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THE RELATIONSHIP BETWEEN EARNINGS' YIELD, MARKET VALUE AND RETURN FOR NYSE COMMON STOCKS

Further Evidence*

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The empirical relationship between earnings' yield, firm size and returns on the common stock of NYSE firms is examined in this paper. The results confirm that the common stock of high E/P firms earn, on average, higher risk-adjusted returns than the common stock of low E/P firms and that this effect is clearly significant even if experimental control is exercised over differences in firm size. On the other hand, while the common stock of small NYSE firms appear to have earned substantially higher returns than the common stock of large NYSE firms, the size effect virtually disappears when returns are controlled for differences in risk and E/P ratios. The evidence presented here indicates that the E/P effect, however, is not entirely independent of firm size and that the effect of both variables on expected returns is considerably more complicated than previously documented in the literature.

1. Introduction

Recent empirical research on the relationship between earnings' yield, firm size and common stock returns has revealed some anomalies with respect to the pricing of corporate equities. In particular, the findings reported in Basu (1975, 1977) indicate that portfolios of high (low) earnings' yield securities trading on the NYSE appear to have earned higher (lower) absolute and risk-adjusted rates of return, on average, than portfolios consisting of randomly selected securities. As noted by Basu, his results suggest a violation in the joint hypothesis that (i) the single-period capital asset pricing model (CAPM) has descriptive validity; and (ii) security price behavior on the NYSE is consistent with market efficiency.

Similarly, Banz (1981) shows that common stock of small NYSE firms earned higher risk-adjusted returns, on average, than the common stock of

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***Editors' Note:* On January 7, 1983, Professor Basu suffered a fatal heart attack. His obituary appears at the end of this issue. The editors' office was responsible for proofreading the manuscript.

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large NYSE firms. This size effect appears to have been in existence for at least forty years and, according to him, constitutes evidence that the CAPM is misspecified. Moreover, relying on the work of Reinganum (1981), Banz asserts that the earnings' yield effect is a proxy for size and not vice-versa. Indeed, Reinganum (1981) concludes that his tests, which are based on a composite AMEX–NYSE sample of firms, demonstrate that the size effect 'subsumes' the *E/P* effect. In other words according to Reinganum, although the size and earnings' yield anomalies seem to be related to the same set of factors missing from the one-period CAPM specification, these factors appear to be more closely associated with firm size than with *E/P* ratios.

This latter result is somewhat surprising since, as pointed out by Ball (1978), the *E/P* ratio can be viewed as a direct proxy for expected returns.[1] Thus, one would expect the *E/P* variable to be an important factor in explaining expected returns in the event the asset pricing model employed is misspecified or there are deficiencies in the empirical implementation of the model (e.g., the use of an incomplete version of the market portfolio). On the other hand, size per se is not such an obvious direct proxy for expected returns, although variables missing from the equilibrium model might well be correlated with market value of common stock. Reinganum's finding moreover, if descriptively valid, is a significant one since it not only provides an alternative explanation for the earnings' yield anomaly, but more importantly it suggests that in conducting tests of market reaction and/or efficiency researchers need only control for firm size.

The purpose of this paper is to re-examine the relationship between earnings' yield (*E/P* ratios), firm size and returns on the common stock of NYSE firms. In doing so, an attempt is made to determine the extent to which the conclusions of the Reinganum (1981) paper are robust with respect to the use of both a different database and test sample, as well as an alternative methodological approach. Perhaps the most substantive difference in this regard concerns the method adopted to control for the effect of risk on returns. For reasons that are elaborated at a later point, this paper adjusts the returns of the various earnings' yield and size portfolios not only for the effect of differences in their systematic risks, but also for the differences in their total risk levels (i.e., variability). Reinganum (1981), on the other hand, employed a methodology which does not control for the effect of risk — either systematic or total — on returns.[2] This can be observed by

[1]Ball (1978) develops the argument that since *E/P* and dividend-price ratios constitute measures of yields they are likely to be correlated with 'true' yields or expected returns on common stock.

