.

And very much the same can be said within the Eurozone.

Over the past 10 years:

- The high Identity statistics indicate that each of the main sector-adjusted style portfolios displays a distinctive performance identity.
- The high levels of the Attribution statistics indicate that individually and together both size and book to price are very important in ‘explaining’ the performance of individual securities. Note that, unlike the situation in the UK, where there is a very large, in numbers, small company sector that distorts the analysis of the size effect,

size is a key attribution factor in both standard and weighted regression analysis;

- Trend patterns, in some styles, are observable over particular assessment periods. There are five situations (of a possible 12) where the Regularity statistic is significant at 1 standard deviation.

Within the individual markets of the Eurozone, however, the picture is less clear.

Within France, Germany and the Netherlands, it is apparent that:

- The individual sector adjusted style portfolios do not display the same distinctive performance identities in all markets.
- Although the standard *t*-statistics indicate low explanatory power and only loose clustering, the weighted analysis identifies that, among the larger companies, and so for institutional portfolio management practices, the main factors contribute significantly to explaining returns, at least in France and Germany.

— Trend patterns are particularly erratic. It does not appear to be possible to extract much information from the historic patterns of returns of the various styles in these markets. In the three markets considered, there are only four situations (among 36) where the Regularity statistic is significant at 1 standard deviation.

The initial tests based on ten years of historical data strongly suggest the existence of styles and style influences within the US, UK and across the Eurozone. Within France and Germany, the style patterns are less well defined across the total markets; but style clustering (from the attribution statistics) is observable within the larger company sector.

Using the same techniques as above, it is possible to review the significance of style factors more deeply within the structure of the individual markets. In the next section, we apply these techniques to examine style characteristics within industrial and economic sectors within each of the major markets considered above and within the Eurozone. While this is certainly of intellectual interest — since it shows how deeply styles go within markets and regions — it also has an immediate practical application.

European equity management: The market decision vs the sector decision

The establishment of the Euro and the formation of the Eurozone, and all the talk of an emerging single European equity market have encouraged widespread rethinking of the processes of equity management across the region. Previously, for top-down managers, the country allocation decision came first and sector allocation and stock selection

followed. But now many European managers are considering putting the sector decision first and, very often, leaving out the country decision altogether to focus more immediately on the features of individual securities.

The clear contrast between the two practices, managing the country allocation first or managing the sector allocation first, understandably invites the natural question: 'Which way works best?' This is a very difficult question to answer, not surprisingly since it is also a very difficult question to pose in a formal manner.

The question does not ask simply whether market returns or sector returns are the largest component in the typical Euro security's historic or projected returns.¹³ Nor does it ask whether by using, for example, regression models, sector performance or market performance is the more significant factor in 'explaining' historic (or projected) stock returns. Answers to these, and related, questions are not particularly helpful.

Knowing that, as may still be the case on some standards of measurement, 'country effects are larger than sector effects' does not help in the structuring of an investment process. Logically, 'putting more effort on getting the market allocation right' (or putting it first) does not assure success. And it may be more logical for managers to focus more on those decisions that do not seem to have the greatest pay-off (or risk), in the belief that lesser investors' interest will decrease market efficiency at that level of decision making and so open up greater opportunity.¹⁴

Rather than go around the topic in this manner, there is an alternative approach. Undeniably, both sector allocations and market allocations are important top-down decisions. And considerable effort can go towards

