Ben Graham's Net Current Asset Value Rule Revisited: The Size-Adjusted Returns

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Abstract

The study demonstrates how size controls can alter the outlook of an investment strategy. The Ben Graham net current asset value rule provides excellent excess returns according to traditional performance measures. Size-adjustment procedures, however, reveal that its size-adjusted excess return is approximately zero.

Introduction

Ben Graham has received much attention in recent academic research. Arbel, Carvell, and Postnieks (1988) show how Graham's fundamental valuation model could predict the October 1987 drop in stock prices accurately. Vu (1988) presents evidence that the net current asset value rule developed by Ben Graham in the 1930s is still profitable in the 1970s and early 1980s.

The study focuses on Ben Graham's net current asset value asset rule (NCAV hereafter). The NCAV rule recommends buying all stocks that sell for less than their net current asset value per share. (Net current asset value is defined as current assets minus all liabilities including long-term debt and preferred stock.) By buying stocks below NCAV, the investor seems to buy a bargain because apparently he or she pays nothing at all for the fixed assets of the firm.

Vu (1988) recently examined the NCAV rule. Using standard event study methodology, he finds that buying stocks immediately after they fall below NCAV per share and selling two years afterward provides an excess return of over 24 percent. This result is not due to future mergers of NCAV firms. NCAV stocks that did not merge earned an excess return of approximately 20 percent.

The problem with Vu's (1988) impressive results is methodological. NCAV stocks have declined in relative size while dropping below net current asset value per share. Dimson and Marsh (1986) demonstrate that in such cases (cases of

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systematic relative size changes), the standard event study methodology (used in Vu, 1988) fails. Other studies such as Zarowin (1990) and Lauterbach and Vu (1992) also indicate that anomalies of the type of the NCAV rule, i.e., anomalies that belong to the losers-will-be-winners class, are susceptible to size biases. Hence, it seems appropriate to reexamine Ben Graham's NCAV rule performance using a size-adjusted methodology.

The intuition behind the suspicion surrounding the previous results is simple. The evidence documented in Vu (1988) is that the return of stocks that fell below net current asset value per share increased significantly after the drop below NCAV. Given the facts that these firms have become relatively smaller and that smaller firms tend to earn higher average returns, the observed increase in average return may not be that anomalous.

The results of this study show that investing in Ben Graham's NCAV stock yields a two year excess return of 25 percent according to the standard market model-based methodology and a two year excess return of -15 percent according to Dimson and Marsh's (1986) size-control technique.

Size-Related Biases—When and Why?

It is well known that individual stock returns are correlated not only with general stock market movements, but also with firm size. (See Banz, 1981; Reinganum, 1981; and others.) Accordingly, throughout this paper, the return of the stock is assumed to be specified by:

$$(1)\ R_{i,t} = \alpha_i + \beta_i R_{m,t} + \Pi_t^{si} + \varepsilon_{i,t}.$$

where:

- $R_{i,t}$ = Return of stock i in period t;
- $R_{m,t}$ = Return of the stock market in period t;
- Π_t^{si} = Size premium, i.e., a return premium (in period t) for firms of size si;
- $\varepsilon_{i,t}$. = Idiosyncratic return of stock i in period t (a mean zero, random disturbance term that is orthogonal to both the return on the market and the size premium); and
- α_i, β_i = Constant parameters.

The standard event study method is not based on equation (1). Rather, it relies on the market model:

(2) $R_{i,t} = a_i + b_i R_{m,t} + e_{i,t}$,

where:

$R_{i,t}$ = Return of stock i in period t;
$R_{m,t}$ = Return of the stock market in period t;
$e_{i,t}$ = Idiosyncratic return of stock i in period t (a mean zero, random disturbance term that is orthogonal to $R_{m,t}$);
a_i, b_i = Constant parameters.

The effect of misspecification of the market model is to make the intercept of the market model dependent on the size premium. If the size premium is uncorrelated with the return on the market, then:

$$(3)\ b_i = \frac{COV(R_{i,t}, R_{m,t})}{VAR(R_{m,t})} = \beta_i + \frac{COV(\Pi_t^{si}, R_{m,t})}{VAR(R_{m,t})} = \beta_i + 0 = \beta_i, \text{ and}$$

$$(4)\ a_i = \overline{R}_i - b_i \overline{R}_m = \alpha_i + \beta_i \overline{R}_m + \overline{\Pi}^{si} - \beta_i \overline{R}_m = \alpha_i + \overline{\Pi}^{si},$$

where:

$\overline{R}_i$ = Mean return on the stock;
$\overline{R}_m$ = Mean return on the market; and
$\overline{\Pi}^{si}$ = Mean size premium on the stock.

This seemingly minor effect is the source of the size-related bias.

Consider, for example, the case where the event has no effect on stock returns; that is, the mean $\varepsilon_{i,t}$ of equation (1) equals zero throughout the event period. In this benchmark case of no excess returns:

$$(5)\ \overline{R}_{i,t} = \alpha_i + \beta_i \overline{R}_{m,t} + \overline{\Pi}_t^{si}.$$

The standard event study method measures abnormal returns relative to the market model, i.e.,

$$(6)\ AR_{i,T} = R_{i,T} - \hat{a}_i - \hat{b}_i R_{m,T},$$

where:

$AR_{i,T}$ = The estimated abnormal (or excess) return of stock i in month T of the event period; and

$\hat{a}_i, \hat{b}_i$ = Estimates of the parameters of the market model of stock i.

Thus, in the benchmark case of no excess returns (equation (5)), the standard event study methodology would estimate $\overline{AR}_{i,EV}$, the average excess return of stock i over all month of an event window, EV, as:

$$(7)\ \overline{AR}_{i,EV} = \overline{R}_{i,EV} - \hat{a}_i - \hat{b}_i R_{m,EV},$$

$$= (\alpha_i + \beta_i \overline{R}_{m,EV} + \overline{\Pi}^{si}_{EV}) - (\alpha_i + \overline{\Pi}^{si}_{EST} + \varepsilon_{ai}) - (\beta_i + \varepsilon_{bi}) \overline{R}_{m,EV}$$

$$= \overline{\Pi}^{si}_{EV} - \overline{\Pi}^{si}_{EST} + \eta_i,$$

where the first row is obtained by averaging equation (6) over the event window, the second row is obtained by substitution of equations (5), (4), and (3) (in that order) into the appropriate terms of the first row, and

$\overline{R}_{i,EV}$ = The average monthly return on stock i during the event window period EV;

$\overline{R}_{m,EV}$ = The average monthly return on the market during the event window period EV;

$\overline{\Pi}^{si}_{EV}$ = The average monthly size premium on stock i during the event window period EV;

$\overline{\Pi}^{si}_{EST}$ = The average monthly size premium on stock i during the period in which a_i and b_i are estimated;

α_i, β_i = Parameters of equation (1);

ε_{ai} = Estimation error embedded in $\hat{a}_i$, i.e., $\varepsilon_{ai} \equiv \hat{a}_i, - \alpha_i$;

ε_{bi} = Estimation error embedded in $\hat{b}_i$, i.e., $\varepsilon_{bi} \equiv \hat{b}_i, - b_i$; and

η_i = A mean zero random term ($\eta_i \equiv \varepsilon_{ai} - \varepsilon_{bi} \overline{R}_{m,eEV}$).

