# HIGH-DEFINITION STYLE ROTATION

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> Those concerned with [style] distinctions have focused most of their research on long-run average return differences; that is, they have asked whether small stocks or value stocks "do better than they should" in the long run. Less attention has been paid to likely sources of short-run variability in returns among such groups.
>
> — William F. Sharpe [1992, p. 9]

While most active managers have focused on adding value via stock selection, research suggests that, for large, well-diversified multimanager plans, stock selection adds little value (see, e.g., Brinson et al. [1991]). Rather, as Brinson and his coauthors have documented, it is asset allocation that has the largest impact on investment fund returns. Over 90% of an average fund's total return variance can be traced to its investment policy, the long-term allocation of its investments across asset classes.

Consultants and funds have lately become more concerned with the allocation of investments *within* an asset category — in particular, equities. How much does an equity portfolio's allocation to different categories of equity — growth, value, large-cap, small-cap — contribute to its total return?

Recent studies suggest that a regression of portfolio returns on the returns to various equity style indexes can explain much of a portfolio's return. Thus, for 1985–1989, over 97% of the returns of a well-known "stock picker" — the Fidelity Magellan Fund — were mirrored by a passive fund invested in large-cap growth stocks (46%), medium-sized stocks (31%), small stocks (19%), and European stocks (4%) (see Sharpe [1992, p. 13]).

A glance at Exhibits 1 and 2 gives some idea of the importance of style. Exhibit 1 shows the rolling three-year return to the Frank Russell large-cap growth stock index minus the comparable return to the Russell large-cap value stock index. Exhibit 2 illustrates the rolling three-year return to the small-

cap index less the return to the large-cap index.[1] The figures indicate significant differential performance across styles.

For the three years ending in December 1991, for example, large-cap growth stocks returned 91% and large-cap value stocks 43%, for a return spread of almost 50 percentage points. Value stocks outperformed growth stocks by a similar spread over the three-year period ending in mid-1985. Small-cap stocks outperformed large-cap stocks by about 45 percentage points in the three-year period ending in the fourth quarter of 1993, while they underperformed large-cap stocks by about 42 percentage points for the three years ending in mid-1987.

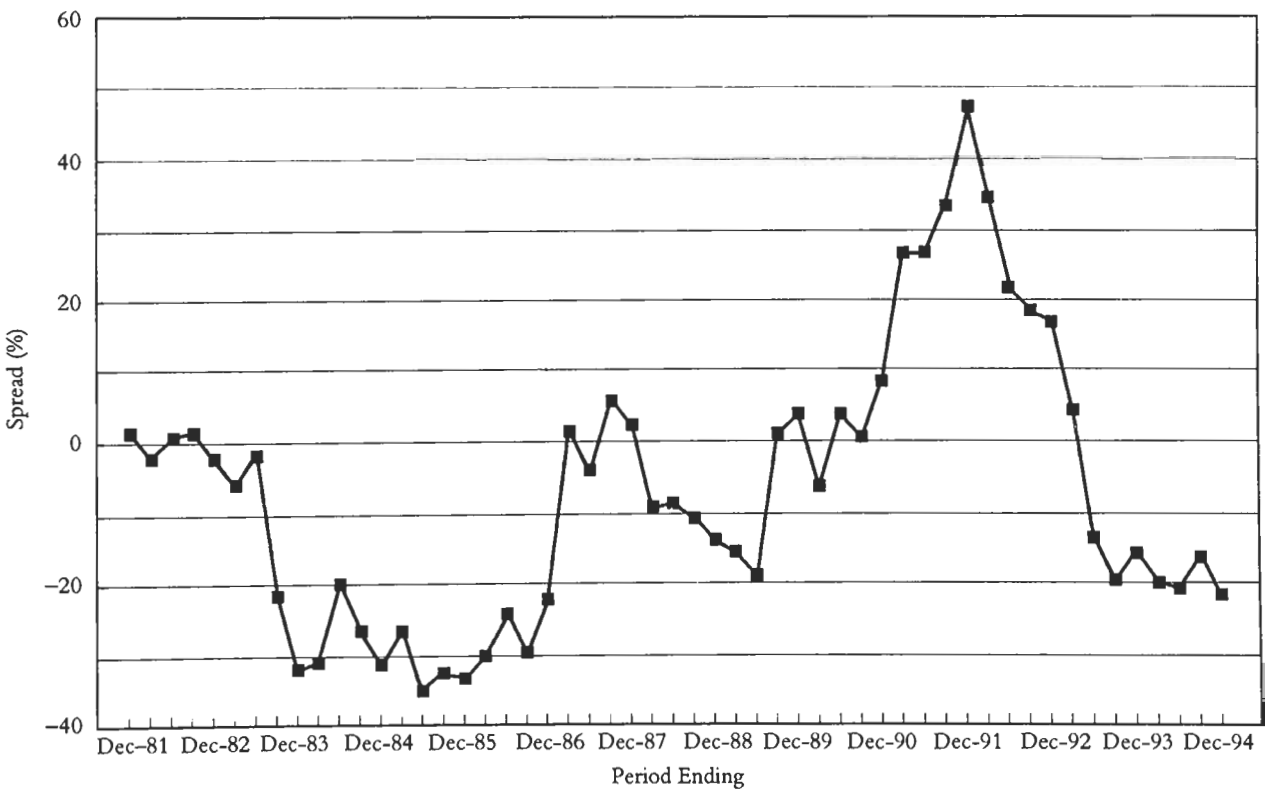
The performance of style managers tends to reflect the differentials between style indexes. For the three years ending in the fourth quarter of 1991, for example, the median growth manager in the Frank Russell universe returned 57 percentage points more than the median value manager (104% versus 47%). And for the three-year period ending in the fourth quarter of 1993, the median small-cap manager in the Frank Russell universe returned 48 percentage points more than the median large-cap manager (111% versus 63%).

