Persuasive evidence of market inefficiency

A book/price strategy and a "specific-return-reversal" strategy, subject to careful tests, lead to the "inescapable conclusion" that prices on the NYSE are inefficient.

Barr Rosenberg, Kenneth Reid, and Ronald Lanstein

This article reports the statistically significant abnormal performance of two strategies. One strategy is a "book/price" strategy. The strategy buys stocks with a high ratio of book value of common equity per share to market price per share and sells stocks with a low book/price ratio, where "book value" is common equity per share, including intangibles. The second strategy is a "specific-return-reversal" strategy. This strategy calculates the difference between the investment return for the previous month on the stock and a fitted value for that return based upon common factors in the stock market in the previous month. This differential return is the "specific return" that is unique to the stock. This strategy expects the specific return to reverse in the subsequent month. It therefore buys stocks having negative specific returns in the prior month.

We selected both strategies as interesting candidates for tests of market inefficiency based on data through 1980. We evaluated the prior performance of the strategies in 1980 and described them in speeches and articles in 1982 [6, 7, 10, 11]. Based on monthly returns since the completion of the prior study, both strategies have shown persuasive evidence of market inefficiency.

Despite the relatively short time span, the strategies have separately achieved t-statistics of 3.7 and 11.54, respectively, each implying that the null hypothesis of market efficiency can be rejected at a very high level of confidence. Further, both strategies produced performance in this evaluation period that was closely consistent with their prior performance. We obtained still higher t-statistics when the prior data and the evaluation-period data were combined.

The two strategies are also expected to be statistically independent a priori, because the results have shown a negative and statistically insignificant correlation during the evaluation period. Thus, each study is an independent test of market inefficiency, which means that the confluence of the two results suggests still stronger evidence for market inefficiency.

We defined the strategies and singled them out for prospective study because we felt that they arose naturally as straightforward tests of market efficiency. Each strategy can be viewed as the result of using an "instrumental variable" for pricing error. To the extent that pricing errors, for whatever cause, are present in the U.S. stock market, we anticipated that these tests might show up that inefficiency by means of the instrumental variables (the book/price ratio and the prior month's specific return, respectively) that are used. We believe that this study leads to the inescapable conclusion that prices on the New York Stock Exchange are inefficient.

PROPERTIES OF THE STRATEGIES

We define each strategy by a set of weights, \( w_{ij} \), for each of the approximately 1400 stocks in a prospectively defined universe of large companies, called the HICAP universe. The set of weights is calculated as of the end of the previous month, based upon data available on or before that date. The outcome of the strategy, called the "return to the strategy" and denoted by "\( R \)" is the weighted average of the monthly returns for the stocks:
where $r_n$ is the rate of return on stock $n$.

The set of weights for each strategy has the following characteristics:

1. The weights are both positive and negative, and the sum of the weights is zero. Consequently, the return to the strategy can be viewed as the return on a "pure hedge portfolio" with a zero investment value.

2. The weights are constructed so that the sum of the weights is zero within each of 55 industry groups. Each strategy therefore takes both long and short positions in each industry, which average out to zero, and so is immunized against industry factors of return.

3. The strategy is also constructed to be orthogonal to a set of "risk indexes," with which common factors of return are also associated. The weighted sum of each of the following risk indexes, weighted by the strategy weights, is zero:

   1. Variability in Markets. Beta prediction based upon stock price behavior, option price, etc.
   2. Success. Past success of the company, as measured by stock's performance and earnings growth.
   4. Trading Activity. Indicators of share turnover.
   5. Growth. A predictive index for subsequent earnings per share growth.
   6. Earnings/Price. Ratio of estimated current normal earnings per share to stock price.
   9. Foreign Income. Proportion of income identified as foreign.
   10. Labor Intensity. Ratio of labor cost to capital cost.

Consequently, the return to the strategy is immunized against any common factor returns associated with these stock characteristics.

4. The book/price and specific-return-reversal strategies are orthogonal to one another. The two sets of weights have zero cross-product. Consequently, the return on each strategy is expected to be independent of the other one.

