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Style characteristics and the cross-section of JSE returns

1. INTRODUCTION AND PRIOR RESEARCH

Internationally the influence of, what have become labelled, "*style-based*" effects, is a rapidly expanding arena of enquiry. While earlier studies on the Johannesburg Stock Exchange (JSE) such as De Villiers, Lowlings, Petit and Affleck-Graves (1986), Bradfield, Barr and Affleck-Graves (1988), Page and Palmer (1991) and Page (1996) investigate the existence of isolated 'anomalies' within the framework of traditional asset pricing theory, only recently have research methodologies been specifically designed to comprehensively determine the identity of style effects on the JSE. The advantage of a more comprehensive approach lies not only the documentation of new anomalies but, more fundamentally, it is a prerequisite to achieve the aim of identifying a fully specified model of expected returns. Given beta's apparent ineffectiveness in fulfilling this task, this is the pressing avenue of empirical enquiry in the field of asset pricing.

Van Rensburg (2001) adopts the 'portfolio-based' approach[1] to search for the presence of style-based effects among a set of 23 candidate attributes using a sample of JSE industrial shares from 1983 to 1999. A total of eleven effects are identified that persisted after risk adjustment. The returns of the style portfolios clustered to indicate the presence of 'value' (earnings yield, dividend yield, price to NAV, prior five year's earnings growth), 'quality' (size[2], turnover, leverage, cashflow-to-debt) and 'momentum' (past three, six and twelve month's return) groupings of anomalies. More than half of these identified effects had not previously been investigated on the JSE.

This paper continues this strand of research by adopting the 'characteristic-based approach' supported by Daniel and Titman (1997). Here, share returns over a particular period are cross-sectionally regressed on the values of various style characteristics as observed at the beginning of the period. The time-series of the slope coefficients estimated in this manner represent the 'rewards' accruing to each characteristic in each period while a share's exposure to the factor is directly observable by the value of the characteristic concerned. Note that, unlike Daniel and Titman (1997), the focus of this paper is not on the relative appropriateness of the characteristic approach versus the (allegedly) more theoretically appealing 'risk based' factor loading approach (see Robertson and van Rensburg, 2003 for an empirical investigation of this issue on the JSE). Rather, the central concern of the paper is to discern the *identity* of the style-based factors that explain the cross-section of JSE returns.

The remainder of the paper is organised as follows. Section 2 discusses the data and methodology employed in the study. Section 3 reports the results and section 4 concludes.

2. DATA AND METHODOLOGY

The financial ratios for all JSE listed shares contained in the McGregor/Bureau of Financial Analysis (McG/BFA) database of standardised financial accounts were extracted for each month from July 1990 to June 2000. The dividend-adjusted return data, for both individual shares and indices, was supplied by BARRA who accounted for all capital events involved in their calculation. Trading volume data was supplied by I-Net Bridge. For every stock in each month, a turnover ratio was calculated by taking the average number of shares traded daily for the month and expressing it as a proportion of the number of ordinary shares outstanding at the end of the previous month. The data set was then filtered to include only shares with a turnover ratio of greater than 0,01%, thereby conservatively ensuring that each share included in the sample traded at least once during each month.

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[1] In this approach, factor-mimicking portfolios are formed by ranking shares on a particular characteristic and adopting long positions in the shares that constitute, for example, the top one third of the characteristic and short positions in the bottom one third. The returns on these portfolios in each month are interpreted to represent the reward to the style concerned. A share or portfolio's exposure (or "loading") to a style factor is estimated by the slope of a time-series regression of its returns on the returns of the factor-mimicking portfolio.

[2] Note that the documentation of a size effect in this work differs from the findings of De Villiers *et al.* (1986) and Page and Palmer (1991) who did not find evidence of a size effect over the particular time-periods and share samples that they examined.

Table 1: Average number of shares before and after adjusting for thin trading

Years	All	1	2	3	4	5	6	7	8	9	10
- Before	419	312	335	350	361	377	399	421	461	549	627
- After	336	210	209	220	263	284	325	366	419	499	562

The yearly figures represent the average number of shares in each twelve month period from July 1990 to June 2000. Non-surviving firms are included in the sample until delisting. All years represent the average number of shares in each month across all 120 months in the sample.