Equation (7) demonstrates that the mean excess return calculated by the market model-based event study may be nonzero, even when the stock has no abnormal returns. The bias is size related. Its mean ($\overline{\Pi}^{si}_{EV} - \overline{\Pi}^{si}_{EST}$) depends solely on how the size premium on the firm has changed between the estimation and event periods.

The size premium of the stock changes between the estimation and event periods (and a size bias emerges) in two typical cases:

- When the size of the firm changes between the estimation and event periods; and

- When the size premium is stochastic, and it changes between the estimation and event periods.[1]

If size premiums are constant over time and the firm's size does not change between the estimation and event periods, the size-related bias vanishes, and the standard event study method is adequate.

It is possible to develop an expanded set of conditions under which standard event study methods are appropriate. Event studies typically base their inference on $\overline{AR}_{EV}$, the average excess return across all N firms in the sample, where:

$$(8)\ \overline{AR}_{EV} = \frac{\Sigma_i \overline{AR}_{i,EV}}{N}.$$

Now if:

- The sample of firms does not change systematically in size, i.e., the proportion of firms that increase in size is approximately equal to the proportion of firms that decrease in size;

and if:

- The sample period is long, and events are relatively uniformly scattered across time (so that estimation periods on average would have the same size premiums as event periods); or
- The distribution of sample firm size is approximately uniform across size deciles (so that the mean size premium is close to zero) both before and after the event;

the size-related bias should be miniscule.

In sum, the current analysis confirms Dimson and Marsh's (1986) contention that only under rather special circumstances is the traditional, market model-based event study subject to size-related biases. In many ways this conclusion is reassuring. The preponderance of scholarly work using standard event study methods is not suspect in regard to size-related biases. Only extreme cases should be reexamined.

One of these extreme cases is the sample of NCAV stocks. NCAV stocks become smaller almost by definition in the period prior to the event (the fall below net current asset value per share). In addition, NCAV events are clustered because firms are more likely to fall below NCAV during recessions. Hence, the

[1]Brown, Kleidon, and Marsh (1983) show that the size premium fluctuates considerably over time. (See also Figure 2, which is a reproduction of Brown, Kleidon, and Marsh's Figure 2.)

first two conditions of the above discussion are violated, and size biases can be expected.[2]

Size Adjustment—How?

When sample characteristics are such that the potential for, and consequences of, a size-related bias cannot be ignored, one must adjust for size. Two possible size-adjustment procedures are outlined in this section. Both are based on parsimonious representations of the ten-factor size-indices return-generating model:

(9) $R_{i,t} = \alpha_{i0} + \alpha_{i1} R1_t + \alpha_{i2} R2_t + \ldots + \alpha_{i10} R10_t + \varepsilon_{i,t}$,

where:

$R_{i,t}$ = Return on stock i in month t;
$R1_t$ = Average return in month t on the smallest size decile stocks;
$R10_t$ = Average return in month t on the largest size decile stocks;
$\varepsilon_{i,t}$ = An idiosyncratic mean-zero residual return; and
$\alpha_i s$ = Constant firm-specific parameters.

The first size-adjustment procedure examined is suggested in Dimson and Marsh (1986). It assumes that in equation (9):

$a_{ij} = 1$ if firm i belong to the jth size decile; and
$a_{ij} = 0$ otherwise.

Accordingly, $AR_{i,t}$, the excess return on stock i in month T, is estimated as:

(10) $AR_{i,T} = R_{i,T} - RSi_T$,

where:

RSi_T = Average return in month T on all stocks that belong to the same size decile as i.

The second size-control methodology is based on Huberman and Kandel (1985). It assumes that in equation (9):

[2]Concrete evidence on the relative size decrease and clustering problem in the current sample is presented in the discussion section.

$\alpha_{i1} = \alpha_{i2} = b_i$, $\alpha_{i5} = \alpha_{i6} = c_i$, $\alpha_{i9} = \alpha_{i10} = d_i$, and $\alpha_{i3} = \alpha_{i4} = \alpha_{i7} = \alpha_{i8} = 0$.[3]

$AR_{i,T}$, the excess return of stock i in month T, is calculated as:

$$(11)\ AR_{i,T} = R_{i,T} - \hat{a}_i + \hat{b}_i R_{s,T} - \hat{c}_i R_{a,T} - \hat{d}_i R_{1,t},$$

where:

$R_{i,T}$ = Return of stock i in month T;
$R_{s,T}$ = Return on an index of small size (decile 1 and 2) stocks in month T;
$R_{a,T}$ = Return on an index of average size (decile 5 and 6) stocks in month T;
$R_{1,t}$ = Return on an index of large size (decile 9 and 10) stocks in month T; and
$\hat{a}_i, \hat{b}_i, \hat{c}_i, \hat{d}_i$ = Estimated parameters of the Huberman and Kandel model.

Although the Huberman and Kandel-based methodology seems less restrictive than that or Dimson and Marsh, *a priori* it is not clear which is preferable. This is because the parameters necessary for the Huberman and Kandel method have to be estimated in the period preceding the event. The issue somewhat resembles the question of whether an all-betas-equal-1 model provides more reliable excess return estimates than the traditional excess return measure (equation (6)).

Data

The sample selection method is identical to Vu (1988). A list of stocks selling at discount from net current asset value per share is obtained weekly from the *Value Line Investment Survey*. The month in which a stock first enters the list is defined as the event month (month 0) for that stock.