5. Each strategy is standardized, so as to imply an exposure to the variable that is constant over time. For the book/price strategy, the weighted sum of book/price ratios differs from the market average by one cross-sectional standard deviation of that ratio. In other words, the strategy is persistently located one standard deviation away from the capitalization-weighted mean value for all stocks. For the specific-return-reversal strategy, the sum of the positive weights is 1.0, and the sum of the negative weights is -1.0, so the return on the strategy corresponds to the difference between returns on a "buy portfolio" of stocks with negative prior specific returns and a "sell portfolio" of stocks with positive prior specific returns. (With respect to an "indicator variable" for the sign of the previous month's specific return, this strategy is positioned at two cross-sectional standard deviations away from the mean, so that it is, in a precise sense, twice as aggressive with respect to its instrumental variable as the book/price ratio strategy is with respect to its instrumental variable.)

6. The set of weights for each strategy is calculated so as to minimize the variance of the strategy's return arising from the specific returns of the individual companies, subject to meeting the above five restrictions. In other words, the noise resulting from the random specific returns of the individual stocks is made as small as possible.

Because each strategy is a "pure hedge portfolio," we can view the return to the strategy as a potential incremental return that an investor can earn by adjusting an existing portfolio in the direction of the strategy.

Let $h_n$ denote the investment proportions in an ordinary portfolio of common stocks. Let $r_n$ denote the investment rate of return on that portfolio. Then if the initial portfolio is adjusted in the direction of the hedged portfolio, so that the resulting investment weights are each $(h_n + w_n)$, then the rate of return on the adjusted portfolio will be $r_n + f$. For this reason, statistically significant performance of the strategy — to the extent that that performance is uncorrelated with the return on the initial portfolio — implies that it is necessarily possible to improve the mean/variance characteristics of the initial portfolio by making the adjustment, and so suggests that the investor holding portfolio weights $h_n$ would prefer to hold portfolio weights $h_n + w_n$; thus, good performance suggests an inefficiency in the marketplace.

THE TWO STRATEGIES AS INSTRUMENTS FOR MARKET INEFFICIENCY

Suppose that the market is in fact inefficient, in the sense that if $v_n$ is the "fair value" of stock $n,
then the stock price $p_n$ differs from the fair value by a pricing error $e_n$, i.e., $p_n = v_n + e_n$. The usual presumption is that the market price is unfair in the sense that the pricing error $e$ will be reversed in the future. Consequently, the rate of return in the subsequent month, $r_n$, is negatively correlated with $e_n$. A variable, $x_n$, will serve as an "instrumental variable" for subsequent performance, $r_n$, if it is correlated with the initial pricing error, $e_n$. Therefore, to search for market inefficiency, we should search for a variable, $x$, which we expect to be negatively correlated with $e$, and therefore positively correlated with subsequent return, $r$. This variable will define the strategy that tests for the existence of the pricing error, by means of the test of subsequent returns.

One way to obtain an instrument for $e$ is to find a variable that is correlated with the difference $v - p$, since $-e = v - p$. For a variable $x$ to be positively correlated with $v - p$, $x$ must increase when the value of the firm increases relative to the price of the firm.

Traditionally, ratios of the firm’s activity to the stock price have been used for this purpose. In principle, any ratio, such as book/price, earnings/price, or dividend/price = yield, can be used. Nevertheless, the value of these financial ratios as instruments may be destroyed if they are used in the process of security analysis or as a quantitative screen by investors using quantitative techniques.

If an investor uses the variable $x$ as an indication of the desirable stock quality, so that stock price is bid up in proportion to $x$, then $x$ may acquire a positive correlation with $p$, over and above the indirect relationship with $p$, which $x$ obtains through its link to underlying value, $v$. As the correlation with $p$ increases (as the stocks with high $x$ values are bid up in price and stocks with low $x$ values are bid down in price), the result is to reduce the correlation of $x$ with $v - p$ and eventually to destroy its usefulness entirely. Since substantial work had previously been done with yield as a criterion for investment, and since the earnings/price ratio was much emphasized in security analysis and had previously been studied in the finance literature by S. Basu, we felt that the book/price ratio was an intriguing candidate for study. Since it had not been heavily described in the quantitative literature, it might possibly serve as an as-yet unspoiled instrument.

Another approach to obtaining an instrumental variable is to attempt to find a variable $x$ that is directly correlated with the pricing error $e$. The previous month’s specific return, $u_{n-1}$, is a natural instrument for this purpose.

The explanation of this relationship is straightforward. Suppose that a common-factor model is used to fit the most probable return for this stock in the previous month, by analogy with the returns with similar stocks. In other words, the common-factor model explains the returns on all stocks as a result of their characteristics, and so estimates factors of return associated with industry groups and with risk indexes. Then, to the extent that the stock’s previous month’s return differed from this fitted return, the difference was unique to that stock. If there is a pricing error for the stock, that error would probably show up as a component of this unique return.