[2]While this criticism is applicable to the earnings' yield and market value (size) results contained in sections 4 and 5 of the Reinganum paper, it does not apply to the tests included in sections 2 and 3 of that paper, which deal with standardized unexpected earnings and quarterly *E/P* ratios. In this latter situation, the experimental portfolios were constructed by weighting securities in such a manner that they all have equivalent systematic risks.

noting that despite significant differences in the systematic risk levels of the E/P and value (size) portfolios shown in table 11 of the Reinganum (1981) paper, excess or 'abnormal' returns are computed as the difference between a given portfolio's realized return and that earned by an equally-weighted NYSE–AMEX index (also see his table 10).

There are two consequences of this failure to adjust for risk differences. First, the configuration of the risk levels for the various portfolios indicates that the observed size effect is biased upwards. Note on this account that while the small firms in each of the five E/P categories considered by Reinganum have earned higher absolute returns than their larger counterparts, they also have considerably higher levels of systematic risk. It would appear, however, that the relative magnitude of the differences in risk levels are not sufficiently large so as to fully account for the differences in returns. This seems to be the case notwithstanding Roll's (1981) arguments that beta estimates of small firms obtained from the market model may be downward biased because of infrequent trading; see Reinganum (1982) for some evidence on this latter issue.

Second and perhaps more importantly, Reinganum's failure to adjust for risk differences seems to have biased his results against observing a significant earnings' yield effect when one, in fact, may have existed. Table 11 of the Reinganum (1981) paper clearly shows that the estimated betas for the low E/P firms are considerably larger than those for their high E/P counterparts. This is especially the case for the three market value classes *MV1–MV3* where the lowest E/P firms have systematic risks that are at least 25% more than the corresponding levels for the highest E/P firms. Furthermore, the degree of bias on performance evaluation can be discerned from table 1, which shows the actual and risk-adjusted returns applicable to an arbitrage portfolio that had a 'long' position in Reinganum's highest E/P quintile, *EP5*, and a 'short' position in the lowest quintile, *EP1*.[3]

The risk-adjusted returns for the arbitrage portfolios are uniformly positive and suggest that the E/P effect is observable in all five size classes. In contrast, the use of actual or unadjusted returns to assess the earnings' yield effect introduces not only a substantial downward bias, as evidenced by column (3) in table 1, but leads to the inference, albeit incorrectly, that within

[3]The risk-adjusted returns were computed by first appropriately levering the two earnings' yield portfolios in a given size class so that they both have betas equal to unity and then by subtracting the levered returns for *EP1* from the corresponding returns for *EP5*. More specifically, the return on the levered iso-beta portfolio p, R_p, was determined as $R_p = w_p R_p + (1-w_p)R_f$, where $w_p = 1/\hat{\beta}_p$ = proportion of wealth invested in E/P portfolio p with estimated systematic risk equal to $\hat{\beta}_p$; the estimated betas were obtained from table 11 of Reinganum (1981); R_p = return on E/P portfolio p computed as the sum of the excess return shown in table 10 of Reinganum (1981) and the return on the equally-weighted NYSE–AMEX index; and R_f = return on 30-day treasury bills (proxy for risk-free asset). The propriety of this adjustment, of course, is conditional on the descriptive validity of the Sharpe–Lintner version of the CAPM.

Table 1

Mean daily return for arbitrage portfolio (*EP5–EP1*).

Market value (size) class	Actual realized return (unequal risk portfolios) (1)	Risk-adjusted return (iso-risk portfolios) (2)	Bias attributable to risk (3)=(1)−(2)
MV1	−0.0165%	0.0033%	−0.0198%
MV2	0.0028	0.0123	−0.0095
MV3	0.0083	0.0166	−0.0083
MV4	0.0203	0.0221	−0.0018
MV5	0.0119	0.0144	−0.0025
Average	0.0054	0.0137	−0.0083

the lowest size quintile, *MV1*, 'the predicted *E/P* effect may be reversed' [Reinganum (1981, p. 44)].

Section 2 describes the data, sample and other methodological considerations. The empirical results are then presented and discussed in section 3. Finally, some concluding remarks are provided in section 4.