Following McG/BFA, all the financial statement data used in this study is drawn from audited reports with interim results being ignored. The financial ratios tested in this study have been lagged so that the accounting data for all fiscal year-ends in calendar year $t-1$ is matched with the returns for May of year t. This lag conservatively ensures that all financial statement data used is available to the public at the time of inclusion[3]. Note that, unlike the return data, the financial statement information will have an annual rather than monthly periodicity. This, together with the conservative reporting lag, will bias the findings against finding significant results. Some of the financial ratios investigated include market prices in their construction and, thus, do have values that may vary on a monthly basis even if their financial statement component remains unchanged. Berk (1995) points out that because returns are mechanically related to prices, financial ratios that use market prices in their construction are *a priori* related to returns. This problem is avoided in this study, however, as the financial ratios are lagged with respect to share returns and contemporaneous relationships are not being investigated. The 24 style attributes investigated in this study are listed in Table 2. The full definitions of the ratios as provided by the data vendor are presented in Appendix A.

In the few instances where firms have multiple share classes such as non-voting issues or other ownership restrictions, the fundamental information has not been altered. Cash shell companies, however, were excluded from the sample. One, six and twelve-month prior return figures were also constructed to represent technical indicators of momentum that were calculated for every share in each month on a rolling basis. A firm was deleted from the data set in a month if the financial statement item under consideration was missing, but remains in the sample otherwise. Where a company has been delisted or failed to comply with the regulations of the JSE in terms of reporting requirements and has consequently been suspended from trade, the share has been excluded from the dataset of share returns by BARRA for the remainder of the sample period. This ensures that the share sample does not consist only of surviving shares and meaningfully augments the share sample. The average number of shares in the sample in each year after removing non-traded and thinly traded shares is shown in Table 1. After the adjustment, the minimum number of shares in a month was 206 (July 1990) and the maximum was 542 (June 2000), with an average of 336 over the entire sample period. This is a larger sample of shares than that used in prior asset pricing studies on the JSE. It is often the case in JSE share samples that smaller firms tend to be seriously under represented, one consequence being a dilution of the power of statistical tests to find a size effect.

Table 2: Style characteristics tested

(i) Measures of 'Value'
- (a) Price-to-earnings
- (b) Dividend yield
- (c) Price-to-profit
- (d) Price-to-NAV
- (e) Cash flow-to-price

(ii) Measures of Future Earnings Growth

(A) Earnings Growth
- (a) Sustainable growth
- (b) Retention rate

(B) Measures of 'Bankruptcy Improbability'
- (a) Size (Log of market capitalisation)
- (b) Return-on-equity
- (c) Return-on-assets
- (d) Debt-to-cash flow
- (e) Debt-to-assets
- (f) Long term loans-to-assets
- (g) Debt-to-equity
- (h) Leverage
- (i) Financial distress
- (j) Current ratio
- (k) Quick ratio
- (l) Owner's interest

(iii) Measures of Irrationality and Neglect

(A) Price Momentum
- (a) Previous one month's return
- (b) Previous six month's return
- (c) Previous one year's return

(B) Neglect
- (a) Trading volume
- (b) Shares in issue

[3]The minimum lag (for firms reporting in December) was 5 months and the maximum lag (for firms reporting in January) was 17 months. The JSE Securities Exchange requires all listed companies to make financial reports available within 90-days of their fiscal year-end.

To reduce the influence of extreme outliers in the data, the range of data points in each month is winsorised in a method similar to Fama and French (1992). The largest and smallest 0,5% of the data points in each month were set to a value equal to the 99,5th and 0,5th percentiles respectively. After truncation, the cross-sectional distribution of each style characteristic in each month is standardised to have a mean of zero and a standard deviation of unity. This allows comparisons to be made between the magnitudes of the slopes estimated in the cross-sectional regressions that follow. (In a confirmatory exercise, the standardisation did not meaningfully affect the t-statistics of the time series of average monthly slope coefficients).