These substantial return differentials suggest that style rotation — rotating portfolio investments across stocks of different styles as economic and market conditions change — offers an opportunity to enhance portfolio returns. We find, moreover, that style rotation based on finely drawn distinctions between style attributes offers return enhancement over style rotation carried out via passive style indexes. Clear and precise definitions of style (or high-definition style) facilitate more accurate style allocations, which can provide superior realized returns.

## HIGH-DEFINITION STYLE

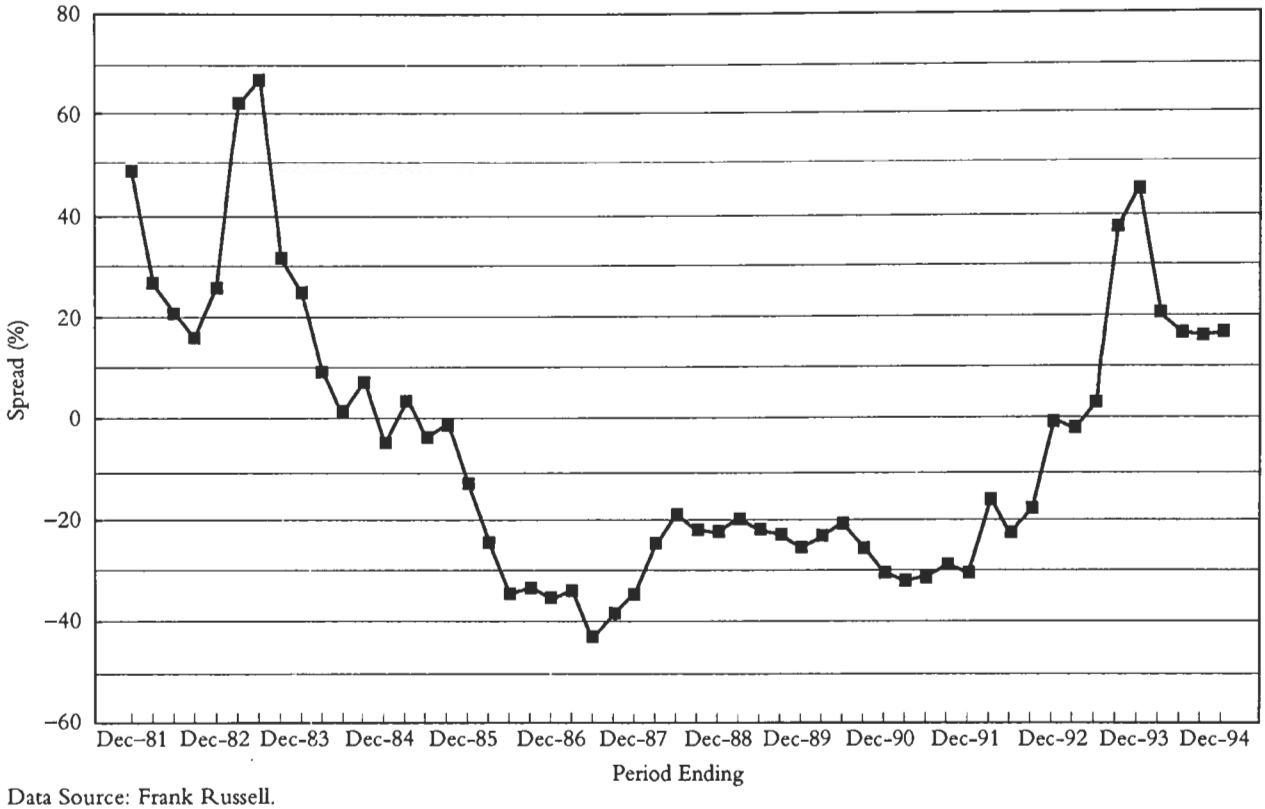
While the terms "value" and "growth" reflect common usage in the investment profession, they serve only as convenient names for stocks that tend to be similar in several respects. As is well known, across securities there is significant positive correlation among: book/price, earnings/price, low earnings growth, dividend yield, and low return on equity. Moreover, the

**EXHIBIT 1**
**GROWTH–VALUE SPREAD — ROLLING THREE-YEAR RETURNS 1979–1994**




Data Source: Frank Russell.

## EXHIBIT 2
### Small Cap–Large Cap Spread — Rolling Three-Year Returns 1979–1994




Data Source: Frank Russell.