2. Data and methodology

The following general research design was employed to examine the relations between *E/P* ratios, firm size and common stock returns. Initially, securities were partitioned into groups or classes on the basis of their *E/P* ratios and the market value of their common stocks. These groups were then combined to form (i) a set of earnings' yield portfolios, each consisting of securities with similar *E/P* ratios but simultaneously belonging to different market value classes; and (ii) a set of market value portfolios, each consisting of securities with similar market values of equity but simultaneously belonging to different *E/P* classes. In other words, the earnings' yield and market value portfolios were constructed by controlling for (i.e., randomizing) the effect of firm size and *E/P* ratios, respectively. The risk–return relationships of these portfolios then were compared and, finally, their risk-adjusted returns were tested statistically in a multivariate setting in order to determine the existence of a significant earnings' yield and/or size effects.

2.1. Data and sample

The primary data for this investigation were drawn from two sources. Accounting earnings per share, on a 12-month moving basis, for the years ended December 1962 through 1978 were collected from an annually updated version of the Compustat Prices–Dividends–Earnings (PDE) Tape. The updated version of the PDE tape is analogous to the Merged Annual

Industrial Compustat Tape produced by CRSP. Security prices, returns and common share data were obtained from the monthly stock return file of the CRSP tape.

To be included in the sample for a given year T ($T = 1963, 1964, \ldots, 1979$), a firm was required to have been listed on the New York Stock Exchange as of January 1 and have traded for at least the first month in that year. In addition, the applicable monthly rates of return, as well as the market value and accounting earnings data as of the beginning of year T must not have been missing from the data bases described above. A total of about thirteen hundred firms satisfied these requirements for at least one year, with approximately nine hundred qualifying for inclusion, on average, in each of the seventeen years investigated.

2.2. Portfolio formation and risk adjustment issues

From a methodological point of view, the earnings–price ratios and market values of the common stock of all sample firms were computed as of the beginning of each year T ($T = 1963, 1964, \ldots, 1979$). While the market value of common stock was determined as the market price times the number of shares outstanding, the E/P ratio was defined as the most recent 12-month moving earnings per share, excluding extraordinary items and discontinued operations, as of the beginning of year T scaled by the market price of common stock at that date.[4]

The computed E/P ratios for each year T then were ranked in ascending order and the quintiles from the distribution served as the basis for assigning sample firms to one of five earnings' yield portfolios, i.e., lowest quintile to portfolio *EP1*, next lowest to portfolio *EP2* and so on. As such, portfolio *EP1* includes firms with the lowest E/P ratios, while portfolio *EP5* includes those with the highest E/P ratios. These ranking and portfolio assignment procedures were repeated, but in this instance on the basis of the market value of common stock variable, to form five market value (size) portfolios with the smallest firms being included in portfolio *MV1* and the largest in *MV5*. Since the ranking and portfolio assignment on the basis of E/P ratios and market value was repeated in each of the seventeen years, the composition of the five earnings' yield and size portfolios respectively changes annually. Some summary statistics pertaining to these two sets of portfolios are included in panel A of table 2.

[4]In the case of firms with a calendar fiscal year-end, the earnings measure represents the annual primary earnings per share figure reported in the annual report to shareholders for year $T-1$. For other firms, it represents the sum of the primary earnings per share applicable to the four most recent quarters in year $T-1$; see the Compustat PDE Manual for an elaboration. Owing to the inherent difficulty in interpreting and classifying securities with negative earnings' yields, all firms with 'losses' for year $T-1$ were excluded from the sample in year T.