After the more than one million data points used in the study were suitably prepared, the procedure outlined below was followed in order to construct a characteristic-based model of the cross-section of JSE returns:

First, each of the characteristics listed in Table 2 are tested on an individual basis using a one-factor cross-sectional regression similar to Fama and MacBeth (1973):

$$r_{i,t+1} = \gamma_{0,t+1} + \gamma_{1,t+1}A_t + \varepsilon_{i,t+1} \quad \ldots (1)$$

The dependant variable is $r_{i,t+1}$ and is the realised return on share i for the month $t+1$. The single independent variable in the regression is denoted as A_t representing the standardised value of the attribute of the share at the end of each month t. $\gamma_{1,t+1}$ is the cross-sectional slope coefficient to be estimated using ordinary least squares. For each characteristic this regression is repeated in each month of the sample period. The time-series of slopes measured in this way represents the 'reward' to each characteristic in each month. Candidate factors for further multifactor testing were identified as those variables where the time-series mean value cross-sectional slope coefficient is significantly different from zero using Student's t-test.

To determine whether the attributes can explain share returns beyond that already explained by market beta, a CAPM-based risk adjustment is conducted on the data set of share returns. Using a time series regression, the excess return of each share is regressed on the excess market return. The monthly error term for each share is recorded and added to the estimated intercept term. The result is a data set of monthly CAPM risk adjusted returns for all shares. Conducting the risk adjustment by first allowing the market and only, thereafter, the attributes to explain returns is conservative in the direction of its bias. The CAPM risk adjusted return is calculated as:

$$(\alpha_i + \varepsilon_{i,t}) = (r_{i,t} - r_{f,t}) - \beta_i(r_{m,t} - r_{f,t}) \quad \ldots (2)$$

where the monthly error term, $\varepsilon_{i,t}$, is scaled by adding the intercept term, α_i, to provide an expression of the total return, $(\alpha_i + \varepsilon_{i,t})$, for share i in month t that is not explained by beta, β_t. $r_{m,t}$ is the return on share i and the return on the market (as proxied by the JSE All Share Index) for month t. r_f is the risk-free rate (3 month T-Bill) of return in month t. By substituting $(\alpha_i + \varepsilon_{i,t+1})$ for $r_{i,t+1}$ in equation (1) the univariate cross-sectional regression of the CAPM risk adjusted share returns on beginning period individual attribute values can be restated as:

$$(\alpha_i + \varepsilon_{i,t+1}) = \gamma_{0,t+1} + \gamma_{1,t+1}A_t + e_{i,t+1} \quad \ldots (3)$$

where the dependant variable is $(\alpha_i + \varepsilon_{i,t+1})$, as previously estimated in equation 2, and represents the return of share i in month t +1 that is not explained by market beta. The single independent variable in the regression is again denoted as A_t representing the value of the attribute of share i that is available at the end of month t and $\gamma_{1,t+1}$ being the cross-sectional coefficient to be estimated using OLS. Note that $e_{i,t+1}$ represents the residual errors as estimated in equation 3 while, in contrast, the $\varepsilon_{I,t+1}$ values have been 'imported' from equation 2.

To determine whether the attributes have explanatory power beyond the risk factors in an arbitrage pricing theory (APT) model, all attributes are re-tested using a data set of share returns that has been modified using the two factor APT model suggested by van Rensburg (2002):

$$(\alpha_i + \varepsilon_{i,t}) = (r_{i,t} - r_{f,t}) - \beta_{findi,i}(r_{findi,t} - r_{f,t}) - \beta_{resi,i}(r_{resi,t} - r_{f,t}) \quad \ldots (4)$$

where, as before, the monthly error term, $\varepsilon_{i,t}$, is scaled by adding the time series intercept term, α_i, to provide an expression of the return that is not explained by the two factor APT model: $(\alpha_i + \varepsilon_{i,t})$. $\beta_{findi,i}$ and $\beta_{resi,i}$ are the time series estimates of the sensitivities of share i to the return on the JSE Financial and Industrial index, r_{findi}, and the return on the JSE Resources index, r_{resi}. The returns on these indices are used as observable proxies for the first two factor analytically extracted sources of common variation in JSE returns (see van Rensburg, 2002). By substituting $(\alpha_i + \varepsilon_{i,t+1})$ from equation (4) for $r_{i,t+1}$ in equation (1) the univariate cross-sectional regressions of risk adjusted return on individual attribute values takes a similar form to equation (3).