## EXHIBIT 3
### Naive Returns to Size-Related Attributes 1978–1994

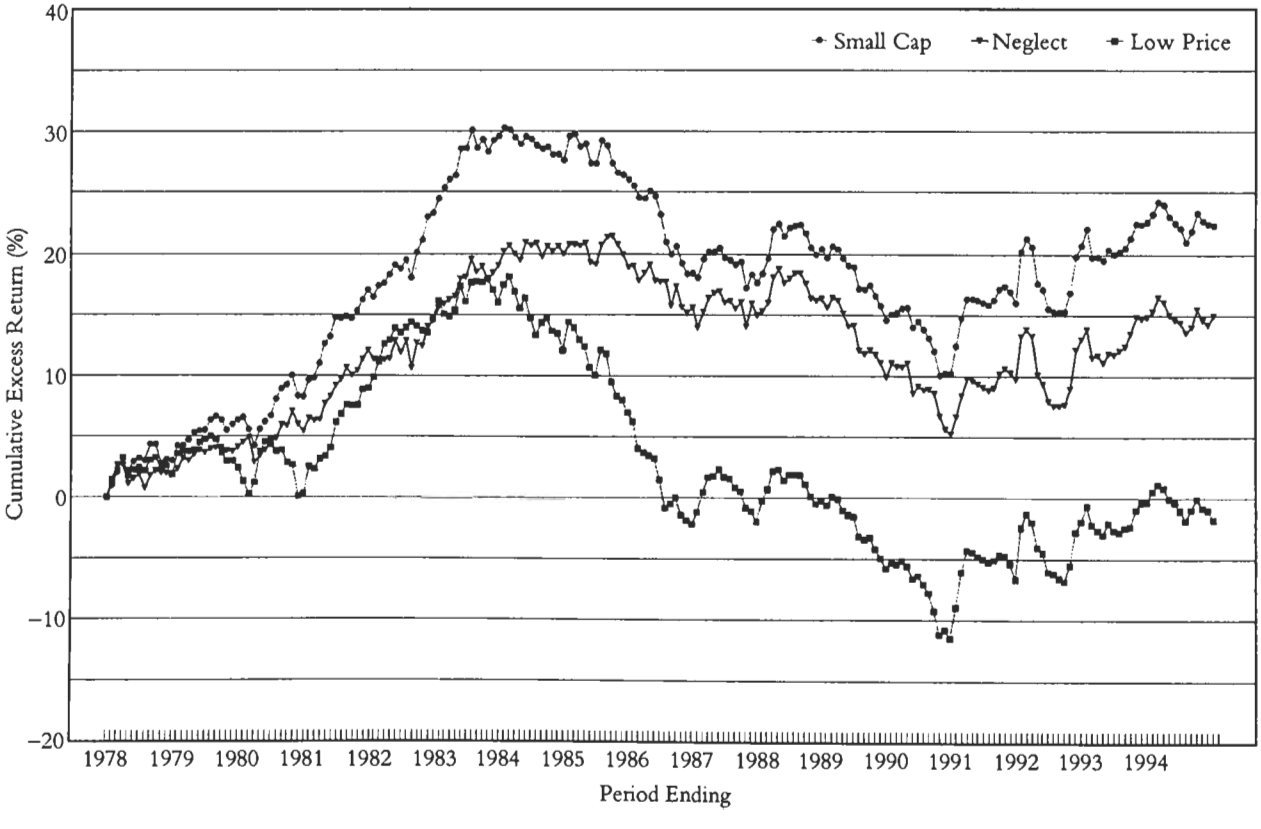


**EXHIBIT 4**
**CORRELATIONS BETWEEN MONTHLY RETURNS TO SIZE-RELATED ATTRIBUTES 1978–1994***

| ATTRIBUTE | NAIVE | PURE |
|---|---|---|
| Small-Cap/Low Price | 0.80 | −0.14 |
| Small-Cap/Neglect | 0.85 | −0.22 |
| Neglect/Low Price | 0.64 | −0.14 |

*A coefficient of 0.14 is significant at the 5% level.

industry compositions of the value and growth groups differ (Sharpe [1992, p. 9]).

Definitions of style can be extremely simple. One example: Rank the securities in the investment universe by book-to-price ratio or earnings-to-price ratio, and divide in two. Stocks with above-average ratios are categorized as value stocks, and those with low ratios are categorized as growth stocks. Define small-cap stocks as the ninth and tenth deciles of market capitalization, or all stocks with capitalizations below a certain amount.

Simple solutions are not always the best, however; sometimes they are just simplistic. For one thing, what do you do with all the stocks that fall in the middle of these divisions? Will stocks with average P/Es or B/Ps perform like value stocks? Growth stocks? What about medium-capitalization companies? Are they large companies that are shrinking? Small companies that are growing?

Also, many different factors can be used to define style. Is growth potential best captured by historical growth? Sustainable growth? Analysts' growth estimates? Is B/P the best marker of potential value? What about dividend discount model (DDM) value? Or fundamentals such as earnings, cash flow, and sales?

Most style managers and many consultants now recognize the limitations of "single screen" style definitions. Some consultants use probability weightings to assign stocks to various style categories. Others use multiple value/growth screens. An even more complex approach considers a large number of stock attributes and industry affiliations for a large and diverse universe of stocks. This approach permits more finely tuned style allocations, as well as greater flexibility in rotating the portfolio across stock attributes in pursuit of profit opportunities.

Value analysis, for example, may entail an examination of earnings, cash flow, sales, dividend discount value, and yield, among other attributes. Growth measurements to be considered include historical, expected, and sustainable growth, as well as the momentum and stability of earnings. And in addition to market capitalization as a size measure, one can use share price, volatility, analyst coverage, and other size-related attributes.

These factors are often closely correlated with each other. Consider the example of small-cap stocks. Small-cap stocks tend to have low P/Es; low P/E is correlated with high yield; both low P/E and high yield are correlated with dividend discount model estimations of value (see Jacobs and Levy [1989a]). Furthermore, all these attributes may be correlated with a stock's industry affiliation. A simple low-P/E screen, for example, will often end up selecting a large number of bank and utility stocks. Such correlations can distort naive attempts to relate returns to style attributes.