Table 2

Selected values from the pooled annual distributions of market values and E/P ratios over the period 1963–79 for basic (panel A) and randomized (panel B) size and earnings' yield portfolios.[a]

		Summary statistics from the distribution of:			
		Market value (millions of $)		E/P ratio	
	Portfolio	Median	Inter-quartile range	Median	Inter-quartile range
Panel A					
Market value	*MV1*	30.3	24.6	0.100	0.091
	MV2	81.6	45.3	0.094	0.087
	MV3	177.1	87.4	0.085	0.074
	MV4	414.9	211.2	0.078	0.064
	MV5	1163.8	1261.9	0.072	0.059
Earnings' yield	*EP1*	338.7	840.9	0.039	0.034
	EP2	257.6	513.4	0.063	0.054
	EP3	187.5	432.7	0.080	0.065
	EP4	135.6	321.3	0.097	0.079
	EP5	74.2	178.4	0.141	0.119
Panel B					
Market value	*MV1**	32.7	32.3	0.086	0.078
	*MV2**	94.0	79.8	0.086	0.075
	*MV3**	189.4	162.1	0.086	0.074
	*MV4**	414.8	340.3	0.084	0.071
	*MV5**	1082.3	1346.9	0.085	0.072
Earnings' yield	*EP1**	180.9	470.8	0.042	0.038
	*EP2**	176.4	460.6	0.067	0.057
	*EP3**	171.2	449.3	0.084	0.069
	*EP4**	174.2	443.1	0.103	0.080
	*EP5**	176.9	449.0	0.131	0.115

[a]The basic (or non-randomized) portfolios are formed by ranking securities, annually, on market value or earnings' yield, as appropriate. The randomized market value (earnings' yield) portfolios are formed by controlling for the differences in earnings' yield (market value), i.e., $MV1^*-MV5^*$ ($EP1^*-EP5^*$) are constructed by first partitioning firms included in the five earnings' yield (market value) classes in panel A on the basis of market values (E/P ratios) and then recombining the securities so that the effect of earnings' yield (market value) is randomized. All portfolios, basic or randomized, contain approximately the same number of firms and securities with negative earnings' yields are excluded from the sample for the given year.

For each portfolio, the market values and E/P ratios of constituent securities for each of the seventeen years investigated were pooled. The summary statistics shown are based on these inter-temporally pooled distributions.

As might be expected, the size (*MV1–MV5*) and earnings' yield (*EP1–EP5*) portfolios differ quite dramatically in terms of market value and the *E/P* ratio, respectively. More importantly however, the data in panel A indicate that these two variables appear to be negatively associated. Observe from the north-east quadrant that smaller firms, on average, seem to have somewhat higher *E/P* ratios than the larger firms. Conversely, the south-west quadrant of panel A reveals that the low *E/P* portfolios, on average, consist of larger firms when compared with the high *E/P* portfolios. Non-parametric analysis of variance (Kruskal–Wallis), moreover, confirms that the null hypotheses of equality in *E/P* ratios for the five size portfolios and the equality in market values for the five earnings' yield portfolios respectively, can be rejected at the 1% level or higher.

In order to control for the confounding effects that might arise because of the negative association discussed above, two additional sets of size and earnings' yield portfolios were constructed by randomizing with respect to the *E/P* and market value variables respectively. Consider initially the formation of the earnings' yield portfolios that are randomized in terms of firm size.

At the outset for each year T ($T=1963, 1964, \ldots, 1979$), all firms included in each of the five basic market value or size portfolios, *MV1–MV5*, were ranked from minimum to maximum on the basis of their *E/P* ratios. The quintiles from the distributions applicable to a given value class (portfolio) then were used to assign firms to one of five earnings' yields groups or subportfolios. Next, the lowest earnings' yield groups relating to the five market value classes were combined to form randomized portfolio *EP1**. In other words, if $\{S_{j,k}\}$ represents the set of securities assigned each year to earnings' yield subportfolio k ($k=1,2,\ldots,5$) in market value class j ($j=1,2,\ldots,5$), then portfolio *EP1** consists of firms contained in the subset $\{S_{j,1},\ j=1,2,\ldots,5\}$. The firms included in the other four earnings' yield groups were combined in an analogous manner to form randomized portfolios *EP2*–EP5**, i.e., portfolio *EPk** ($k=2,\ldots,5$) includes securities in $\{S_{j,k},\ j=1,2,\ldots,5\}$. Since these earnings' yield portfolios include securities drawn from the entire set of market value classes, they can be viewed as being randomized with respect to firm size. Moreover, as the size and *E/P* rankings were repeated annually, the composition of *EP1*–EP5** changes in each of the seventeen years under investigation.