Finally, all permutations of pairs of candidate factors were regressed simultaneously in a two-factor model:

$$r_{i,t+1} = \gamma_{0,t+1} + \gamma_{1,t+1}A_t + \gamma_{2,t+1}B_t + \varepsilon_{i,t+1} \quad \ldots (5)$$

The return of the shares in each month is related to a pair of standardised candidate factors labelled A_t and

B_t respectively with $\gamma_{1,t+1}$ and $\gamma_{2,t+1}$ being the respective cross-sectional coefficients. Next, a three-factor regression was performed in each month for all permutations of significant pairs of candidate factors together with an additional candidate factor. The process is repeated until no more factors could be added without some or all factors losing their joint significance.

2. EMPIRICAL RESULTS

2.1 Univariate regression results

The univariate cross-sectional regressions conducted on all attributes using non-thinly traded shares in each month from July 1990 through June 2000 identify six candidate attributes for further multifactor testing. As mentioned, the candidate factors are identified as those characteristics where the time-series of their individual cross-sectional coefficients are significantly different from zero. Each panel in Table 3 reports the average coefficient values and their associated t-statistics for all variables in descending order of significance. Considering the results conducted on unadjusted returns as displayed in panel A of Table 3, there is evidence of a significant value effect under which the attributes cashflow-to-price, dividend yield, price-to-earnings, price-to-profit and price-to-NAV may be classified. Evidence of a small firm effect is also observed over the sample period. Unlike the findings of Fraser and Page (2000) and van Rensburg (2001), who confine their analysis to the industrial sector of the JSE, none of the measures of price momentum are found to be significant. The value effects of cashflow-to-price and price-to-profit are documented here for the first time on the JSE[4].

After conducting a risk adjustment of the share returns data set using the CAPM, the same list of candidate attributes, except for price-to-profit, are significant above the ninety-five percent level of confidence (see panel B of table 3). While there is some variation in the ordering of the attributes when ranked in descending order of the t-statistics, the payoffs are of similar magnitudes. The results in panel C of Table 3 show that, apart from the price-to-profit attribute which becomes statistically significant, the effect of risk adjusting the share return data set with the two factor APT model does not materially affect the cross-sectional explanatory power of the attributes. This observation has prior precedent in Page (1996:41) who concludes that *"...any model misspecification within the CAPM framework is clearly not removed by adopting an APT approach"*.

2.2 Constructing a multifactor model

In anticipation of the issues of multicollinearity arising in the construction of a multifactor model, correlation matrix of the style characteristics was examined (see Appendix B). As can be seen, value characteristics tend to be positively related to each other. Size is insignificantly related to all of these characteristics except exhibiting a negative relation with dividend yield. This result conforms to preconceptions regarding the nature of the life-cycle of the firm. When all permutations of paired candidate factors were tested using two-factor cross-sectional regressions, only one pair of candidate factors was found to be jointly significant. Table 4 reports the results of this model.

As can be seen, a two-factor characteristic-based model using size and price-to-earnings as explanatory variables is derived for the cross-section of JSE returns. Surprisingly, this is despite price-to-NAV being the most significant value factor on a univariate basis. When appended as a third factor to this model, none of the candidate factors were found to be significant. Note that, since the cross-sectional regressions are conducted at the individual share level, the R-squared term is, as expected, relatively low. Note that this figure can easily be manipulated higher as the research design employs larger and larger portfolios of shares sorted by the characteristics concerned rather than individual shares in the cross-sectional regressions.

3. CONCLUSION

In this study individual share-level characteristic attributes are regressed on non-thinly traded JSE share returns using Fama and MacBeth (1973) cross-sectional regressions. From this procedure, a short-list of six candidate factors (price-to-NAV, dividend yield, price-to-earnings, cash flow-to-price, price-to-profit and size) representing individually significant effects are filtered from a set of 24 fundamental and technical attributes. The ensuing multifactor results support a two-factor model with size and price-to-earnings as the explanatory variables. It appears that the characteristic factors of size and price-to-earnings broadly conform to those to those documented in van Rensburg (2001) and capture the central intuition behind the international evidence of the style effects relating to value and size effects (Fama and French, 1992 *inter alia*).

While the explicit aim of this study is to specific a style based model of expected returns for the JSE, it can also be seen as a 'multi-anomaly' test of the CAPM. The CAPM fails this test in the case of a number of characteristics. Neither does the two factor APT decomposition of risk succeed in removing the anomalies identified. The cross-section of returns does not appear to be adequately explained by exposures to single or multifactor sources of return covariance.

What we have now is an empirically derived model of JSE returns that, at present, is void of theoretical backing. Time will show that this is a considerable progression from a theory of asset pricing that is void of empirical backing.