Monthly returns for the stocks come from the Center for Research in Security Prices (CRSP) monthly returns file. For the five stocks in the sample that were delisted from the New York Stock Exchange in the months following the event, the missing postevent returns were calculated using data from the

[3]The Huberman and Kandel model assumes that α_{i3}, α_{i4}, α_{i7}, and α_{i8} equal zero in order to minimize the collinearity of the three size indices it constructs (see equation (10)). The returns of adjacent size decile indices behave similarly. Thus, the Huberman-Kandel method of omitting the seam-line deciles (deciles 3, 4, 7, and 8) seems to minimize collinearity while maintaining the spanning (differentiation) ability of the indices.

Standard & Poor's Daily Stock Price Record and from various issues of the *Wall Street Journal* and the *Los Angeles Times*.

Excluded from the sample are stocks not on the CRSP monthly return file (all non-NYSE stocks), stocks without at least 12 returns in the parameter estimation period, and stocks that entered the NCAV list twice (that is, entered, left, and reentered the list) within a period of less than two years. The final sample consists of 121 NYSE stocks that dropped below NCAV per share in the period 1977-1984.

Results of a Standard Event Study

The standard event study method (originated by Fama, Fisher, Jensen, and Roll, 1969) and discussed in Brown and Warner (1980) proceeds in the following steps:

- Stock returns are assumed to follow the market model (equation (2)), and the parameters of the model, a_i and b_i, are estimated in a period preceding the event. In this study, the parameter estimation period includes months -84 to -25 (month 0 is the event month);
- The abnormal (or excess) returns of each stock in the months surrounding the event are calculated using equation (6). This study computes the abnormal return in months -24 and +24 relative to the event month. The event window, therefore, is 49 months long;
- Average abnormal performance measures are calculated. The average abnormal return in month T, AR_T, is computed as:

$$(12)\ AR_T = \frac{\Sigma_i AR_{i,T}}{N_T}$$

where:

$AR_{i,T}$ = Excess return of stock i in month T; and
N_T = Number of stocks for which the excess return in month T can be calculated.

Similarly, the cumulative average excess return in months Tb through T_e, $CAR(T_b, T_e)$, is calculated as:

$$(13)\ CAR\ (T_b, T_e) = \sum_{T=T_b}^{T_e} AR_T.$$

- The statistical significance of the average abnormal performance measures is assessed. The Patell (1976) standardized residuals technique is used. The exact test statistics computation formulae are shown in the appendix.

Table 1 documents the average performance measures of 121 NCAV stocks using the standard event study method with the NYSE value-weighted index as the proxy for the market index. The first column indicates the month relative to the event date. The second and third columns report the average raw returns and the cumulative average raw returns. NCAV stocks demonstrate a remarkable recovery after falling below net current asset value per share. The cumulative average raw return in months 1 to 24 is 40.0 percent, which is approximately 7.8 times higher than the cumulative average raw return in months -24 to 0.

The abnormal performance measures yield a similar picture. Average excess return (the AR_Ts) are positive in 20 of the 24 months included in the postevent period. The cumulative postevent average excess return, CAR (1, 24), is 25.1 percent with a t-statistic of 4.9

The finding of significant positive postevent excess return is robust to the specific choices made regarding the length of the parameter estimation period and the size of the event window. The event study was replicated for all six combinations of a parameter estimation period of 36, 48, and 60 months and an event window of 25 and 49 months with essentially the same results. Results also are robust to the statistical method employed. Using the cross-sectional t-statistics calculation technique described in the appendix yields almost identical t-values.

Table 2 reports the results of a standard event study with the NYSE equally weighted index as a proxy of the market index. The results confirm Table 1: postevent AR_Ts are typically positive, and CAR (1, 24) is 17.8 percent ($t = 3.9$).

The evidence in Tables 1 and 2 is consistent with Vu's (1988) findings. NCAV stocks seem to offer some special opportunities. The investor in these stocks apparently buys underpriced securities and joyfully watches the upward correction in their price.

Results of a Size-Adjusted Event Study

Some preparatory work is required before implementing the size-adjustment methods. First, the total market value of each stock traded on the NYSE at each calendar year-end since 1974 is calculated. Second, size decile cutoffs are determined for each year according to this stock capitalization figure. Next, at each year-end each NYSE stock is assigned to a particular size decile portfolio. (The stock remains a member of that portfolio for the next twelve months.) Last, the nth size decile portfolio return is calculated as a simple (equally weighted) average of its member returns.

The first size-control method attempted is the Dimson and Marsh (1986) method. Abnormal returns are computed as the difference between the return on the stock and the return on its size decile portfolio. (See equation (10).) For example, if stock X belongs to the jth NYSE size decile on December 31, 1980, the excess return of X in any month of 1981 (for example, May 1981) is computed as the return on stock X in May 1981 minus the return in May 1981 on an equally weighted portfolio of all the stocks in the jth size decile as of December 31, 1980.

Average abnormal performance measures in the Dimson-Marsh method are calculated exactly as in steps 2 and 3 of the standard event study method. Statistical significance is measured using the cross-sectional method. The switch to the cross-sectional method occurs because Dimson and Marsh's size-control method does not require any parameter estimation period. Without data estimated over such a period, the Patell t-statistics technique cannot be employed.

Table 3 documents the results of the Dimson and Marsh size adjustment. The average excess return is negative in 16 of the 24 postevent months examined. The cumulative average postevent excess return, CAR (1, 24) is -14.5 percent with a t-statistic of -3.2. Stocks of NCAV firms evidently earn significantly less than do stock of similarly size firms.[4]

The second size-adjustment procedure applied is based on the Huberman and Kandel (1985) size indices model. The first step of this procedure is to estimate the parameters of the size indices model in the parameter estimation period. Once the parameters are estimated, the abnormal returns on each stock in months -24 through +24 are computed using equation (11). The rest of this size-control technique proceeds in the same way as the standard event study technique. First, average abnormal returns and cumulative average abnormal returns are calculated using equations (12) and (13). Then the Patell technique is used to assess statistical significance.

Table 4 presents the results of this procedure. Most (17 of 24) of the postevent months exhibit positive average excess returns. The cumulative postevent average excess return is, however, relatively low. CAR (1, 24) is 7.6 percent with a t-statistic of 1.7.

Discussion

Figure 1 presents graphically the different estimates of the performance of NCAV stocks. Figure 1 prompts two main questions. First, why is there such a big difference between the market model results and size-adjusted results? Second, how can we account for the different in results between the two size control procedures?