Table 8 Style factors within sectors across the Eurozone^{ab}

	Financials and Insurance						Resources and Utilities					
	Size	B/P	S/P	RoE	IBES	Mtm	Size	B/P	S/P	RoE	IBES	Mtm
Identity	89	74	86	76	78	34	0	38	16	12	2	19
Reg 12	-0.21	-0.30	-0.18	-0.40	0.24	-0.43	-0.18	-0.33	-0.26	-0.18	-0.46	-0.21
<i>t</i> -statistic	2.4	1.7	1.8	1.5	1.1	1.7	1.1	1.2	1.0	1.1	0.8	1.0
<i>t</i> > 2	44	41	33	23	15	33	13	21	8	18	10	18
Wtd <i>t</i> -stat	3.0	2.4	2.6	1.8	1.6	2.4	1.5	1.5	1.1	1.3	1.0	1.4
Wtd <i>t</i> > 2	59	46	62	41	28	46	26	26	15	21	10	23
	Information Technology						Consumers (cyclical and non-cyclical)					
	Size	B/P	S/P	RoE	IBES	Mtm	Size	B/P	S/P	RoE	IBES	Mtm
Identity	50	54	30	26	54	62	30	93	94	51	14	85
Reg 12	1.18	0.89	0.23	-0.38	0.80	0.09	-0.45	0.19	0.95	0.04	-0.24	-0.19
<i>t</i> -statistic	1.3	1.2	0.9	1.1	0.9	1.3	1.6	1.6	1.4	1.8	0.9	1.9
<i>t</i> > 2	26	18	13	15	10	21	33	33	21	41	8	38
Wtd <i>t</i> -stat	2.2	2.3	1.8	1.4	1.4	2.4	2.2	2.8	2.6	2.2	1.7	2.3
Wtd <i>t</i> > 2	46	41	33	21	15	44	46	54	54	44	33	38
	Services (cyclical and non-cyclical)						General and Basic Industries					
	Size	B/P	S/P	RoE	IBES	Mtm	Size	B/P	S/P	RoE	IBES	Mtm
Identity	3	6	13	20	5	5	98	98	97	22	54	99
Reg 12	-0.52	-0.19	-0.28	-0.61	-0.47	-0.21	-0.08	-0.01	-0.22	0.08	-0.27	-0.18
<i>t</i> -statistic	1.5	1.8	1.6	1.5	1.0	1.9	3.1	2.0	1.9	1.9	1.1	1.8
<i>t</i> > 2	31	36	23	31	15	49	64	31	46	49	21	33
Wtd <i>t</i> -stat	2.2	2.3	1.6	2.7	1.4	1.9	4.1	3.1	2.8	1.9	1.6	2.8
Wtd <i>t</i> > 2	41	41	33	64	26	49	59	62	54	44	33	64

^aThe factors selected represent: size, by market capitalisation; value, by book value per share to share price (a stock measure) and by sales per share to share price (a flow measure); growth by return on equity and by the constructed IBES 12 month forward earnings estimates; and, short-term momentum (the six most recent monthly market relative returns, exponentially weighted using a decay factor of 2/3).

^bIn all Eurozone analysis, the attribute-sorted portfolios are constructed using country adjusted and, where appropriate, country and sector adjusted data. This ensures that the research methodology picks up specific style factor effects and not only market effects or, where relevant (in grouped sectors), sector effects.

developing explainable, convincing and manageable processes to do either, or both. Some of the processes may also appear to work. But the interesting part comes in considering what to do next, when attention turns towards stock selection. The crucial obligation on senior management is to develop an explainable, convincing and manageable stock selection process that is consistent with the first level of top-down decision making (the market or sector allocation decision level).

Put simply, if market allocation is to be the first process then it is important to be able to develop explainable, convincing and manageable processes for

selecting stocks market by market. And if sector allocation is to be the first process, then one needs to develop explainable, convincing and manageable processes for selecting stocks sector by sector.

In this light, the 'market allocations vs sector allocations' question can be answered pragmatically by showing whether styles are more pronounced and relevant within the individual Eurozone markets or within the individual Eurozone sectors. Since the existence of styles, according to the definition given earlier, establishes the opportunity to construct systematic stock selection processes that are explainable, convincing and manageable, the choice between