In fact, we can consider the difference between the pricing error for the stock at the end of the prior month and the pricing error at the inception of that month as one of the components of the previous month’s specific return. Therefore, in the absence of some adjustment to remove this relationship, we would expect that the previous month’s specific return would be positively correlated with every one of its components and, particularly, with the component that was the change in the pricing error.

The final step in the argument is to notice that the pricing error at the end of the previous month is the starting point for the current month’s return: A larger change in pricing error over the previous month implies, ceteris paribus, a likelihood of a larger pricing error at the end of the previous month.

The complete linkage is as follows: The previous month’s specific return is positively correlated with its component, which is the change in the pricing error over the previous month, which is positively correlated with the magnitude of the pricing error at the end of the previous month. Therefore, the previous month’s specific return is intrinsically positively correlated with the pricing error at the end of the previous month. Consequently, we can expect the negative of the specific return to be positively correlated with this month’s investment return.

As in the case of the book/price variable, we must ask whether this correlation would be vitiated by use of the previous month’s specific return by technicians as a transaction strategy. In other words, if market participants were actively seeking to profit from anticipated specific return reversals, the results would be to reduce, and even eliminate, the use of the instrumental variable.

There are two reasons, however, to think that the instrument might remain valid. First of all, because the strategy requires a high rate of turnover, the inhibition provided by transaction costs could leave a significant correlation even if the investment value of the strategy had been fully removed. Second, because of the strong bias toward market efficiency
that has been present in academic circles, there might be skepticism about the use of such a simple, technical, quantitative rule for trading strategies.

For these reasons, we felt that the book/price (B/P) strategy and the specific-return-reversal (SRR) strategy were natural instruments to use in the search for market inefficiencies.

IMPLEMENTATION OF THE STRATEGIES AND CALCULATION OF THE RESULTS

We based the initial retrospective test of these strategies on a data base of monthly stock data from January 1973 through March 1980 for the B/P strategy, and on through December 1980 for the SRR strategy. For the retrospective study, we strove to assure that all data used in calculation of the weights in the strategies would have been available prior to the month for which the return was calculated. We also carefully screened the data base to remove as many errors as possible, so that the investment returns would be valid.

We based this analysis primarily upon the Standard & Poor’s Compustat data base and the IBES Analytics data base. There was no retrospective bias in the latter, and retrospective bias in the former could be avoided by use of the Compustat Research Tape. As a result, we were able to avoid survivorship bias and retrospective inclusion bias.

For present purposes, the key concern is with the prospective tests, beginning with the endpoints of the retrospective studies. Strategy weights for every month were calculated, based upon data through to the prior month’s close, and calculation of the strategy weights was usually completed by the second or third business day of the month. The sample was defined prospectively as the HICAP universe. The strategic returns calculated here are therefore a true test of the outcome of a predefined investment strategy.

PERFORMANCE OF THE BOOK/PRICE STRATEGY

The monthly strategy returns $f_t$ can be analyzed for their relationships with the market returns by means of the time-series regression:

$$f_t = \alpha + \beta_{SM} r_{SM} + \epsilon_t \quad t = 1, \ldots, T \quad (1)$$

where $r_{SM}$ is the excess return on the market (the monthly S&P 500 return minus the monthly 30-day Treasury Bill return), and $\epsilon_t$ is the unexplained return. The coefficient $\beta$ gives the responsiveness of the strategy return to the market portfolio, and $\alpha$ is the average residual factor return. Let $\omega$ denote the standard deviation of the residual return, $\omega = \text{std. dev.} (\epsilon_t)$.

Table 1 summarizes the results of this regression for the 87 months of the retrospective study, for the 54 months of the prospective study, and for the total sample of 141 months. Each panel provides the average residual return ($\alpha$) for this strategy and the standard deviation of the residual return ($\omega$), in basis points per month. For example, the average residual return for the entire period was $\alpha = 36$ basis points, or 0.36 percent per month, and the standard deviation of the monthly residual return was 76 basis points.

The systematic risk coefficient, $\beta$, was indistinguishable from zero, so it is not reported in the table. The foot of Table 1 shows the number of monthly returns that were positive, negative, and the total for each subperiod and for the entire history.