[4]The Dimson and Marsh method also was run using size quintiles instead of size deciles. The results are similar. CAR (1, 24) is -14.0 percent with a t-statistic of -3.1

The Components of the Size-Related Bias

There are two reasons for the difference in results between the market model and the size-based models. First, the typical firm size decreases between the estimation and event periods. Table 5 records the size distribution of the sample firms at two times: the middle of the estimation period and the middle of the event period. The mean and median firm size drop by one decile between the estimation and event periods. The drop in relative size is statistically significant and comprehensive. Sixty-five percent of the firms drop in size, and the t-statistic of the change in size decile is -8.6.[5]

The document decline in firm size tends to bias the excess returns estimates of the standard methodology upward. According to equation (7), the monthly bias in the standard methodology is equal on average to the difference between the event and estimation periods monthly size premiums. Given that the sample firms decline in size between the estimation and event periods and that size premiums are typically larger for smaller firms, it can be concluded that the standard methodology induces spurious positive excess returns in this case.

The second reason for the large excess returns assessed by the market model is that the size premium is typically higher in the postevent period. Most of the sample firms are small, and most of the events included in the study occurred in 1977 and 1978. The preevent parameter estimation period (months -25 to -84) thus is typically the early to mid-1970s, a period notorious for its relatively low small firm premiums. (See Brown, Kleidon, and Marsh (1983) from whose work Figure 2 is reproduced.) Again, if the size premium during the estimation period is lower than the size premium during the event period, spurious positive excess returns appear.

It is possible to demonstrate empirically the importance of the bias induced by the increase in the relevant size premiums during the 1970s. The plot of the portfolio 1 (smallest firms) size premium in Figure 2 indicates that the difference between the estimation period and the event period mean size premium is particularly large for events in the beginning of the sample. (This is because the estimation period for an event in the beginning of the sample includes the 1970-1972 era of historically low small firm premiums.) Exclusion of these events would be expected to diminish the size-related bias and, hence, the excess return calculated by the market model-based methodology. The data support this prediction. When the 35 stocks included in the first NCAV list (in April 1977) are omitted from the sample, the postevent CAR (1, 24) estimated using the market

[5]The one decile drop in relative size is also economically significant. During the sample years (mid-1970s to mid-1980s) the average market value of equity of decile 2 firms was smaller than the average market value of equity of decile 3 firms by approximately 35 percent.

model with the value-weighted index drops more than a third to a level of 14.6 percent.

An Evaluation of the Size-Adjustment Techniques

The second issue to address is the difference between the results of the two size-adjustment techniques. The explanations presented hereafter are based on arguments of incorrect estimation of the true size-decile behavior of the stock. If a particular technique overestimates the size decile of the firm in the event window, spurious positive excess returns appear. This is because the assumed normal returns of the stocks in the event period are lower than the true normal returns. Smaller firms normally yield higher average returns. Thus, an overestimation of an event period size also implies a presumption that the normal return is lower than it is, with the result of artificially inducing positive abnormal returns. Similarly, an underestimation of the firm size induces spurious negative excess returns.

The Huberman and Kandel method probably overestimates the size of the sample stocks. This is because the Huberman and Kandel size indices model is fitted two to seven years before the event, when the sample firms were systematically larger. Thus, the postevent excess returns estimated by the Huberman and Kandel size indices method are likely to be upward biased.

The systematic preevent size change also may bias the Dimson and Marsh-based excess return estimates. The Dimson and Marsh technique assumes that each stock behaves each month according to its size in that month, but this may not be true for transition stocks (stocks that only recently moved from one decile to another), where an adjustment process may occur. If the preevent fall in the value of NCAV stocks does not mean automatically that they start following the behavior of smaller firm stocks, then the Dimson-Marsh excess return estimates will be biased downward because, on average, the sample firms behave like the larger firms.

The discussion above suggests that the true excess returns lie between the (downward biased) estimates produced by the Dimson and Marsh method and the (upward biased) estimates produced by the Huberman and Kandel-based method. If so, then the typical round trip transaction costs for small firm stock (Schultz, 1983; Stoll and Whaley, 1983) would seem to preclude any economically significant return.

Concluding Remarks

The study demonstrates how size controls can alter the outlook of an investment strategy. The Ben Graham net current asset value rule provides excellent excess returns according to traditional performance measures. Size-adjustment procedures, however, reveal that its size-adjusted excess return is approximately zero.

The study also has an interesting economic caveat about the losers-will-be-winners anomaly exposed by DeBondt and Thaler (1985, 1987). Losers in the current sample (the NCAV firms) become winners (earn significant postevent excess returns) only when the inappropriate (market model-based) method is used. It thus seems prudent to suggest that studies of overreaction and related phenomena consider explicitly the possibility of size-related biases. (See Zarowin (1990) and Lauterbach and Vu (1992) for recent attempts in this direction.)

References

1. Arbel, A., S. Carvell, and E. Postnieks, "The Smart Crash of October 19th," *Harvard Business Review*, 666 (May-June 1988), pp. 124-136.

2. Banz, R., "The Relationship Between Return and Market Value of Common Stocks," *Journal of Financial Economics*, 9 (March 1981), pp. 3-18.

3. Brown, P., A. Kleidon, and T. Marsh, "New Evidence on the Nature of Size-Related Anomalies in Stock Prices," *Journal of Financial Economics*, 12 (June 1983), pp. 33-56.

4. Brown, S., and J. Warner, "Measuring Security Price Performance," *Journal of Financial Economics*, 8 (June 1980), pp. 205-258.

5. Collins, D., and W. Dent, "A Comparison of Alternative Testing Methodologies Used in Capital Market Research," *Journal of Accounting Research*, 22 (Spring 1984), pp. 48-84.

6. DeBondt, W., and R. Thaler, "Does the Stock Market Overreact?" *Journal of Finance*, 40 (July 1985), pp. 793-805.

7. DeBondt, W., and R. Thaler, "Further Evidence on Investor Overreaction and Stock Market Seasonality," *Journal of Finance*, 42 (July 1987), pp. 793-805.

8. Dimson, E., and P. Marsh, "Event Study Methodologies and the Size Effect: The Case of U.K. Press Recommendations," *Journal of Financial Economics*, 17 (September 1986), pp. 113-142.

9. Fama, E, L. Fisher, M. Jensen, and R. Roll, "The Adjustment of Stock Prices to New Information," *International Economic Review*, 10 (February 1969), pp. 1-21.

10. Huberman, G. and S. Kandel "Size-Related Covariation of Stock Returns," University of Chicago working paper, 1985.

11. Lauterbach, B., and J. Vu, "Evidence on the Overreaction Hypothesis: The Case of Management Awards," *Quarterly Journal of Business and Economics*, 31, no. 1 (Winter 1992), pp. 45-67.