Table 9 Reference style factors within sectors across the United States

	Financials and Insurance						Resources and Utilities					
	Size	B/P	S/P	RoE	IBES	Mtm	Size	B/P	S/P	RoE	IBES	Mtm
Identity	99	100	100	99	90	99	96	41	98	70	89	69
Reg 12	-0.08	-0.17	-0.50	-0.31	-0.21	-0.17	0.56	-0.25	0.78	-0.15	0.04	-0.22
t-statistic	2.2	2.7	2.7	2.8	1.7	2.1	3.8	1.4	1.8	2.5	2.2	2.3
t > 2	46	49	46	51	31	41	64	26	41	56	46	54
Wtd t-stat	3.8	4.1	3.8	3.1	2.3	3.2	5.1	2.3	2.4	2.1	2.3	2.8
Wtd t > 2	64	79	69	49	41	56	72	56	49	49	49	64
	Information Technology						Consumers (cyclical and non-cyclical)					
	Size	B/P	S/P	RoE	IBES	Mtm	Size	B/P	S/P	RoE	IBES	Mtm
Identity	93	38	30	94	30	47	100	100	99	100	98	98
Reg 12	0.70	0.04	-0.37	0.43	-0.05	0.08	-0.09	0.07	0.19	1.37	-0.10	-0.36
t-statistic	1.7	1.7	2.0	2.0	1.3	1.7	2.5	1.9	2.3	3.1	1.4	1.9
t > 2	26	31	41	41	18	38	49	41	49	56	23	41
Wtd t-stat	2.8	3.5	2.9	3.2	2.3	3.3	4.3	3.9	3.3	3.9	2.8	2.3
Wtd t > 2	56	67	64	64	49	59	69	72	62	67	62	46
	Services (cyclical and non-cyclical)						General and Basic Industries					
	Size	B/P	S/P	RoE	IBES	Mtm	Size	B/P	S/P	RoE	IBES	Mtm
Identity	95	100	97	100	72	97	93	92	99	52	64	18
Reg 12	0.52	0.70	-0.29	0.54	-0.58	0.27	-0.16	-0.18	-0.04	0.01	0.00	-0.29
t-statistic	1.2	1.9	2.5	2.5	1.4	2.3	1.5	1.7	2.2	1.9	1.4	1.9
t > 2	18	36	51	46	23	38	28	33	46	33	33	36
Wtd t-stat	3.6	2.8	3.3	3.3	2.2	3.5	3.7	2.7	3.0	2.8	2.8	2.6
Wtd t > 2	77	41	67	64	56	67	64	62	67	59	56	49

market allocations vs sector allocations can be answered on basic style-oriented criteria. If styles appear to be best defined within individual country markets of the Eurozone (as opposed to within economic sectors across the Eurozone), then it is probably best to allocate across Eurozone country markets first and implement style-based or factor-based systematic stock selection methods within the individual markets. If, by contrast, styles appear better defined across the Eurozone sectors, then the more convincing investment process would start with sector allocations and then proceed to implement style-based or factor-based systematic stock selection methods within the individual pan-Eurozone sectors.¹⁵

In Tables 8–12 we compare the style relevance criteria for a number of popular stock research factors, using the

method described earlier, but applied individually to single factors: (a) within various sectors across the Eurozone (Table 8); and (b) within six major markets of the Eurozone (Table 11). We also show, for reference, how these criteria ‘score’ in the US and the UK (Tables 9 and 10 — for comparison against (a), above, style factors within sectors across the Eurozone; and Table 12 — for comparison against (b), above, style factors in major markets of the Eurozone).

Using only the crudest of techniques, Tables 13 and 14 simply average the statistics of the preceding tables.

Although the patterns within the Eurozone sectors (Table 13) are not nearly as significant as in the US or the UK (Table 14), there still appears to be evidence of significant style influences overall; and, in a number of particular

Table 10 Reference style factors within sectors across the United Kingdom

	Financials and Insurance						Resources and Utilities					
	Size	B/P	S/P	RoE	IBES	Mtm	Size	B/P	S/P	RoE	IBES	Mtm
Identity	100	100	100	99	100	99	89	95	93	62	97	93
Reg 12	-0.02	0.25	-0.17	0.10	-0.02	-0.36	-0.28	-0.08	-0.38	-0.10	0.29	0.23
<i>t</i> -statistic	2.6	2.3	2.2	2.0	1.2	2.3	2.8	1.6	1.5	1.6	1.4	1.6
<i>t</i> > 2	67	49	51	41	21	54	64	31	21	28	28	36
Wtd <i>t</i> -stat	5.1	5.1	4.6	4.7	2.8	5.4	2.1	2.3	2.0	1.9	1.5	2.3
Wtd <i>t</i> > 2	85	82	72	74	67	82	49	51	36	46	31	51
	Information Technology						Consumers (cyclical and non-cyclical)					
	Size	B/P	S/P	RoE	IBES	Mtm	Size	B/P	S/P	RoE	IBES	Mtm
Identity	72	98	92	29	99	40	98	99	100	99	90	69
Reg 12	-0.24	-0.38	-0.51	0.37	-0.18	-0.25	0.25	-0.02	0.45	-0.34	-0.48	0.40
<i>t</i> -statistic	1.0	1.2	1.1	1.2	1.0	1.4	1.1	1.3	1.3	1.2	1.2	1.6
<i>t</i> > 2	8	15	15	15	15	28	15	18	18	13	23	38
Wtd <i>t</i> -stat	1.7	2.5	1.4	1.4	2.2	2.4	4.3	3.8	3.6	3.9	2.0	3.4
Wtd <i>t</i> > 2	36	46	28	28	49	54	77	64	67	79	38	64
	Services (cyclical and non-cyclical)						General and Basic Industries					
	Size	B/P	S/P	RoE	IBES	Mtm	Size	B/P	S/P	RoE	IBES	Mtm
Identity	89	97	94	58	94	73	68	100	100	99	74	88
Reg 12	-0.35	0.39	-0.08	-0.11	-0.13	-0.23	-0.40	0.14	0.13	0.71	0.04	-0.30
<i>t</i> -statistic	1.6	1.3	1.8	1.2	1.5	2.4	1.7	1.7	1.8	1.9	1.6	2.0
<i>t</i> > 2	28	15	41	15	23	54	33	31	44	41	28	41
Wtd <i>t</i> -stat	2.4	3.0	2.8	2.6	2.5	2.4	3.3	3.0	2.8	3.5	2.6	3.0
Wtd <i>t</i> > 2	46	59	64	56	51	49	69	49	54	62	46	59