The randomization approach described above was then employed to construct five market value or size portfolios, *MV1*–MV5**, which are randomized in terms of the earnings' yield variable. Essentially, the market values of firms included in each of the basic earnings' yield classes (portfolios), *EP1–EP5*, were ranked annually and the quintiles from the underlying distribution were employed to assign firms to one of five market value or size groups. Securities assigned to the ith size group (i.e., ith market value quintile) applicable to each of the five E/P classes then were combined to form randomized portfolio MVi^* ($i=1,2,\dots,5$). Some summary measures relating to these size portfolios, as well as to the earnings' yield portfolios $EP1^*$–$EP5^*$, are provided in panel B of table 2.

As in the case of the basic portfolios, the randomized size ($MV1^*$–$MV5^*$) and earnings' yield ($EP1^*$–$EP5^*$) portfolios differ quite significantly in terms of market value and the E/P ratio, respectively. However by construction, all of the size portfolios $MV1^*$–$MV5^*$ have similar E/P ratios (about 8.4–8.6% on average), while the five earnings' yield portfolios $EP1^*$–$EP5^*$ consist of firms of similar size — the market value of common stock of firms included in each of these latter portfolios, on average, is about $170–180 million. Indeed, results of statistical tests indicate that neither the null hypothesis of equality in E/P ratios for portfolios $MV1^*$–$MV5^*$ nor the null hypothesis of equality in market values for portfolios $EP1^*$–$EP5^*$ can be rejected at any reasonable level of significance.[5] This, of course, suggests that confounding effects attributable to the earnings' yield variable cannot be expected to be present in comparisons involving the size portfolios $MV1^*$–$MV5^*$. Similarly, assessments based on the earnings' yield portfolios $EP1^*$–$EP5^*$ should be free from any confounding effects stemming from the size factor.

The analysis then entailed the measurement of the risk–return relationships for the various size and earnings' yield portfolios. First, for each year T ($T=1963,1964,\dots,1979$), monthly returns for the various portfolios were computed as an arithmetic average of the corresponding returns for constituent firms, i.e., the monthly returns of securities included in a given portfolio were equally weighted. While the assignment of firms to the various size and earnings' yield portfolios in year T are based on market value and E/P ratio data as of January 1 of that year, the applicable returns are computed for the 12-month period commencing April 1 in order to minimize the potential for biases that can be attributed to quarterly earnings releases for firms with interim periods ending December 31.[6] Next, two measures of risk — standard deviation of monthly returns[7] and systematic risk — were

[5]Non-parametric analysis of variance (Kruskal–Wallis) was employed in this regard; see Hollander and Wolfe (1973) or Conover (1980) for an elaboration. The computed Kruskal–Wallis test statistics — distributed approximately as a chi-square random variable with 4 degrees of freedom and based on more than 15,000 observations (pooled annual data) — are 2.24 and 5.17 for the null hypotheses pertaining to portfolios $MV1^*$–$MV5^*$ and $EP1^*$–$EP5^*$, respectively. These amounts are well below even the critical value at the 10% level of significance, i.e., $\Pr[\chi^2(4)>7.78]=0.90$.

[6]Sensitivity analysis reveals that the conclusions of this paper are not altered in any substantive way if the computation of portfolio returns for year T are computed for the 12-month period commencing July 1, October 1 or January 1 of the following year, respectively. Evidence on this issue is presented and discussed at a later point.

[7]Standard deviation of monthly returns was selected as a measure of risk largely because of the analytical results of Levy (1978), who demonstrates that the variance of a security (portfolio) becomes the dominant factor in the return generating process when the asset either is not held widely or is not held by diversified investors. This result led Levy to posit that 'the classic

estimated for each portfolio. The systematic risk measure in particular was determined in the context of the two-parameter capital asset pricing model:

$$r_{p,t}-r_{f,t}=\hat{\delta}_p+\hat{\beta}_p[r_{m,t}-r_{f,t}], \quad (1)$$

where

$r_{p,t}$ = return on portfolio p in month t; computed as the cross-sectional arithmetic average of the realized monthly returns on securities included in p;

$r_{f,t}$ = return on 'risk-free' asset in month t; measured as the realized monthly return on 30-day U.S. treasury bills;

$r_{m,t}$ = return on the 'market' portfolio in month t; measured by the CRSP Index of NYSE firms;[8]

$\hat{\delta}_p$ = differential or abnormal return for portfolio p (estimated OLS intercept);

$\hat{\beta}_p$ = systematic risk for portfolio p (estimated OLS slope).