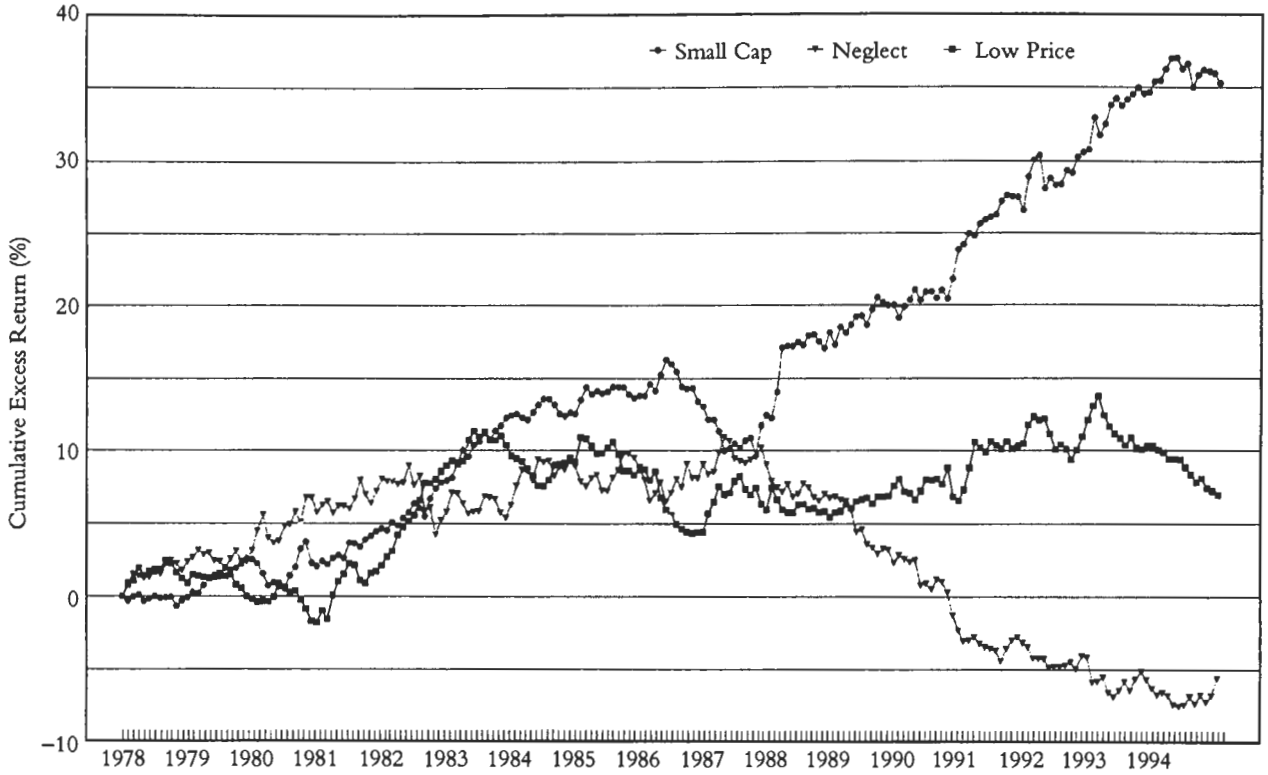
Consider Exhibit 3, which plots the cumulative excess returns (relative to a 3,000-stock universe) to a one-standard deviation exposure to three different size-related attributes over the period from January 1, 1978, through December 31, 1994. These results represent estimates from monthly univariate regressions; the "small cap" line thus represents the cumulative excess returns to a portfolio of stocks naively chosen on the basis of their size (small), with no attempt made to control other attributes.[2] An investment in such a portfolio made in January 1978 and rebalanced monthly would have returned (before transaction costs) about 23 percentage points more than the overall market by the end of December 1994.

Note that, in Exhibit 3, the returns to small-cap are closely correlated with the returns to the measure of analyst neglect. In general, returns to all three attributes — small-cap, neglect, and low price per share — tend to move together, if not in lockstep. This is confirmed by the first column of Exhibit 4, which presents the correlation coefficients between the "naive" returns to the three attributes. The correlations between the returns to small-cap and low price and neglect each exceed 0.80, while neglect and low price per share are correlated at 0.64.

### Pure Style Returns

A different picture emerges when these size attributes are "disentangled" to derive "pure" returns to each attribute. This is done by using multivariate regression analysis, which allows one to examine the relationship between returns and a given stock attribute while controlling for the effects of other

## EXHIBIT 5
### PURE RETURNS TO SIZE-RELATED ATTRIBUTES 1978–1994




related factors. In this way, one can look at returns to a portfolio that is characterized by, say, its market capitalization (small) or by its price per share (low); in all other respects, the portfolio is market-like, having average values of all other size-related attributes, as well as market-like value and growth attributes and industry weightings.

Exhibit 5 plots the "purified," disentangled cumulative excess returns to each of the attributes shown in Exhibit 3 over the same period. Two results are immediately apparent. First, the attributes no longer appear to be so positively correlated. Exhibit 3 shows the naive returns to small-cap and neglect to be virtually identical over a rather long horizon. The pure returns in Exhibit 5, however, show returns to small-cap behaving quite differently from returns to neglect.

This finding is supported by the pure correlation results in the last column of Exhibit 4. The often large positive correlations of the naive returns have disappeared — to be replaced by significant negative correlations. The naive small-cap measure's 0.80 and 0.85 correlations with low price and neglect, for example, become −0.14 and −0.22 when one examines pure returns.

Second, the returns in Exhibit 5 display much less volatility than those in Exhibit 3. While the returns in Exhibit 3 plot a general up/down/up pattern (corresponding to eras favoring small-cap, large-cap, and then small-cap stocks), they show much month-to-month volatility within these trends. By contrast, the results in Exhibit 5 appear to be much smoother and more consistent.