[4] In unreported results using the full McG/BFA database i.e. both thinly and non-thinly traded shares, five candidate factors were identified. These were the same candidate factors generated by the non-thinly traded sample, with the exception of the price-to-profit indicator.

Table 3: Monthly cross-sectional regression results

For each attribute, a slope coefficient is estimated in each month from July 1990 to June 2000 using univariate cross-sectional regressions of non-thinly traded share returns (Panel A), CAPM risk-adjusted share returns (Panel B) and two factor APT risk-adjusted share returns (Panel C) on individual attributes. To facilitate the comparison of the magnitude of slope values across attributes, in each month each attribute has been standardized so as to have a mean of zero and a standard deviation of unity. Results in bold indicate where the mean value of the time series of cross-sectional slope coefficients is significantly different from zero at the ninety-five percent level of confidence.

Panel A: Unadjusted Returns

	Average coefficient	t-statistic		Average coefficient	t-statistic
Price-to-NAV	-0,007	**-3,699**	Return-on-equity	-0,022	-0,773
Dividend yield	0,016	**3,530**	Owners interest	-0,001	-0,645
Price-to-earnings	-0,007	**-3,322**	Trading volume	-0,001	-0,566
Size	-0,007	**-3,208**	Debt-to-equity	0,003	0,549
Cash flow-to-price	0,019	**2,513**	Sustainable growth	-0,005	-0,479
Price-to-profit	-0,003	**-2,050**	LT Loans-to-assets	-0,001	-0,389
Retention rate	0,382	1,485	Twelve months prior	-0,001	-0,306
Debt-to-asset	-0,028	-1,331	Current ratio	-0,001	-0,266
Leverage	-0,018	-1,218	Quick ratio	-0,001	-0,247
Return-on-assets	-0,190	-0,902	Debt-to-cash flow	-0,001	-0,031
Shares in issue	-0,190	-0,902	Six months prior	0,713	0,012
Financial distress	0,014	0,834	One month prior	-0,305	0,008

Panel B: CAPM Adjusted Returns.

	Average coefficient	t-statistic		Average coefficient	t-statistic
Price-to-NAV	-0,007	**-3,748**	Debt-to-equity	0,004	0,800
Size	-0,006	**-3,590**	Six months prior	0,002	0,745
Price-to-earnings	-0,007	**-3,277**	Owners interest	-0,001	-0,660
Dividend yield	0,022	**3,208**	Trading volume	-0,001	-0,469
Cash flow-to-price	0,019	**2,489**	Sustainable growth	-0,005	-0,440
Price-to-profit	-0,003	-1,766	Shares in issue	0,001	0,433
Retention rate	0,422	1,589	One month prior	-0,001	-0,335
Debt-to-assets	-0,027	-1,308	LT Loans-to-assets	-0,001	-0,327
Return-on-assets	-0,179	-0,978	Debt-to-cash flow	-0,007	-0,299
Leverage	-0,011	-0,933	Current ratio	-0,001	-0,274
Financial distress	0,015	0,906	Quick ratio	-0,001	-0,252
Return on equity	-0,023	-0,809	Twelve months prior	0,000	-0,214

Panel C: APT Adjusted Returns

	Average coefficient	t-statistic		Average coefficient	t-statistic
Price-to-NAV	-0,008	**-3,803**	Six months prior	0,002	0,713
Price-to-earnings	-0,007	**-3,322**	Owners interest	-0,001	-0,645
Size	-0,007	**-3,208**	Debt-to-equity	0,003	0,549
Dividend yield	0,021	**3,090**	Trading volume	-0,001	-0,415
Cash flow-to-price	0,021	**2,729**	Twelve months prior	-0,001	-0,306
Price-to-profit	-0,003	**-2,050**	LT Loans-to-assets	0,000	-0,294
Retention rate	0,382	1,485	Shares in issue	0,000	0,249
Return on assets	-0,262	-1,419	Current ratio	-0,001	-0,247
Debt-to-asset	-0,028	-1,331	Quick ratio	-0,001	-0,247
Leverage	-0,015	-1,191	Sustainable growth	-0,002	-0,164
Financial distress	0,017	1,034	One month prior	0,000	0,057
Return on equity	-0,023	-0,817	Debt-to-cash flow	-0,001	-0,034

Table 4: Significant paired permutations of candidate factors
Monthly two-factor cross-sectional regressions results

	Average Coefficient	t-statistic	R-squared
Size	-0,005	**-2,112**	1,11%
Price-to-earnings	-0,005	**-2,481**	

Cross-sectional coefficients that are significantly different from zero at the 95% level for the 120 months from July 1990 to June 2000 are indicated in bold. Both explanatory variables have been standardised in each month such that their cross-sectional standard deviations are unity.