Finally, the configurations of the risk-adjusted differential or abnormal returns, $\hat{\delta}_p$, for the various market value and E/P portfolios were examined in order to ascertain the presence of size and earnings' yield effects respectively. More specifically, the null hypothesis of no size effect on risk-adjusted returns was tested in the context of Hotelling's multivariate T^2 methodology by assessing whether the vector of $\hat{\delta}_p$ applicable to the five size portfolios *MV1*–MV5** is significantly different from zero.[9] The null hypothesis of no earnings' yield effect was tested in an analogous manner by employing the $\hat{\delta}_p$ pertaining to the portfolios *EP1*–EP5**.

3. Empirical results

3.1. Rates of return for size and E/P portfolios

At the outset, consider some descriptive statistics pertaining to the rates of

CAPM may be the approximate equilibrium model for stocks of firms which are held by many investors (for example, AT&T), but not for small firms whose stocks are held by a relatively small group of investors' (p. 650).

[8]Both the 'equally-weighted' and 'value-weighted' versions of this index are employed in this paper in order to determine the extent to which the results are sensitive to the choice of a surrogate for the 'market' portfolio.

[9]See, for example, Morrison (1967) for an elaboration on the properties of the Hotelling's T^2-test of means. The use of an analysis of covariance (i.e., cross-sectional 'Chow' test) framework to test the null hypothesis of equal $\hat{\delta}_p$ was rejected because the critical assumption of equal variances was clearly violated in the case of the size portfolios. Furthermore, the Hotelling test can be viewed as a generalized version of the multivariate counterparts formulated to test for the equality of coefficients within Zellner's seemingly unrelated regression framework; a description of the Zellner framework can be found, for example, in Theil (1971). Note that the Hotelling T^2-methodology simultaneously tests all possible linear combinations of δ_p, including the ones formulated in the context of the Zellner framework.

return earned by the various size and earnings' yield portfolios. Table 3 shows the mean monthly return, $\bar{r}_p$, and related standard deviation, $\sigma(\tilde{r}_p)$, for (i) the basic market value and earnings' yield portfolios (panel A); (ii) their randomized counterparts — *MV1*–MV5** and *EP1*–EP5** (panel B); and (iii) the equally-weighted and value-weighted versions of a NYSE-based 'market' index (panel C). In addition, the mean return per unit of standard deviation, $\bar{r}_p/\sigma(\tilde{r}_p)$, or a reciprocal of the coefficient of variation of monthly returns for the various portfolios is shown in column (3), and the differences between that amount and the corresponding values for the two versions of the 'market' index, respectively, are shown in columns (4) and (5) of table 3.

A survey of the results in panel A indicates that, consistent with previously published findings, the common stock of small NYSE firms appear to have earned, on average, higher monthly returns than the common stock of large firms: the smallest market value quintile, for instance, experienced an average monthly return of 1.38% during the seventeen years ending March 1980, while the largest had earned about 0.59% per month.[10] Similarly, portfolios of firms with high *E/P* ratios seem to have earned higher rates of return than their low *E/P* counterparts. Note, for example, that the highest earnings' yield quintile earned about 1.38% per month versus about 0.72% earned by the lowest quintile. More interestingly however, while the higher returns for the small firms appear to be simultaneously accompanied by generally higher levels of variability (risk), as evidenced by the $\sigma(\tilde{r}_p)$ values in column (2) of table 3, this is clearly not the case for the high *E/P* portfolios. As a consequence, while the dispersion in the mean return per unit of variability measure, $\bar{r}_p/\sigma(\tilde{r}_p)$, for the five basic *E/P* portfolios largely parallels that for its unscaled counterpart (i.e., $\bar{r}_p$), it is substantially less in the case of the basic size portfolios.