The return to the B/P strategy was positive in 38 of the 54 months of the prospective evaluation. The mean residual return was 32 basis points and the standard deviation of monthly residual return was 62 basis points. This led to a t-statistic of 3.7, which permits us to reject the hypothesis that the mean residual return is zero at the 99.95% level of confidence. The performance of the B/P strategy in the evaluation period was consistent with the prior experience. Therefore, we are justified in combining the entire sample history into a single test of market efficiency.

Table 2 shows an intriguing aspect of the B/P strategy. Monthly Performance of the Book/Price Strategy

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Monthly Performance of the Book/Price Strategy</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\alpha$ (basis points)</td>
<td>41</td>
</tr>
<tr>
<td>$t$-statistic</td>
<td>4.5</td>
</tr>
<tr>
<td>$\omega$ (basis points)</td>
<td>83</td>
</tr>
<tr>
<td>Number of months positive</td>
<td>64</td>
</tr>
<tr>
<td>Number of months negative</td>
<td>23</td>
</tr>
<tr>
<td>Number of months total</td>
<td>87</td>
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</tbody>
</table>

Table 2 shows an intriguing aspect of the B/P strategy for the 12 calendar months. The left-hand
panel shows the mean and standard deviation of the returns over the historical sample. Both the mean (μ) and the standard deviation (σ) of the book/price return were much higher in January than in any other month. There appears to be a downward trend in μ over the course of the year. As the monthly t-statistics in the left-hand panel show, the mean return was highly significant in January (t-statistic = 4.39), and the t-statistic exceeded 2 in February, June, July, and September. We emphasized this seasonal pattern in our discussions of the strategy in 1982 [11].

The central panel of Table 2 displays the monthly means and standard deviations during the prospective evaluations. Again, the January mean stands out sharply and, again, there is an appearance of a downtrend in the mean values from January through December. Despite the brevity of the sample, the January and February means achieve high statistical significance, and the April and July means have t-statistics greater than 2.0.

The right-hand panel shows the seasonality for the entire eleven- and-three-quarter year sample. Here the downtrend from January through to the end of the year is pronounced, and the t-statistics for January, February, March, April, May, and July are each separately greater than 2.0.

PERFORMANCE OF THE SPECIFIC-RETURN-REVERSAL STRATEGY

The SRR strategy defined in the earlier paper [10] (Rosenberg and Rudd (1982)) used the negative of the previous month’s specific return as the instrumental variable. Table 3 reports the strategy reported in the earlier paper, together with the subsequent performance of the strategy.

| TABLE 3 |
| Monthly Performance of Specific-Return-Reversal Strategy |
|-----------|----------------|----------------|
| μ (basis points) | 112             | 104             | 109             |
| t-statistic     | 10.4            | 10.34           | 13.83           |
| σ (basis points) | 103             | 68              | 93              |
| Number of months positive | 83              | 43              | 126             |
| Number of months negative | 9               | 3               | 12              |
| Number of months total | 92              | 46              | 138             |

The performance in the prospective evaluation is similar to the historical study. The mean monthly return is smaller, but the time-series variability of the return is reduced even more, so that the strategy achieves even higher significance per unit time after the prospective evaluation. In fact, the results are positive 43 months out of 46. The result is a t-statistic of 10.3, which permits an essentially conclusive rejection of the null hypothesis that the actual mean return of the strategy is 0.0.

To provide a still clearer strategy, and to insulate the results from the effects of misrecorded prices, we considered an alternative strategy in which the instrumental variable is the sign of the previous month’s specific return. In other words, the strategy is simplified to purchasing an equal-weighted “buy portfolio” of stocks whose previous month’s specific returns were negative and selling short an equal-weighted portfolio whose previous month’s specific returns were positive. The monthly return on that strategy is simply the difference between the monthly returns for the buy and sell portfolios, which coincides with the difference between the average return for the month on the stocks whose previous month’s specific returns were negative and the average return in the month for the stocks whose previous month’s specific returns were positive. The results of that strategy appear in Table 4. As the beta was significantly different from zero, we carried out the time-series regression on the market return (Equation 1) and report the alpha, beta, and residual standard deviation, omega, in the table. This strategy achieves an even higher level of statistical significance, with a t-statistic of 11.5 for the 46-month sample. The results are positive 45 months out of 46. Average January abnormal profits were 202 basis points, versus 129 basis points on average for the other eleven months of the year. This difference is intriguing, but it was not statistically significant.

| TABLE 4 |
| SRR Monthly Return (Basis Points) |
| α | β | ω |
| 136 | 0.10 | 80 |
| (11.54) | (3.65) | |