The latter impression is verified by a look at

## EXHIBIT 6
### STANDARD DEVIATIONS (%) OF MONTHLY RETURNS TO SIZE-RELATED ATTRIBUTES 1978–1994*

| ATTRIBUTE | NAIVE | PURE |
|---|---|---|
| Small-Cap | 0.85 | 0.58 |
| Neglect | 0.87 | 0.69 |
| Low Price | 1.04 | 0.58 |

*All differences between naive and pure return standard deviations are significant at the 1% level.

**EXHIBIT 7**
**MARKET SENSITIVITIES OF MONTHLY RETURNS TO VALUE-RELATED ATTRIBUTES 1978–1994**

| ATTRIBUTE | NAIVE SENSITIVITY (T-STAT.) | PURE SENSITIVITY (T-STAT.) |
|---|---|---|
| DDM | 0.06 (5.5) | 0.04 (5.1) |
| B/P | −0.10 (−6.1) | −0.01 (−0.9) |
| Yield | −0.08 (−7.3) | −0.03 (−3.3) |

Exhibit 6, which presents monthly standard deviations for both naive and pure returns to the size-related attributes. All the pure return series exhibit significantly less volatility.[3]

### Implications

The use of pure returns rather than naive returns to equity attributes can help investors avoid some investment pitfalls and can highlight more investment opportunities.

Value modeling, for example, often considers price/earnings ratios and dividend yields. The naive returns to low P/E and to high yield suggest the two are highly correlated (0.47 correlation over the 1978–1994 period). The pure returns display little correlation, however (0.07). Similarly, the growth stock investor would do well to distinguish between historical and sustainable growth measures; the pure returns to these attributes are negatively correlated (−0.13), although their naive returns are fairly highly correlated (0.56).

Investors may look to value stocks in unsettled or bearish markets. But what value attributes should they use? DDM value? Dividend yield? Book-to-price ratio? Exhibit 7 shows the results of regressing both naive and pure returns to several value-related attributes on market (S&P 500) returns over the 1978–1994 period.

The results suggest that DDM value is a poor indicator of a stock's ability to withstand a tide of receding market prices. The regression coefficient in the first column indicates that a portfolio with a one-standard deviation exposure to DDM value will tend to underperform by 0.06% when the market falls by 1.00% (and to outperform by a similar magnitude when the market rises); the coefficient for pure returns gives a similar result. Whether their returns are measured in pure or naive form, stocks with high DDM values tend to behave procyclically.

Book-to-price ratio appears to be a better indicator of defensiveness: It has a regression coefficient of -0.10 in naive form. In pure form, however, B/P is virtually unaffected by market movements; it is neither aggressive nor defensive. Apparently, B/P as naively measured picks up the effects of truly defensive value-related attributes such as high yield.

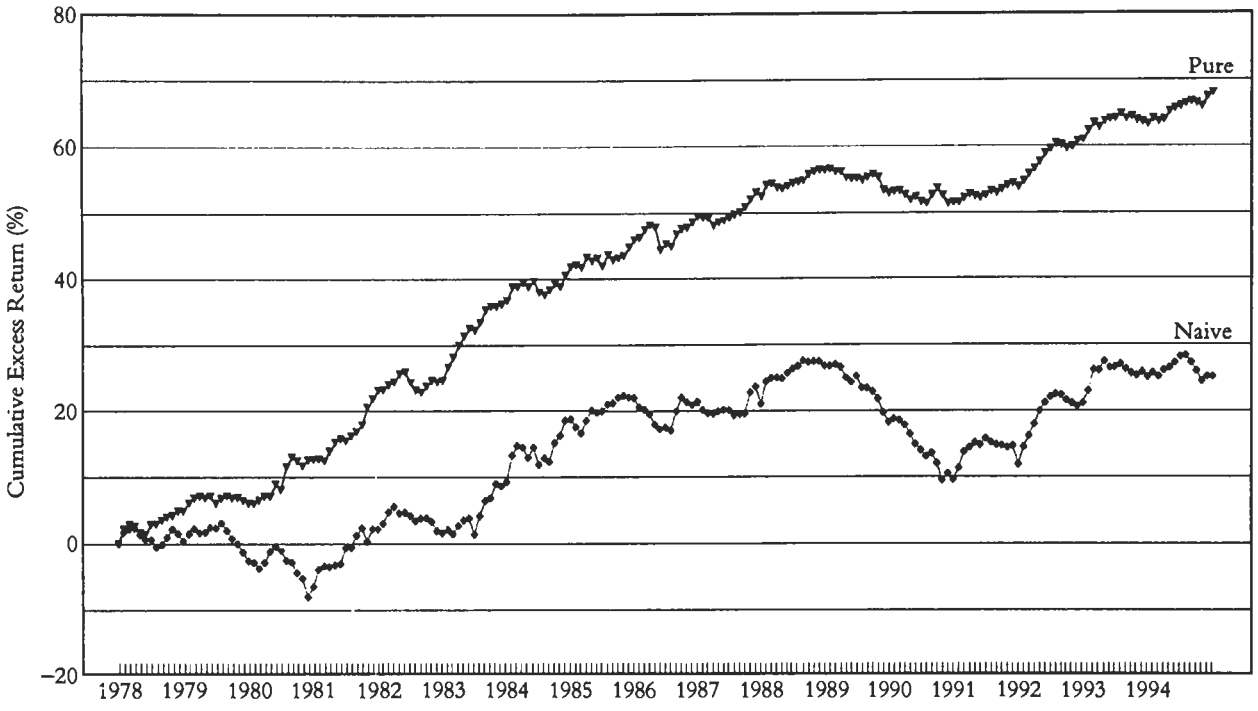
The value investor in search of a defensive posture in uncertain market environments should consider moving toward high yield: The regression coefficients for both naive and pure returns to high yield indicate significantly negative market sensitivities. Stocks with high yields may be expected to move in a direction opposite to that of the overall market.[4]

A comparison of Exhibits 3 and 5 highlights some examples of the investment opportunities that may be uncovered by using pure returns. In Exhibit 3, naive returns to small-cap and neglect are highly correlated; it would seem that investing in a small-cap portfolio over the sample period would have provided results similar to an investment in a portfolio whose stocks are chosen on the basis of analyst neglect.