Turning to panel B of table 3, one finds the results for the market value and earnings' yield portfolios that were constructed by controlling for the confounding effects stemming from differences in the *E/P* and size variables respectively. Although the preceding remarks on the configuration of the rates of return, by and large, are also applicable to these two sets of randomized portfolios, an important difference should be noted. Observe from column (3) that the mean monthly returns per unit of variability, $\bar{r}_p/\sigma(\tilde{r}_p)$, earned by the portfolios of small firms (*MV1** and *MV2**) are, for

[10]These results are based, as mentioned previously, on the sample of firms drawn from the merged Compustat–CRSP data base. In order to test for the existence of a survivorship bias, an additional five market value portfolios were constructed by partitioning all firms contained in the monthly return file of the CRSP tape. The rates of return for these latter portfolios then were compared with those for *MV1–MV5* and the vector of differences between the two sets of returns was tested for statistical significance. Results of Hotelling's T^2-test of means indicates that the difference in returns for the two sets of market value portfolios is not significantly different from zero at any reasonable probability level. This, of course, suggests that the effects of a significant survivorship bias on common stock returns are not present in this study.

Table 3

Monthly rates of return for basic (panel A) and randomized (panel B) market value and earnings' yield portfolios and for *EI*s and *VI*s of the 'market' portfolio (panel C) in the period 4/63–3/80: Some summary statistics.[a]

	Portfolio	$\bar{r}_p$ (1)	$\sigma(\tilde{r}_p)$ (2)	$\{\bar{r}_p/\sigma(\tilde{r}_p)\}$ (3)	$\{\bar{r}_p/\sigma(\tilde{r}_p) - \bar{r}_{EI}/\sigma(\tilde{r}_{EI})\}$ (4)	$\{\bar{r}_p/\sigma(\tilde{r}_p) - \bar{r}_{VI}/\sigma(\tilde{r}_{VI})\}$ (5)
Panel A						
Market value	*MV1*	0.0138	0.0704	0.196	0.021	0.046
	MV2	0.0111	0.0607	0.183	0.008	0.033
	MV3	0.0089	0.0554	0.161	−0.014	0.011
	MV4	0.0083	0.0509	0.163	−0.012	0.013
	MV5	0.0059	0.0437	0.134	−0.040	−0.015
Earnings' yield	*EP1*	0.0072	0.0592	0.122	−0.053	−0.028
	EP2	0.0070	0.0539	0.129	−0.046	−0.020
	EP3	0.0087	0.0531	0.163	−0.012	0.013
	EP4	0.0114	0.0540	0.210	0.035	0.060
	EP5	0.0138	0.0605	0.228	0.053	0.078
Panel B						
Market value	*MV1**	0.0127	0.0701	0.181	0.006	0.031
	*MV2**	0.0100	0.0597	0.167	−0.007	−0.018
	*MV3**	0.0089	0.0548	0.163	−0.011	0.014
	*MV4**	0.0089	0.0509	0.175	0.000	0.025
	*MV5**	0.0075	0.0435	0.172	−0.003	0.022
Earnings' yield	*EP1**	0.0084	0.0623	0.135	−0.040	−0.015
	*EP2**	0.0079	0.0552	0.143	−0.032	−0.007
	*EP3**	0.0086	0.0530	0.162	−0.013	0.012
	*EP4**	0.0108	0.0529	0.203	0.029	0.054
	*EP5**	0.0123	0.0552	0.223	0.048	0.073
Panel C						
Equally-weighted index (*EI*)		0.0101	0.0577	0.175	0.0	0.025
Value-weighted index (*VI*)		0.0064	0.0428	0.150	−0.025	0.0

[a]The basic (or non-randomized) portfolios are formed by ranking securities on market value or earnings' yield, as appropriate. The randomized market value (earnings' yield) portfolios are formed by controlling for inter-portfolio differences in the earnings' yield (market value) variable.