sectors, the style effects are noticeably more prominent. And very similar statements can also be made regarding style patterns within the individual Eurozone markets themselves. Although the averages of the patterns across the individual markets are not particularly strong, styles within the larger Eurozone markets compare quite well with the market-wide evidence from the US and the UK.

On the basis of this brutally simple evidence, the results in Table 13 draw us to the tentative conclusion that market allocation rather than allocation across Eurozone sectors ought to come first. This appears sensible since, within the six major markets, the average Identity statistics are higher, and there is more evidence of style factor Regularity, than within the major Eurozone sectors, and

the average |weighted *t*-statistics| are virtually identical. But this would be premature. The results are not particularly robust and, furthermore, they differ markedly sector by sector, and market by market. Consequently, even on the evidence of these initial summary calculations, the favoured allocation order depends very much on the focus of the interests of the investor.¹⁶

Furthermore, the evidence of style significance is itself time dependent, and the structure of the European markets is rapidly changing. Although statistical analysis of the significance of style effects will continue to be dominated by the exceptional 1998/1999 period,¹⁷ analysis based on the techniques described may be regularly applied to chart the evolution of the Eurozone market(s).

Table 11 Style factors within individual Eurozone markets

	France						Germany					
	Size	B/P	S/P	RoE	IBES	Mtm	Size	B/P	S/P	RoE	IBES	Mtm
Identity	97	100	100	96	38	87	90	78	70	7	50	55
Reg 12	-0.09	0.28	0.24	0.71	0.57	-0.37	-0.25	0.17	0.40	-0.38	-0.32	-0.30
<i>t</i> -statistic	1.4	1.6	1.7	2.0	1.3	2.0	1.3	2.0	1.9	1.6	1.3	2.0
<i>t</i> > 2	23	31	38	46	15	38	23	44	46	26	26	54
Wtd <i>t</i> -stat	2.9	3.5	3.1	2.9	1.6	2.7	3.0	3.3	2.8	1.7	2.2	2.7
Wtd <i>t</i> > 2	67	74	64	62	33	62	56	69	59	33	41	59
	The Netherlands						Italy					
	Size	B/P	S/P	RoE	IBES	Mtm	Size	B/P	S/P	RoE	IBES	Mtm
Identity	89	72	72	99	20	71	24	50	64	32	42	5
Reg 12	-0.16	0.55	0.41	0.57	0.12	-0.35	-0.46	-0.22	-0.31	-0.23	-0.27	-0.48
<i>t</i> -statistic	1.2	1.5	1.6	1.7	1.1	1.5	1.3	2.0	1.3	1.9	1.0	1.7
<i>t</i> > 2	23	33	36	38	15	36	21	33	21	44	8	36
Wtd <i>t</i> -stat	2.2	2.0	1.6	1.7	1.2	1.7	2.5	1.9	1.5	1.9	1.4	2.2
Wtd <i>t</i> > 2	49	38	31	38	18	41	54	44	31	44	26	56
	Spain						Ireland					
	Size	B/P	S/P	RoE	IBES	Mtm	Size	B/P	S/P	RoE	IBES	Mtm
Identity	100	100	67	78	40	81	83	95	91	90	97	67
Reg 12	-0.09	-0.62	-0.62	0.27	-0.38	0.00	-0.52	-0.37	-0.68	-0.28	0.29	-0.46
<i>t</i> -statistic	1.0	1.5	1.3	1.4	1.3	1.3	1.2	1.2	1.1	1.1	1.1	1.4
<i>t</i> > 2	21	26	23	18	21	18	18	15	13	13	13	26
Wtd <i>t</i> -stat	2.1	1.4	1.3	1.3	1.2	1.7	1.5	1.2	1.4	1.0	1.6	1.3
Wtd <i>t</i> > 2	41	31	18	28	15	33	31	21	26	15	28	18