12. Patell, J., "Corporate Forecasts of Earnings per Share and Stock Price Behavior: Empirical Tests," *Journal of Accounting Research*, 14 (Autumn 1976), pp. 246-276.

13. Reinganum, M., "Misspecification in Capital Asset Pricing: Empirical Anomalies Based on Earnings Yields and Market Values," *Journal of Financial Economics*, 9 (March 1981), pp. 19-46.

14. Schultz, P., "Transaction Costs and the Small Firm Effect: A Comment," *Journal of Financial Economics*, 12 (June 1983), pp. 81-88.

15. Stoll, H., and R. Whaley, "Transaction Costs and the Small Firm Effect," *Journal of Financial Economics*, 12 (June 1983), pp. 57-79.

16. Vu, J., "An Empirical Analysis of Ben Graham's Net Current Asset Value Rule," *Financial Review*, 23 (May 1988), pp. 215-225.

17. Zarowin, P., "Size, Seasonality, and Stock Market Overreaction," *Journal of Financial and Quantitative Analysis*, 25 (March 1990), pp. 113-125.

Table 1
Performance Measures of 121 Stocks Falling Below Their Firm's Net Current Asset Value Per Share Using the Market Model With the NYSE Value-Weighted Index 1977-1983

Month	Average Raw Return %	Cumulative Average Raw Return %	Average Excess Return %	Percentage of Positive Excess Return	t-statistic of Average Excess Return (Patell Method)	Cumulative Average Excess Return %	Number of Firms
-24	2.42	2.42	0.18	48.8	-0.06	0.18	121
-23	1.86	4.28	-0.79	43.8	-0.53	-0.60	121
-22	1.18	5.45	0.21	45.5	0.18	-0.39	121
-21	1.31	6.76	2.97	62.0	2.79	2.58	121
-20	1.19	7.96	0.87	48.8	0.76	3.45	121
-19	-0.67	7.28	0.39	54.5	0.21	3.85	121
-18	-0.26	7.54	-2.53	38.8	-2.14	1.32	121
-17	2.18	9.73	0.98	47.9	1.13	2.30	121
-16	-0.22	9.51	-1.33	41.3	-1.04	0.97	121
-15	7.32	16.83	2.43	58.7	3.11	3.40	121
-14	2.23	19.05	3.16	55.8	3.24	6.56	120
-13	0.55	19.61	-0.08	47.9	0.15	6.48	121
-12	-2.25	17.35	-1.80	39.7	-1.86	4.67	121
-11	-2.16	15.20	-1.26	45.5	-0.60	3.42	121
-10	1.85	17.04	0.28	46.7	0.66	3.70	120
-9	0.24	17.28	0.61	52.1	0.49	4.31	121
-8	0.26	17.54	-0.21	44.5	-0.15	4.10	119
-7	-0.67	16.87	-1.16	48.8	-0.85	2.94	121
-6	-3.79	13.09	-1.20	42.7	-1.49	1.74	117
-5	-0.38	12.70	0.29	46.3	0.20	2.03	121
-4	2.63	16.33	0.11	48.8	0.24	2.14	121
-3	0.34	15.67	1.49	58.7	1.02	3.63	121
-2	-2.78	12.90	-0.85	50.4	-0.67	2.79	121
-1	-6.13	6.77	-3.19	38.8	-3.88	-0.41	121
0	-1.67	5.10	-0.30	47.1	-0.83	-0.71	121
1	0.42	5.52	0.01	52.9	-0.33	-0.69	121
2	5.19	10.70	2.05	51.7	2.29	1.36	120
3	0.80	11.51	1.49	58.3	1.18	2.85	120
4	1.19	12.70	2.31	61.3	2.24	5.16	119
5	1.77	14.47	1.32	51.7	0.97	6.47	118
6	0.81	15.28	1.25	55.1	1.69	7.72	118
7	4.63	19.91	0.99	54.3	1.10	8.71	116
8	-0.10	19.81	-1.56	46.6	-1.42	7.15	116
9	0.88	20.69	2.30	62.1	2.36	9.45	116
10	3.52	24.21	3.47	67.2	3.53	12.92	116
11	3.66	27.86	1.79	44.3	1.88	14.71	115
12	4.31	32.18	-0.10	41.7	-0.27	14.61	115
13	4.45	36.63	2.77	53.9	2.71	17.39	115
14	1.80	38.43	1.78	54.4	1.82	19.16	114
15	2.22	40.65	0.22	46.0	-0.36	19.38	113
16	1.41	42.06	1.28	52.6	0.96	20.66	114
17	-0.14	41.92	0.48	50.0	0.57	21.14	114
18	-4.69	37.23	-0.91	43.0	-0.88	20.23	114
19	1.00	38.23	-0.85	47.4	-0.69	19.38	114

Table 1 (cont.)
Performance Measures of 121 Stocks Falling Below Their Firm's Net Current Asset Value Per Share Using the Market Model With the NYSE Value-Weighted Index 1977-1983

Month	Average Raw Return %	Cumulative Average Raw Return %	Average Excess Return %	Percentage of Positive Excess Return	t-statistic of Average Excess Return (Patell Method)	Cumulative Average Excess Return %	Number of Firms
22	-0.81	41.42	0.76	54.0	0.69	22.82	113
23	2.63	44.05	0.58	48.2	0.24	23.39	112
24	1.04	45.09	0.95	52.3	0.69	24.35	111

Notes:
The cumulative average excess return from month 1 to month 24 is 25.05 percent with a t-statistic of 4.92

Beta is estimated from month -84 to month -25

The number of observations in the postevent period drops from 121 to 111 because nine firms were merged and one firm had limited public interest

Table 2
Performance Measures of 121 Stocks Falling Below Their Firm's Net Current Asset Value Per Share Using the Market Model With the NYSE Equally Weighted Index 1977-1983