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Appendix A

Formulae for Financial Statement Variables (Source: McG/BFA)

- *Debt-to-equity*
(Long term borrowings + Current liabilities) / Total owners interest

- *Cash flow-to-price*
(Ordinary dividends + Non cash flow items) / Ordinary shares in issue / Price

- *Current ratio*
Current assets / Current liabilities

- *Debt-to-assets*
(Long term borrowings + Current liabilities) / Total assets

- *Debt-to-cash flow*
(Long term borrowings + Current liabilities) / (Ordinary dividends + Non cashflow items)

- *Dividend yield*
(Ordinary dividends / Ordinary shares) / Price

- *Long term loans-to-assets*
Long term borrowings / Total assets

- *Price-to-earnings*
Price / (Retained Profit – Ordinary dividends) / Ordinary shares

- *Price-to-profit*
Price / (Adjusted profit / Ordinary shares)

- *Price-to-NAV*
Price / (NAV / Ordinary shares)

- *Quick ratio*
(Current assets – Long term group loans) / Current liabilities

- *Retention rate*
Retained profit / Profits due to shareholders

- *Return-on-assets*
(Profit before income and taxation - extraordinary items) / Total assets

- *Shares in issue*
Ordinary shares in issue represents the actual number of ordinary shares issued and is adjusted for partly paid-up shares reduced in the same ratio as that in which the amount paid-up stands to the nominal value of the shares.

- *Financial distress*
The Financial distress indicator is based on a South African adaptation of the widely applied model developed by Altman (1968). The model was adapted by McG/BFA and is updated monthly. The model generates an index, or z-score, and has been shown to be a reasonable indicator of the likelihood of bankruptcy of an individual firm during the upcoming twelve months. A model for the z-scores is estimated by examining financial statements of a sample of firms one year prior to bankruptcy and financial statements for a sample of firms that survived.

The statistical technique applied is discriminant analysis and is a form of regression that distinguishes the best statistical relationship between the variables hypothesized to indicated financial distress. The weaker a firm's collective measures of financial health, the lower the

resulting z-score. The variables include the total profit, outside of financing, before interest and tax expressed as a proportion of total assets and the sum of total current assets and listed investments as a proportion of total liabilities. Also included is profit after taxation relative to average total assets at book value, cash flow profit after tax relative to inflation-adjusted total assets at market value and total stock as a proportion of inflation-adjusted total assets. Once the model has been estimated using samples of bankrupt and surviving firms, its validity is verified using new samples of observations.

- *Leverage*
A proprietary composite indicator of the gearing of a firm compiled and maintained by McG/BFA and included all short-term financing obligations, secured long-term borrowings and debentures.

- *Sustainable growth*
A proprietary composite indicator compiled and maintained by McG/BFA. The indicators in the composite include the percentage return on assets after tax, the proportion of earnings retained, debt, equity and the percentage interest rate on debt after tax. Each of these components are internally consistent meaning that where the return on assets is regarded as return on net assets, the debt figure used is long-term debt and the interest rate applied is the average rate on that debt, whereas if the return on assets is the return on total assets, total debt and the average rate of interest thereon is used.

- *Size*
Ln (Total market capitalisation)

- *Return-on-equity*
Profit after taxation / Total owners interest

- *Owner's interest*
Total owners' interest represents the total interest of the ordinary and preference shareholders in the company, plus the outside shareholders' interest in the ordinary and preference shares of the subsidiaries.