Table 12 Reference style factors within individual style-oriented markets

	United States						United Kingdom					
	Size	B/P	S/P	RoE	IBES	Mtm	Size	B/P	S/P	RoE	IBES	Mtm
Identity	100	100	100	100	98	97	100	100	100	100	100	92
Reg 12	0.50	0.53	-0.21	1.45	-0.08	-0.11	-0.03	0.31	-0.13	0.34	-0.05	-0.51
<i>t</i> -statistic	5.0	3.7	4.2	4.6	2.3	4.0	1.3	2.4	3.0	2.3	2.0	3.7
<i>t</i> > 2	77	69	69	64	49	69	15	49	67	51	44	69
Wtd <i>t</i> -stat	7.5	5.2	5.0	5.5	3.7	5.3	4.1	4.5	3.5	3.1	3.0	3.8
Wtd <i>t</i> > 2	90	79	79	77	72	87	69	74	64	67	62	67

Table 13 Within Eurozone sectors and within the major Eurozone markets

	Within Eurozone sectors	Within the six major markets
Average Identity	47	69
Average weighted <i>t</i> -statistics	2.09	1.98
Average weighted <i>t</i> -stat > 2	40.1	40.4
No. of significant Regularity statistics at 1 SD (of 36)	9	11

Table 14 Reference averages within US sectors and UK sectors

	Within US sectors	Within UK sectors
Average Identity	82	87
Average weighted t -statistics	3.11	2.95
Average weighted t -stat > 2	60.1	56.1
No. of significant Regularity statistics at 1 SD (of 36)	7	4

Conclusions

Style has been a popular investment concept for years, and there are a number of different but related applications of its principles to investment practices. But, even as style is gaining in popularity, concerns regarding its fundamental applicability in new market areas have caused a re-examination of the basic principles upon which it is founded. This paper has presented a set of conditions that can be used to construct a formal definition of what style, in all of its current manifestations, requires of market characteristics in order to be applied productively.

These criteria identify the US and the UK as style-oriented markets and also indicate the degree to which style principles can be applied across and within the Eurozone.

The criteria can also be turned to address the question of market vs sector allocations for managers of Eurozone (or other regional) portfolios. Although the results are currently inconclusive, the method ought to be applied regularly to review the implications of the changing Eurozone 'single market'.

Notes

- 1 See, for example, Haugen (1999).
- 2 See, for example, Sharpe (1992).
- 3 The AIMR has described styles generically as 'identifiable segments of the market with distinguishable patterns of returns' (*Institutional Investor*, March 1996). Sharpe (1992) describes styles contextually from time series analysis, defining the sum of the contributions from the specified coefficients and their corresponding factor rewards as

the return attributable to style. But no comprehensive definition yet is available that describes the circumstances in which style techniques can be justifiably used for market analysis or portfolio analysis.

- 4 This is easily generalised to provide a risk measure for portfolios of securities.
- 5 For a simple summary of the necessary results to effect a principal components characterisation of symmetric matrices see, for example Theil (1971).
- 6 See Haugen (1999).
- 7 A similar assessment criterion was used by Caupal *et al.* (1993).
- 8 t -Statistics have been used in a variety of ways to validate style factors. Most are different from the approach used here. The most common approach (Fama and MacBeth, 1973) is to review the time-series average and the t -statistics of the average of each month's factor regression coefficients (see also Michaud, 1999). This approach provides a measure of the distinctiveness of the historic return against the relative noise of the month to month fluctuations of the individual slope coefficients from the monthly cross-sectional regressions. This type of analysis establishes some degree of identity of style factors (although not as comprehensively as the Identity test), but does not offer any information about clustering or the explanatory power of the style factor with respect to individual security, or portfolio returns.