Exhibit 5 reveals some major differences that lie beneath the surface of naive returns. Pure returns to small-cap have behaved differently from — in fact, largely opposite to — pure returns to neglect, especially since 1986. While by the end of the period an investment in the former would have earned about 35 percentage points in excess of the market return (before transaction costs), an equivalent investment in the latter would have lost about 5 percentage points relative to the market. A hypothetical portfolio designed to exploit pure returns to both attributes could have aimed for superior returns by selecting small-cap stocks with a higher-than-average analyst following (a negative exposure to analyst neglect).

Purified returns, because of their generally lower volatility, may also be more consistent, hence more predictable, than naive returns. Consider the naive returns to one value attribute — high book-to-price ratio. Most banks and electric utility companies have high B/Ps, so these industries constitute a significant portion of many value portfolios. The returns to such a portfolio will be buffeted by industry-related events such as oil embargoes, which may affect utilities although having no fundamental bearing on value stocks in general. Returns to a value portfolio based on naive high B/P will therefore be less predictable than those to a value portfolio based on a pure B/P measure that controls for spurious related variables such as industry concentration.

**EXHIBIT 8**
**RETURNS TO BOOK/PRICE 1978–1994**




This is evident from Exhibit 8, which plots pure and naive returns to high B/P over the 1978–1994 sample period. The return patterns are similar but not identical. Note in particular the divergence of returns over the twelve-month period beginning in March 1979. Naive B/P slid 6 percentage points, while pure B/P was flat. Not coincidentally, the crisis at the Three Mile Island nuclear plant occurred on March 28, 1979. Relative to the market, electric utilities plunged 24 percentage points over the next twelve months, dragging down returns to the naive B/P measure.

## HIGH-DEFINITION MANAGEMENT

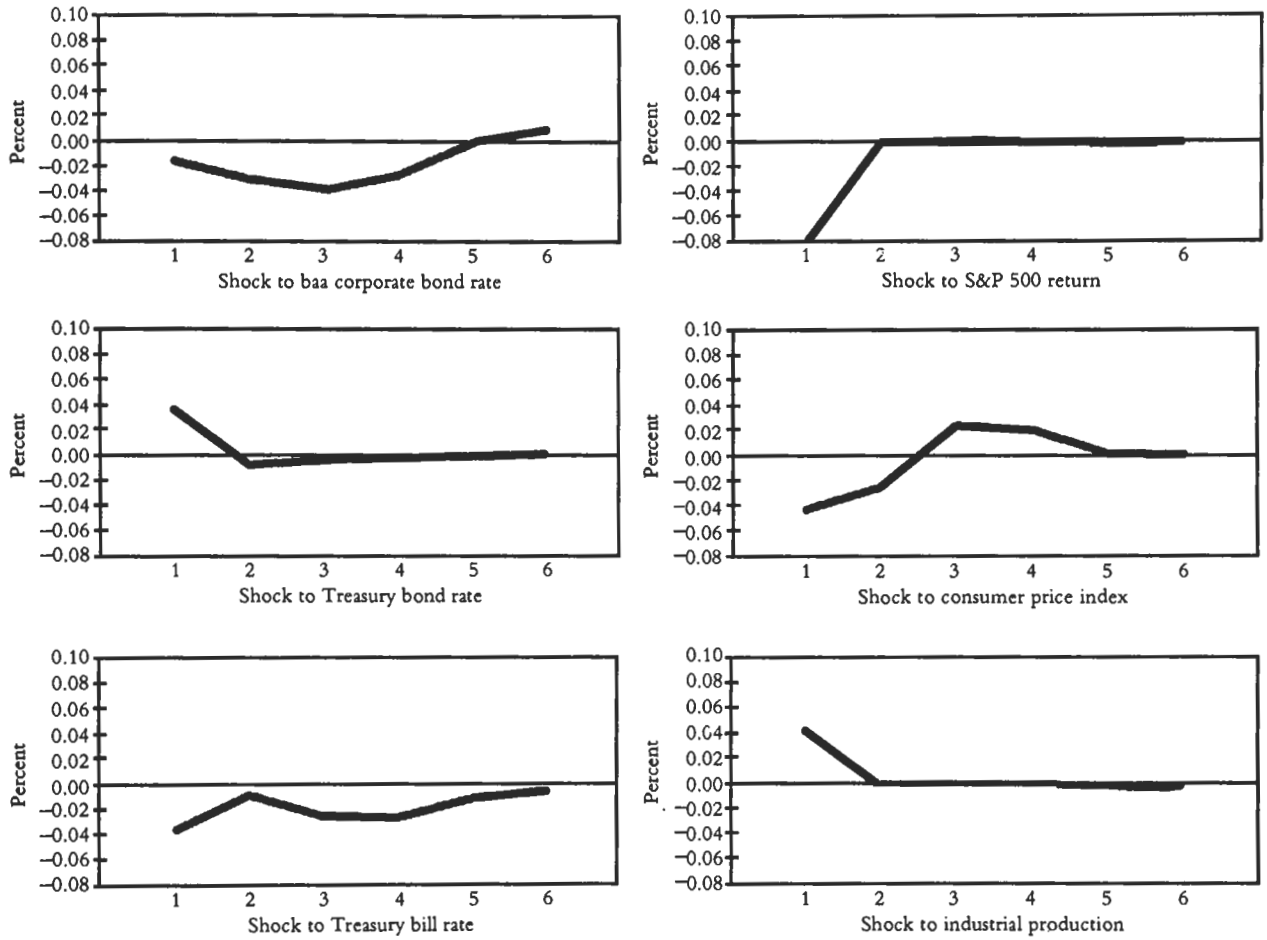
The behavior of the time series of pure attribute returns indicates that they are driven by a combination of economic fundamentals and the psychology of investors, the latter manifesting itself in such return anomalies as trend persistence and reversion to the mean (see Jacobs and Levy [1989a]). That is, economic fundamentals such as interest rates, industrial production, and inflation can explain much, but by no means all, of systematic return variation. Psychology, including investors' tendencies to overreact, their desire to seek safety in numbers, and their selective memories, also plays a role in security pricing. What's more, the effects of different variables, fundamental and otherwise, vary across stocks with different attributes.