TRADING THE STRATEGIES

Trading costs are an important aspect to be considered in applying these strategies. Trading costs include the direct expenses of commissions and taxes, plus the price effect of trading. Trading costs for an institutional investor utilizing the B/P strategy would almost certainly have had a negligible effect upon performance. Urgent trading of the B/P strategy is not necessary, because the B/P criterion variable is not timely; a round-trip trading cost of 100 basis points is probably an ample allowance. Portfolio turnover is
The performance of the SRR strategy, on the other hand, would be greatly reduced for an investor experiencing trading costs. The strategy relies on timely data, so that urgent trading is important. Since the SRR strategy reported in Table 4 involves holding one portfolio long and another portfolio short, and since approximately 50% of the stocks in each portfolio are switched each month, there is a trading cost of 100% of the round-trip trading cost each month. Therefore, a drain of 100 basis points or more against a monthly performance of 136 basis points is not unlikely.

Some investors would not be faced with these trading costs. Brokers and dealers, for example, might face trading costs that were a fraction of this. Also, the investor who had determined to trade for other reasons, and who was using the SRR strategy as a timing device, would face no incremental trading costs from exploiting it.

The abnormal return of 136 basis points per month reported in Table 4 for the SSR strategy may be unobtainable if an investor is unable to sell short the "sell portfolio" at the month-end closing prices. We evaluated an alternate strategy where the investor takes a long position in the "buy portfolio" and sells short the S&P500 index. The average residual return declines from 136 to 96 basis points per month. The long side of the SRR strategy, taken alone, provides most of the abnormal return.

MULTICOLLINEARITY OF MULTIPLE STRATEGIES

Multicollinearity of the strategy variables is another potential problem in studies of factors in market returns. When a variable is used in raw form to construct a strategy, without any attempt to immunize the strategy against other factors, the strategy weights are directly related to that variable. The mode of analysis corresponds to a simple regression on that variable, and we can define the results as a "simple factor" of return. When that approach is taken, the major potential criticism of our study is that that variable may have served as a surrogate for other variables more closely related to the subsequent abnormal returns.

In the present case, we have made each strategy orthogonal to the other strategy, to 55 industry groupings, and to 11 other "risk indexes," which are continuous variables characterizing the stocks. This approach is subject to the criticism that this orthogonalization of the strategy weights may create wildly variable weightings because of multicollinearity of these strategy variables with the other dimensions.

Fortunately, this is not a problem. We deliberately constructed the risk indexes so that multicollinearity would not be severe. As a matter of fact, the time-series standard deviation of the B/P strategy return discussed here is only 76 basis points, whereas the time-series variation of the simple B/P strategy return is 139 basis points. Both strategies have the same standardized exposure to the B/P ratio, so a reduction in the time-series variability can occur only if the risk reduction from immunizing the effects of other common factors has exceeded the risk increase due to higher specific variance from the wider variable weightings. In other words, the multiple-factor strategy has substantially lower time-series risk, which confirms the benefits from orthogonalizing the weights.

Another important question related to the two tests is the extent to which they are independent of each other. Since the weightings are orthogonal a priori, we should expect the strategies to show independent returns. The realized outcome was consistent with this: The correlation between the monthly residual returns on the B/P and SRR strategies was -.19 for the 45 overlapping months, which was insignificantly different from zero. A "super strategy" that exploited a portfolio of the two strategies would therefore have achieved an even higher t-statistic than either strategy separately.

The B/P and SRR strategies are independent in another important sense. The B/P strategy corresponds to a "slow idea," and the SRR strategy to a "fast idea." Specifically, the B/P strategy exploits a decision criterion having data that are one to four months out of date (depending upon the month in the calendar quarter), and stocks purchased based on that criterion tend to be held for more than a year, on average. The SRR strategy exploits timely data, with 50% of the stocks in the portfolio traded at the end of the month. The success of two such diverse strategies tends to confirm, in our minds, the existence of underlying pricing errors in the market, which can be imperfectly detected by either alternative instrument.

POSSIBLE BIAS

One potential problem in the study is a positive bias in the results due to errors in the recorded prices. The B/P and SRR strategies use instrumental variables for pricing error, and these will single out undervalued securities, whether the low price is a true market
price or a problem in recording the price itself. There is a real potential that a pricing error will cause the stock to appear desirable by B/P or SRR criteria and that the correction of the pricing problem in a subsequent month will induce a spurious, favorable return. We have taken much care to eliminate this source of bias.