Month	Average Excess Return %	Percentage of Positive Excess Return	t-statistic of Average Excess Return (Patell Method)	Cumulative Average Excess Return %	Number of Firms
-24	0.70	47.9	0.33	0.70	121
-23	-1.17	43.0	-1.13	-0.47	121
-22	-0.64	43.0	-0.46	-1.11	121
-21	1.73	53.7	1.86	0.62	121
-20	1.28	53.7	1.24	1.90	121
-19	0.35	52.9	0.36	2.25	121
-18	-1.44	43.8	-1.28	0.81	121
-17	0.92	50.4	1.23	1.73	121
-16	-1.81	40.5	-1.95	-0.08	121
-15	0.71	52.9	1.55	0.63	121
-14	0.73	49.2	0.91	1.36	120
-13	0.57	51.2	0.83	1.92	121
-12	-1.98	39.7	-2.08	-0.05	121
-11	-1.29	43.8	-0.80	-1.35	121
-10	-0.13	47.5	0.36	-1.48	120
-9	-0.27	49.6	-0.29	-1.75	121
-8	-0.16	47.1	-0.35	-1.91	119
-7	-1.22	44.6	-1.04	-3.13	121
-6	-1.41	40.2	-1.81	-4.54	117
-5	-1.15	41.3	-1.45	-5.69	121
-4	-1.35	38.8	-1.31	-7.04	121
-3	-0.41	47.9	-0.92	-7.45	121
-2	-0.66	50.4	-0.76	-8.11	121
-1	-3.46	33.9	-4.48	-11.57	121
0	-0.89	47.9	-1.32	-12.46	121
1	-0.79	48.8	-1.27	-13.26	121
2	1.86	51.7	2.24	-11.40	120
3	1.03	51.7	0.75	-10.37	120
4	2.01	58.0	2.21	-8.36	119
5	0.93	50.8	0.78	-7.43	118
6	0.64	52.5	1.01	-6.79	118
7	0.24	48.3	0.48	-6.55	116
8	-1.48	42.2	-1.43	-8.03	116
9	0.96	51.7	1.24	-7.08	116
10	2.55	64.7	2.87	-4.53	116
11	0.91	42.6	0.92	-3.62	115
12	0.81	47.0	0.95	-2.81	115
13	1.91	51.3	1.96	-0.90	115
14	1.32	64.4	1.71	0.43	114
15	0.44	42.5	0.01	0.86	113
16	0.60	51.8	0.38	1.46	114
17	0.59	49.1	0.84	2.05	114
18	0.93	52.6	0.83	2.98	114
19	-0.88	41.2	-0.82	2.11	114

Table 2 (cont.)
Performance Measures of 121 Stocks Falling Below Their Firm's Net Current Asset Value Per Share Using the Market Model With the NYSE Equally Weighted Index 1977-1983

Month	Average Excess Return %	Percentage of Positive Excess Return	t-statistic of Average Excess Return (Patell Method)	Cumulative Average Excess Return %	Number of Firms
20	1.31	54.4	1.64	3.42	114
21	0.16	47.4	0.30	3.58	114
22	0.47	55.8	0.50	4.05	113
23	0.14	46.4	-0.05	4.19	112
24	1.13	50.5	0.83	5.32	111

Notes:
The cumulative average excess return from month 1 to month 24 is 17.78 percent with a t-statistic of 3.85

Beta is estimated from month -84 to month -25

The number of observations in the postevent period drops from 121 to 111 because nine firms were merged and one firm had limited public interest

Table 3
Performance Measures of 121 Stocks Falling Below Their Firm's Net Current Asset Value Per Share Using the Dimson-Marsh Size-Control Method 1977-1983

Month	Average Excess Return %	Percentage of Positive Excess Return	t-statistic of Average Excess Return (Patell Method)	Cumulative Average Excess Return %	Number of Firms
-24	0.47	45.5	0.48	0.47	121
-23	-2.05	42.1	-2.14	-1.57	121
-22	-2.04	42.0	-2.02	-3.61	121
-21	-0.20	48.8	-0.24	-3.81	121
-20	1.00	50.4	1.27	-2.81	121
-19	0.04	47.9	0.04	-2.77	121
-18	-1.24	46.3	-1.29	-4.01	121
-17	-0.14	47.9	-0.16	-4.14	121
-16	-3.47	27.3	-4.84	-7.61	121
-15	-1.31	42.1	-1.49	-8.92	121
-14	-2.33	40.8	-2.46	-11.25	120
-13	0.05	47.9	0.06	-11.20	121
-12	-2.81	35.5	-3.21	-14.01	121
-11	-2.23	38.0	-2.94	-16.24	121
-10	-1.00	41.7	-1.39	-17.24	120
-9	-1.75	43.0	-2.58	-18.99	121
-8	-0.88	42.0	-1.19	-19.87	119
-7	-1.92	43.0	-2.69	-21.79	121
-6	-3.10	26.5	-3.76	-24.89	117
-5	-2.53	35.5	-3.00	-27.42	121
-4	-3.25	32.2	-4.10	-30.66	121
-3	-2.17	33.1	-2.78	-32.83	121
-2	-2.20	36.4	-3.30	-35.03	121
-1	-5.34	25.6	-5.89	-40.37	121
0	-2.34	39.7	-2.50	-42.71	121
1	-2.24	37.2	-2.73	-44.94	121
2	1.26	46.7	1.40	-43.69	120
3	-1.08	41.7	-1.24	-44.77	120
4	0.45	55.5	0.48	-44.32	119
5	-0.36	38.1	-0.38	-44.68	118
6	-0.80	40.7	-0.80	-45.48	118
7	-1.07	44.0	-1.17	-46.56	116
8	-2.20	37.1	-3.33	-48.76	116
9	-1.49	39.7	-1.47	-50.25	116
10	0.58	48.3	0.54	-49.67	116
11	-0.84	35.7	-0.83	-50.51	115
12	0.68	46.1	0.77	-49.83	115
13	0.78	41.7	0.61	-49.05	115
14	-0.06	45.6	-0.07	-49.11	114
15	-0.28	37.2	-0.28	-49.39	113
16	-1.42	41.2	-1.42	-50.81	114
17	-0.72	42.0	-0.92	-51.53	114
18	0.68	50.9	0.63	-50.85	114
19	-1.81	38.6	-2.37	-52.66	114

Table 3 (cont.)
Performance Measures of 121 Stocks Falling Below Their Firm's Net Current Asset Value Per Share Using the Dimson-Marsh Size-Control Method 1977-1983

Month	Average Excess Return %	Percentage of Positive Excess Return	t-statistic of Average Excess Return (Patell Method)	Cumulative Average Excess Return %	Number of Firms
20	0.12	49.1	0.15	-52.54	114
21	-2.20	33.36	-2.45	-54.74	114
22	-1.33	40.7	-1.71	-56.06	113
23	-0.89	42.0	-0.99	-56.95	112
24	-0.29	42.3	-0.28	-57.25	111

Notes:
The cumulative average excess return from month 1 to month 24 is -14.54 percent with a t-statistic of -3.18

Beta is estimated from month -84 to month -25

The number of observations in the postevent period drops from 121 to 111 because nine firms were merged and one firm had limited public interest