It is also very useful to review the results of weighted cross-sectional regressions. The results of weighted regressions may be more relevant to institutional investors for whom the accuracy of characterisations of the performance of larger companies are individually more important than the accuracy of characterisations of the performance of individual smaller companies.
- 9 In markets where style benchmarks are popular and managers generally identify their positions with respect to these standards, the structure of the standard should clearly be adopted. For example, in the US where style benchmarks of the standard construction (not sector adjusted) are well recognised, returns-based analysis according to unadjusted paradigm portfolios is preferred. However, the UK and the Eurozone are different. Although style management is recognised and becoming more established in these markets, no benchmarking culture involving simply constructed style benchmarks has yet developed. In fact, it is

- quite normal for style strategies at the sector level to differ markedly from stock strategies, even among strongly style-based managers. In these market areas, sector adjusted and, where appropriate, country adjusted and country and sector adjusted paradigm portfolios would give the more accurate results.
- 10 It has been suggested that this definition should be extended to require that within different style categories of securities successful management practices ought also to be different. This would support the common practice of appointing different managers for different styles of management and is an interesting subject for further investigation.
 - 11 It is very common to hear the argument that the frequently divergent patterns of style rewards from market to market all but destroy the potential to apply style-based techniques across the Eurozone. Although this is observably changing, it is still important to put the argument into perspective. For many years, investors have managed style exposures within the major markets without regard to the frequently divergent patterns of style rewards within the individual industrial and economic sectors themselves.
 - 12 It is important to recognise that the UK has a much larger population of smaller companies than the other individual markets in the rest of Europe. This may explain some of the differences in the observed significance (ie *t*-statistics) of the various factors across the total markets, and may also indicate why the *t*-statistics from the weighted regressions are so much more in agreement.
 - 13 This is a variation of the usual 'Which is more important, market risk or sector risk?' question.
 - 14 This point is also developed by Kuo and Satchell (1998).
 - 15 Of course, formally, other principles of stock management could give different results. But, given the current popularity of style concepts and its natural association with traditional securities analysis, the use of style criteria as the deciding conditions seems quite appropriate.
 - 16 Clearly, the evidence is also largely influenced by: using only simple unweighted averages; the choice of sector decomposition criteria; and the number of

markets selected for this initial comparison. While different procedures may give different detail, the important information within the exercise lies in the comparison of the ranges and the scales of the various style relevance statistics between markets where style is a recognised feature and markets and regions where it is just starting to be applied.

- 17 For a discussion of the exceptional circumstances and features during the changeover period and the period of introduction of the Euro see Schwob (1999).

References

- Campbell, J., Low, A. and MacKinlay, A. C. (1997) *The Econometrics of Financial Markets*, Princeton University Press, Princeton, NJ.
- Caupal, C., Rowley, I. and Sharpe, W. (1993) 'International Value and Growth Stock Returns', *Financial Analysts Journal*, January–February, 27–36.
- Fama, E. and MacBeth, J. (1973) 'Risk, Return, and Equilibrium — Empirical Tests', *Journal of Political Economy*, 81(3), 607–36.
- Haugen, R. (1999) *The New Finance, The Case Against Efficient Markets*, 2nd edn, Prentice Hall, Englewood Cliffs NJ.
- Kuo, G. and Satchell, S. (1998) 'Global Equity Styles and Industry Effects: The Pre-eminence of Value Relative to Size', Unpublished discussion paper.
- Levis, M. and Liodakis, M. (1999) 'The Profitability of Style Rotation Strategies in the United Kingdom', *Journal of Portfolio Management*, Fall, 73–86.
- Michaud, R. (1999) *Investment Styles, Market Anomalies, and Global Stock Selection*, The Research Foundation of the Institute of Chartered Financial Analysts, Association for Investment Management and Research, Charlottesville, VA.
- Schwob, R. (1999) 'Style and the Euro', *Investments & Pensions Europe*, September, in the supplement, 'European Investment: The Euro Effect', 4–5.
- Sharpe, W. F. (1992) 'Asset Allocation: Management Style and Performance Measurement', *Journal of Portfolio Management*, Winter, 7–19.
- Theil, H. (1971) *Principles of Econometrics*, John Wiley, New York.