Exhibit 9 illustrates, as an example, the estimated effects of changes in various macroeconomic variables on the pure returns to small size (market capitalization). Pure returns to small size may be expected to be negative in the first four months following an unexpected increase in the BAA corporate rate and positive in the first month following an unexpected increase in industrial production. These responses are consistent with the capital constraints on small firms and their relatively greater fragility (see Jacobs and Levy [1989b]).

Such insights into the behavior of security prices can be used to forecast returns to pure attributes. These forecasts can in turn be used to manage a style rotation strategy that seeks to capitalize on the variations in returns to different styles by rotating across stock attributes. Exhibit 10 "maps" the behavior of a portfolio based on such a strategy over the December 1984–December 1994 period.[5]

The style allocations in Exhibit 10 are derived from BARRA's style analysis system, which is based on original work by Sharpe [1988]. Style analysis typically regresses portfolio returns on returns to various style indexes, then allocates the portfolio's returns across styles according to the regression coefficients. A cross-section created by

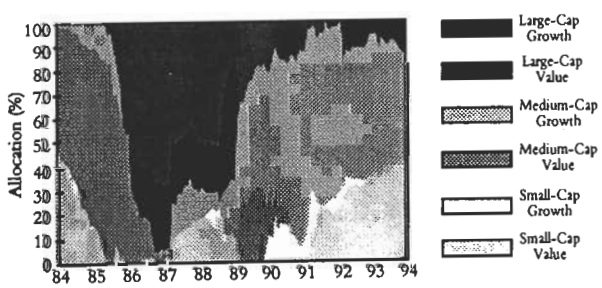
## EXHIBIT 9
### FORECAST MONTHLY RESPONSE OF SMALL SIZE TO MACROECONOMIC SHOCKS 1978–1994




drawing a line vertically through the chart represents the combination of style indexes that is best able to explain the portfolio's returns over the three years ending at that particular time.

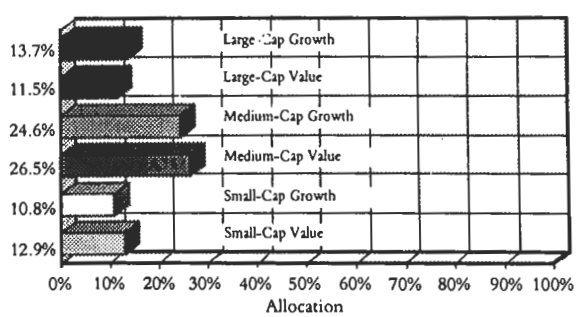
For the three years ending in February 1985, for example, the portfolio was pretty much divided between medium- and small-capitalization value stocks, with a very minor allocation to medium-cap growth

## EXHIBIT 10
### STRATEGY STYLE ALLOCATIONS FOR THREE-YEAR PERIODS ENDING DECEMBER 1984–DECEMBER 1994



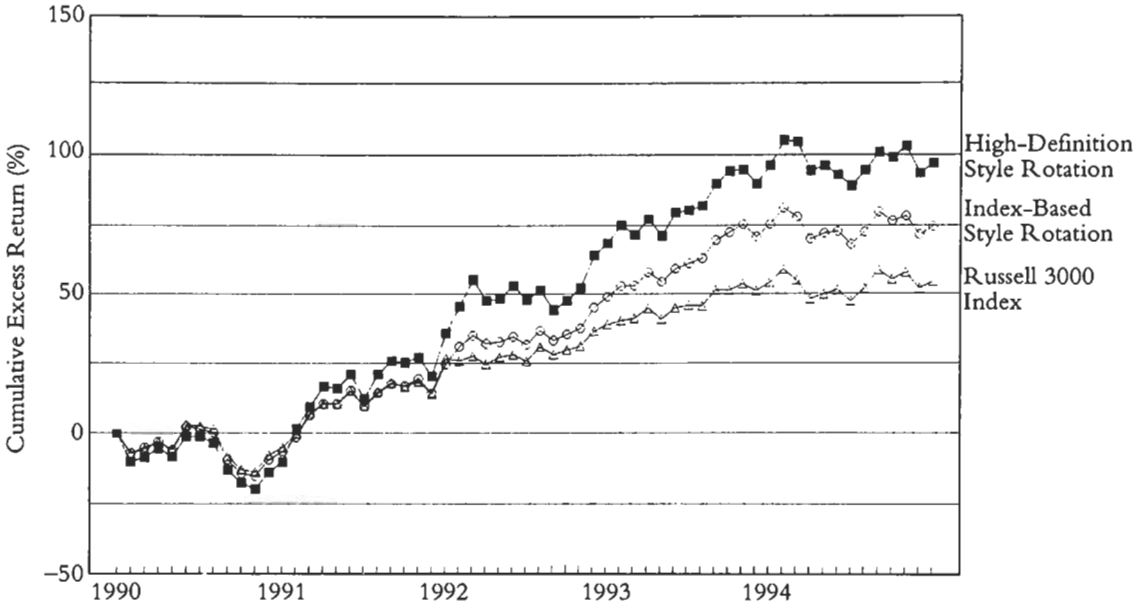

Data Source: BARRA.