First, we screened the data base for errors in prices and adjustment factors. Second, we calculated the B/P variable only once at the inception of each quarter, and the market price used as the denominator is lagged one month prior to the beginning of the quarter. For example, the B/P strategy for the months of January, February, and March is based upon a value of B obtained from the Compustat tapes in mid-December and upon the closing market price P at the end of November. Since the vast majority of pricing errors in the U.S. common stock data bases are reversed within the following month, the one-month lag almost assures that there will be no spurious upward bias in returns due to errors in the denominator of the B/P ratio.

For the SRR strategy, timing is of the essence: It is detrimental to lag the month in which the specific return is calculated. Accordingly, we cannot use lagging to eliminate the potential upward bias from the reversal of the prior month's error during the current month.

We applied two modifications to the original strategy to minimize this bias, relying on the tendency of pricing errors in these data bases to be rare but large. Usual errors arise from mistyping or reversing the digits of the price or from mistiming a stock adjustment; in either instance, the error is likely to be more than 10%. Further, it is the large errors whose reversals have the potential to significantly bias the results in an upward direction. The SRR strategy reported in the previous paper [10] used the prior month’s specific return itself as the instrument, and so undertook positions in stocks that were proportional to the prior month's specific return. This resulted in large weights on the few stocks with large errors, and so in substantial potential profit.

The SRR strategy reported here, in which the weight on the stock depends only on the sign of the prior month’s specific return and not on the magnitude, is a natural adjustment to minimize the impact. Even if there is a 50% downward pricing error in the previous month, the weight on the stock in this month’s buy portfolio will be only 1/700, so that the spurious positive return when the stock returns to the correct price in the current month will be only 1/700 of 100%, or 14 basis points. The results in Table 4 reflect this SRR strategy.

As a second check, we applied the SRR strategy only to those stocks with specific returns between −10% and +10% in the prior month. We deleted all stocks with specific returns beyond these boundaries. This caused more than 15% of the stocks to be ignored, and these were the stocks that would be most desirable according to the logic of the SRR instrument.

Evidently, this strategy is expected to perform less well than the strategy based on all stocks, but the key question is the extent of sacrificed return. If the original return were somehow due to undetected data errors, then we could expect that discarding the stocks with extreme prior specific returns to wipe out the effect. As Table 5 shows, exclusion of the prior returns does reduce the monthly productivity of this strategy from 136 basis points to 105 basis points, which is probably no more than would be expected in the absence of data error. The results for the truncated sample remain excellent, with a time-series t-statistic of 10.94 for the abnormal return.

| SRR Return Excluding Outlying Prior Returns (Basis Points) |
|---|---|---|
| a | b | n |
| 105 | 0.08 | 66 |
| (10.94) | (3.43) |

Table 5: t-statistics in parentheses.

In short, we have been able to satisfy ourselves that the results reported here are not due to pricing error. Rather they reflect opportunities available when trading at the month-end market prices of U.S. common stocks.

Sample bias in favor of survivors is another potential problem in this sort of study. Both strategies single out stocks that have done poorly in the marketplace lately; they may not be as likely to survive as other companies. Any retrospective bias toward survivors would tend to reduce the losses of the strategies and so bias their performance upward. For the study through 1980, we took care to avoid retrospective sample biases, but it is possible that some crept in. For the evaluation since 1980, on the other hand, the sample was routinely defined in advance, and so no retrospective bias was possible.

CONCLUSION

This study has evaluated two prospectively defined strategies for obtaining abnormal performance. Both strategies independently achieved highly significant results, which were consistent with their prior performance in the retrospective study. There-
fore, we conclude that — for this universe of stocks during this time period — the actual market prices were inefficient. The universe of stocks consists of 1400 of the largest companies in the Computstat data base. The time period is from 1980 to 1984. The stocks are priced largely on the NYSE, and a few are priced on the ASE, other regional exchanges, or NASDAQ.

The success of two such diverse instrumental variables in detecting market inefficiency suggests that there are still larger potential profits to be made, provided that the security analyst can identify the valuation errors that correlate with these instruments.

1 Investors can sell short only on up-ticks. It follows that in a declining market, the sell side of the SRR strategy would be difficult to implement in a timely fashion.

2 This strategy could be implemented by selling S&P500 futures contracts.

In an earlier version of the paper presented at the American Finance Association meeting (December 1984), we included only those stocks with a valid price within the last week of the month. We have since verified that the results also apply when all stocks which trade at any time within the month are included, with investment return calculated through to the last price.

REFERENCES