Appendix B: Correlation Table of Style Attributes

	Price-to-NAV	Dividend yield	Price-to-earnings	Size	Cash flow-to-price	Price-to-profit	Retention rate	Debt-to-assets	Leverage	Return-on-assets	Shares in issue	Financial distress	Return-on-equity	Owner's interest	Trading volume	Debt-to-equity	Sustain growth	LT loans-to-assets	12 month prior	Current ratio	Quick ratio	Debt-to-cash flow	6 month prior	1 month prior
Price-to-NAV	1.00	-0.08	**0.32**	0.08	-0.07	**0.33**	-0.01	0.17	**0.21**	0.15	-0.04	-0.03	**0.28**	-0.06	0.05	**0.54**	**0.32**	0.14	-0.03	-0.03	-0.02	**0.34**	0.03	0.01
Dividend yield		1.00	-0.10	**-0.21**	**0.49**	-0.04	-0.05	0.00	0.05	0.00	0.05	0.01	-0.02	-0.08	0.05	0.02	-0.05	-0.03	-0.02	0.02	0.03	0.02	-0.02	-0.01
Price-to-earnings			1.00	0.09	-0.12	**0.26**	0.04	0.05	0.02	-0.06	-0.03	0.06	-0.05	-0.02	0.10	0.05	-0.03	0.04	0.05	0.16	0.17	0.04	0.01	0.01
Size				1.00	-0.14	0.02	-0.16	-0.02	0.00	0.12	**0.47**	0.06	0.08	**0.52**	-0.02	0.00	0.06	0.08	0.14	-0.03	-0.02	-0.01	0.10	0.02
Cash flow-to-price					1.00	-0.08	-0.04	0.06	0.09	0.03	-0.03	-0.04	0.03	-0.05	0.02	0.00	-0.02	-0.06	-0.04	0.00	-0.01	-0.02	-0.03	-0.01
Price-to-profit						1.00	-0.10	0.07	-0.03	-0.09	-0.03	0.13	-0.08	-0.02	0.02	**0.31**	0.00	**0.19**	-0.01	0.01	0.03	**0.54**	-0.01	0.00
Retention rate							1.00	0.07	0.00	-0.08	-0.04	-0.06	-0.09	-0.10	-0.01	-0.03	0.09	0.02	-0.02	0.08	0.07	-0.07	-0.02	0.00
Debt-to-assets								1.00	0.04	**0.27**	0.03	-0.14	0.10	-0.07	0.00	0.12	0.08	0.14	0.00	-0.13	-0.12	0.09	0.00	0.01
Leverage									1.00	-0.11	0.12	0.04	**0.21**	-0.03	0.00	**0.33**	0.11	0.11	0.03	-0.11	0.02	0.03	0.03	0.01
Return-on-assets										1.00	-0.02	-0.08	**0.36**	-0.06	0.01	-0.06	0.16	-0.12	0.05	-0.07	-0.08	-0.04	0.04	0.01
Shares in issue											1.00	0.02	0.00	**0.26**	**0.30**	0.13	0.02	0.07	0.05	-0.03	-0.01	0.03	0.04	0.02
Financial distress												1.00	-0.05	0.05	-0.01	-0.01	-0.07	-0.07	-0.01	**0.53**	**0.54**	-0.02	-0.01	0.00
Return-on-equity													1.00	-0.04	0.01	0.12	**0.59**	-0.01	0.08	-0.05	-0.05	-0.03	0.05	0.02
Owner's interest														1.00	**0.32**	-0.03	-0.03	0.13	0.00	-0.05	-0.04	0.00	0.00	-0.01
Trading volume															1.00	-0.01	0.00	0.02	0.02	-0.02	-0.02	-0.01	0.01	0.01
Debt-to-equity																1.00	**0.26**	**0.29**	0.00	-0.04	-0.02	**0.49**	0.00	0.00
Sustain growth																	1.00	0.04	0.08	-0.05	-0.05	0.02	0.06	0.01
LT loans-to-assets																		1.00	0.03	-0.06	-0.04	**0.35**	0.02	0.00
12 month prior																			1.00	0.01	0.02	-0.01	**0.69**	**0.26**
Current ratio																				1.00	**0.99**	-0.04	0.01	0.01
Quick ratio																					1.00	-0.02	0.01	0.01
Debt-to-cash flow																						1.00	-0.01	-0.01
6 month prior																							1.00	**0.38**
1 month prior																								1.00

The correlation coefficients represent the arithmetic mean of the monthly Pearson product correlations over the sample period (from July 1990 to June 2000). Figures in bold indicate where the coefficients have an mean associated p-value of <0.05. To facilitate comparison, variables are arranged in descending order of the absolute value of their univariate t-stats.