## EXHIBIT 11
### STRATEGY'S AVERAGE STYLE ALLOCATIONS FOR 1982–1994 PERIOD




Data Source: BARRA.

## EXHIBIT 12
### CUMULATIVE RETURNS TO HIGH-DEFINITION STYLE ROTATION 1990–1994




stocks. By December 1987, however, it was predominantly invested in large-cap growth stocks (67%), with about a 28% allocation to large-cap value and a minor (less than 5%) allocation to medium-cap value. By the end of the period illustrated, the portfolio's allocation had changed to include a preponderance of medium-cap growth stocks (about 44%), with significant exposures to small-cap value (38%) and large-cap value (15%), and less than 4% in small-cap growth.

Exhibit 11 displays the style rotation strategy's average allocations over the 1982–1994 period. Note that the strategy, over the whole period, displays no bias toward either growth or value; the allocations to each style total approximately 50%. The strategy did, however, overweight small- and medium-capitalization companies; large-, medium-, and small-cap allocations were 25%, 51%, and 24%, respectively. These allocations reflect the view that, over time, small companies are less efficiently priced than larger, more widely researched firms.

## EXHIBIT 13
### STYLE ROTATION PERFORMANCE 1990–1994

| STRATEGY | ANNUAL RETURN (%) | ANNUAL STANDARD DEVIATION (%) | SHARPE RATIO |
|---|---|---|---|
| High-Definition Style Rotation | 14.56 | 16.68 | 0.58 |
| Index-Based Style Rotation | 11.78 | 12.82 | 0.54 |
| Russell 3000 Index | 9.11 | 12.62 | 0.33 |

## BENEFITS OF HIGH-DEFINITION STYLE

Exhibit 12 compares the actual performance of the style rotation portfolio with the performance of the market (as proxied by the Russell 3000) over the five-year period from January 1, 1990, through December 1994. Over this period, the strategy outperformed the market substantially.

Exhibit 12 also shows that the strategy outperformed a hypothetical index-based style rotation strategy. This hypothetical index-based portfolio provides a measure of the success of style rotation in general and of high-definition style rotation in particular. To construct this strategy, assets are allocated to Russell style indexes in accordance with the high-definition strategy's actual allocations at the beginning of each month.

Note that the *allocations* for this index-based style rotation strategy, being the same as the actual

strategy allocations, reflect the same insights into pure attribute returns and market behavior. The investments themselves, however, are cruder than the actual strategy's to the extent that style indexes do not make the same fine distinctions between stock attributes.

Exhibit 13 gives the annual returns, standard deviations, and Sharpe ratios for the two style rotation strategies and for the market.[6] The actual high-definition style rotation strategy outperformed the market by an annualized 5.45 percentage points (14.56% versus 9.11%). Its standard deviation of 16.68%, although substantially higher than that of the index-based style rotation strategy, or the market, was not so high as to outweigh the gains in return from exploiting the nuances of high-definition style. The Sharpe ratio of 0.58 compares favorably with the index-based strategy's 0.54 and the market's 0.33.

The high-definition strategy's 5.45 percentage point return in excess of the market can be broken down into two components. One component reflects success in rotating across broad styles of stock and can be proxied by the 2.67 percentage point excess return of the index-based style rotation strategy. But rotation across broad styles accounts for slightly less than half of the high-definition strategy's outperformance. The strategy adds another 2.78 percentage points on top of the index-based rotational strategy's return.

Some might attribute this last degree of outperformance to "stock selection," on the grounds that such return increments represent a manager's ability to select outperforming stocks within a particular style category. But the style rotation strategy makes no attempt at stock selection per se. What it does do (and over this period, at least, successfully) is to recognize the subtle distinctions of style that can add value. Exploiting the nuances within broad style definitions adds value relative to a strategy of rotating across traditional style indexes over time.

## ENDNOTES

The authors thank Judith Kimball for her editorial assistance.

[1]The large-cap growth stock index, the Russell 1000 Growth, and the large-cap value index, the Russell 1000 Value, roughly divide the market capitalization of the Russell 1000, the index representing the largest 1,000 stocks in the Russell universe of 3,000 stocks. The small-cap index consists of all stocks in the Russell 2000 — the 2,000 smallest stocks in the Russell 3000.

[2]Data prior to January 1987 are based on a universe of 1,500 securities. For a discussion of the methodology, see Jacobs and Levy [1988a].

[3]The reductions in standard deviation also suggest that the use of multivariate regression has not introduced serious multicollinearity problems (see Kmenta [1971, pp. 380-391]).

[4]For an interpretation of why some value measures are procyclical and others countercyclical, see Jacobs and Levy [1988b].

[5]Allocations are based on actual portfolio returns since January 1990 and on simulated returns prior to that date.

[6]The Sharpe ratio is defined as the portfolio's return less the risk-free return, divided by the portfolio's standard deviation.

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