Table 4
Performance Measures of 121 Stocks Falling Below Their Firm's Net Current Asset Value Per Share Using the Huberman-Kandel Size Indices Model 1977-1983

Month	Average Excess Return %	Percentage of Positive Excess Return	t-statistic of Average Excess Return (Patell Method)	Cumulative Average Excess Return %	Number of Firms
-24	0.97	47.9	0.73	0.97	121
-23	-1.42	43.0	-1.37	-0.46	121
-22	-0.71	43.8	-0.67	-1.17	121
-21	0.37	50.4	-0.39	-0.80	121
-20	0.62	50.4	0.60	-0.17	121
-19	0.25	50.4	0.48	0.08	121
-18	-0.78	44.6	-0.46	-0.70	121
-17	0.86	49.6	1.31	0.17	121
-16	-2.48	35.5	-2.68	-2.32	121
-15	0.01	48.8	0.80	-2.31	121
-14	-0.59	40.8	-0.50	-2.90	120
-13	0.47	49.6	0.90	-2.43	121
-12	-2.59	40.5	-2.82	-5.02	121
-11	-1.56	39.7	-1.19	-6.59	121
-10	-0.71	45.0	-0.19	-7.30	120
-9	-0.97	45.5	-1.18	-8.27	121
-8	-0.12	46.2	-1.16	-8.39	119
-7	-1.91	39.7	-1.91	-10.30	121
-6	-1.79	31.6	-2.31	-12.09	117
-5	-1.90	38.0	-2.16	-14.00	121
-4	-1.99	37.2	-2.14	-15.98	121
-3	-2.06	38.8	-2.71	-18.04	121
-2	-1.15	49.6	-1.21	-19.19	121
-1	-4.12	31.4	-5.39	-23.31	121
0	-1.25	43.8	-1.80	-24.56	121
1	-1.31	43.0	-1.89	-25.84	121
2	1.14	46.7	1.54	-24.73	120
3	0.21	50.0	0.01	-24.52	120
4	1.52	55.5	1.61	-23.00	119
5	0.40	47.5	0.21	-22.60	118
6	0.03	46.6	0.40	-22.57	118
7	-0.11	50.0	0.09	-22.68	116
8	-2.01	39.7	-2.11	-24.69	116
9	-0.18	44.8	-0.05	-24.87	116
10	1.48	53.4	1.75	-23.39	116
11	0.92	42.6	1.04	-22.47	115
12	0.97	51.3	1.05	-21.51	115
13	1.70	49.6	1.85	-19.80	115
14	0.65	51.8	0.89	-19.15	114
15	0.89	42.5	0.51	-18.27	113
16	0.13	46.5	-0.06	-18.13	114
17	0.56	50.9	0.79	-17.57	114
18	1.53	53.5	1.43	-16.04	114
19	-1.71	37.7	-1.88	-17.75	114

Table 4 (cont.)
Performance Measures of 121 Stocks Falling Below Their Firm's Net Current Asset Value Per Share Using the Huberman-Kandel Size Indices Model 1977-1983

Month	Average Excess Return %	Percentage of Positive Excess Return	t-statistic of Average Excess Return (Patell Method)	Cumulative Average Excess Return %	Number of Firms
20	0.72	52.6	1.05	-17.03	114
21	-0.25	38.6	0.14	-17.28	114
22	0.22	52.2	0.15	-17.06	113
23	-0.68	43.8	-0.90	-17.74	112
24	0.73	45.9	0.45	-17.00	111

Notes:

The cumulative average excess return from month 1 to month 24 is 7.56 percent with a t-statistic of 1.65

The parameters of the size indices model are estimated from month -84 to month -25

The number of observations in the postevent period drops from 121 to 111 because nine firms were merged and one firm had limited public interest

Table 5
Changes in Size Between the Event and Estimation Periods for the 121 Stocks Falling Below Their Firm's Net Current Asset Value Per Share

Size Decile Relative to All NYSE Stocks	Number of NCAV Stocks in Each Decile at: The Middle of the Preevent Parameter Estimation Period	The Middle of the Postevent Parameter Estimation Period
1	29	60
2	25	22
3	26	14
4	14	9
5	7	10
6	8	4
7	10	1
8	1	1
9	1	--
10	--	--
Mean Size	3.17	2.24
Median Size	3	2

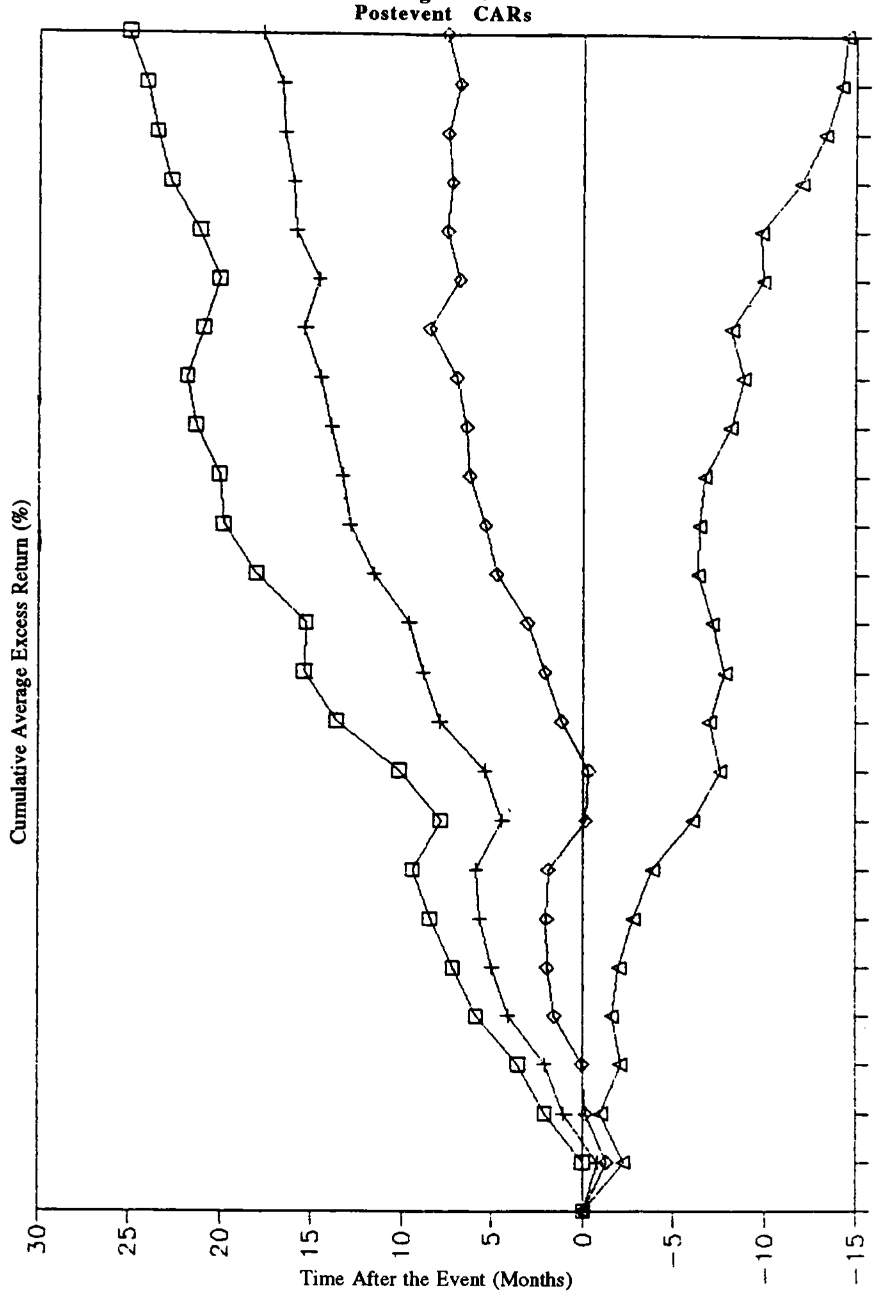
Notes:

The t-statistic of the difference in mean size decile is -8.6

Decile 1 includes the 10 percent smallest NYSE firms, and decile 10 includes the 10 percent largest NYSE firms

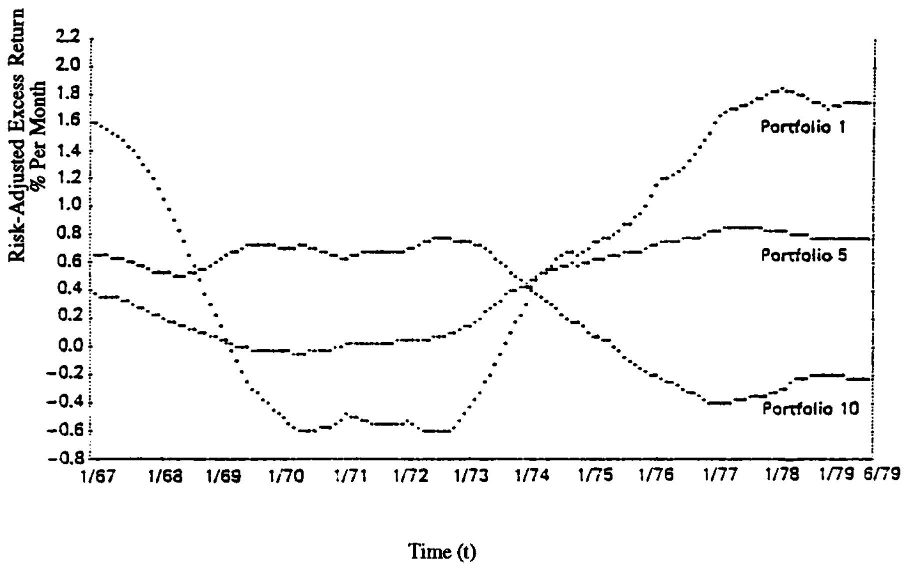
For firms with complete preevent and postevent data, the middle of the preevent parameter estimation period is month -54, and the middle of the post event evaluation period is month +13

Figure 1
Postevent CARs



□ Market model with value-weighted index
◊ Huberman and Kandel size-indices model
\+ Market model with equally weighted index
Δ Dimson and Marsh size decile adjustment

Figure 2
Brown, Kleidon, and Marsh Estimates of Size Premiums



Source: Brown, Kleidon, and Marsh (1983, p. 48). Portfolio includes the 10 percent smallest NYSE firms, and portfolio 10 includes the 10 percent largest NYSE firms

Appendix
An Outline of the Test Statistics

The Patell Method Test Statistics

For the Mean Abnormal Return in Month T

Patell (1976, p. 257) shows that under the null hypothesis of no abnormal returns in month T:

$$(A.1)\ Z_T = \frac{\sum_{i=1}^{N_T} \frac{AR_{i,T}}{\hat{\sigma}_i \sqrt{C_{i,T}}}}{\left(\sum_{i=1}^{N_T} \frac{N_{i-2}}{N_{i-4}} \right)^{0.5}}$$

is distributed N (0, 1) in samples of reasonable size,

where:

T	=	Time (in months) relative to the event month;
$AR_{i,T}$	=	Abnormal return of stock i in month T;
$\hat{\sigma}_i$	=	Residual standard deviation of the market regression of stock i in the parameter estimation period;
$C_{i,T}$	=	A variance-inflating factor necessary because $AR_{i,T}$ is an out-of-sample prediction;
N_T	=	The number of stocks for which excess returns in month T can be calculated; and
N_i	=	Number of nonmissing return observations of stock i in the parameter estimation period.

For the Cumulative Average Abnormal Return

The statistical significance of CAR (Tb, Te)—the cumulative average abnormal return in month Tb through Te (relative to the event)—is tested by the statistic:

$$(A.2)\ \sqrt{\frac{1}{T_e - T_b + 1}} \sum_{T=T_b}^{T_e} Z_T.$$

Under the null that CAR (Tb, Te) = 0, the statistic described by equation (A.2) is distributed N (0, 1).

The Cross-Sectional Method Test Statistics

For the Mean Abnormal Return in Month T

According to the cross-sectional method (for example, see Collins and Dent, 1984, p. 60), under the null of no abnormal return in month T:

$$\text{(A.3)} \quad \frac{AR_T}{\hat{\sigma}(AR_T)}$$

is distributed N (0, 1) in samples of reasonable size,

where:

$$\hat{\sigma}(AR_T) = \left(\frac{\sum_{i=1}^{Nt} (AR_{i,T} - AR_T)^2}{N_T\,(N_{T-1})} \right)^{0.5}$$

AR_T = Average abnormal return in month T (equation (11));

and the rest of the notation is as in equation (A.1).

For the Cumulative Average Abnormal Return

The statistic

$$\text{(A.4)} \quad \frac{CAR\ (T_b, T_e)}{\sqrt{\sum_{T=T_b}^{T_e} \hat{\sigma}^2(AR_T)}}$$

is distributed N (0, 1) in samples of reasonable size, under the null that CAR $(T_b, T_e) = 0$.