Symbols are defined as follows: $\bar{r}_p$ = mean monthly return on portfolio *p*; $\sigma(\tilde{r}_p)$ = standard deviation of monthly return on portfolio *p*; and $\bar{r}_p/\sigma(\tilde{r}_p)$ = reciprocal of the coefficient of variation of monthly returns for portfolio *p*. The subscripts *EI* and *VI* represent equally-weighted and value-weighted indexes of NYSE firms, respectively.

all practical purposes, virtually identical to the amounts earned by their large firm counterparts (*MV4** and *MV5**). In other words, the higher mean monthly returns experienced by *MV1** and *MV2** are accompanied by proportionately higher levels of variability in returns so that their coefficients of variation [i.e., the reciprocal of $\bar{r}_p/\sigma(\tilde{r}_p)$ shown in column (3)] are largely similar to the levels reported for portfolios *MV4** and *MV5**. It would appear, accordingly, that after controlling for confounding *E/P* effects, the entire difference in the realized returns for small and large NYSE firms can be explained by or attributed to differences in risk (variability) levels.[11] The lack of homogeneity in the $\bar{r}_p/\sigma(\tilde{r}_p)$ statistic for portfolios *EP1**–*EP5**, on the other hand, confirms that the differential performance of the earnings' yield portfolios cannot be explained along these lines, i.e., the difference in returns between low and high *E/P* firms cannot be attributed to differences in variability (risk) or firm size.

Finally, the relative performance of the experimental portfolios vis-à-vis the equally-weighted and value-weighted versions of the NYSE index can be discerned from columns (4) and (5). A comparison of the statistics reported in these two columns reveals that the results are quite sensitive to the choice of a 'market' index. In this regard, note that the $\bar{r}_p/\sigma(\tilde{r}_p)$ statistic for the equally-weighted index is about 17% higher than the corresponding value for its value-weighted counterpart, i.e., 0.175 in the case of the former versus 0.150 for the latter (see panel C).

3.2. CAPM risk–return relationships

Although the preceding analysis provides some insights into the risk–return relations for the various experimental portfolios, it fails to address an important issue. Essentially, to what extent are the risk–return relations observed for these portfolios consistent with the relationships predicted by the Sharpe–Lintner version of the two-parameter capital asset pricing model?[12] In order to examine this issue, eq. (1) was estimated for each of the size and earnings' yield portfolios by employing ordinary least squares. The equally-weighted NYSE index was assumed to be the surrogate for the 'market' portfolio and selected results pertaining to these asset pricing regressions are shown in table 4; the results corresponding to the use of the value-weighted NYSE index as a surrogate 'market' portfolio are introduced at a later point. Specifically, table 4 includes: (1) the estimated systematic risk for experimental portfolio *p*, $\hat{\beta}_p$; (2) the coefficient of correlation between the return on portfolio *p*, net of the risk-free rate, and the corresponding net return on the 'market' portfolio, $\rho(r'_p, r'_m)$; (3) the estimated abnormal or

[11]The issue as to whether the difference in returns of small and large NYSE firms can also be explained in terms of systematic risk per se is addressed in the next subsection. Recall that the variability measure, $\sigma(\tilde{r}_p)$, includes both systematic and unsystematic risk.

[12]Results of sensitivity analysis reported in Basu (1977) indicate that the relative performance rankings, at least for the *E/P* portfolios, are insensitive to the choice of either the Sharpe–Lintner or Black's 'zero-beta' versions of the CAPM. Consequently, only the Sharpe–Lintner specification is employed here. It is important to note that while empirical research by Black, Jensen and Scholes (1972) and Fama and Macbeth (1973) suggests that the zero-beta version might be a more appropriate specification, Gibbons' (1982) findings tend to question the substantive content of both versions of the CAPM.

Table 4

Some CAPM results for basic (panel A) and randomized (panel B) market value and earnings' yield portfolios based on the equally-weighted NYSE–CRSP index.[a]

	Portfolio	CAPM statistic $\hat{\beta}_p$ (1)	$\rho(r'_p, r'_m)$ (2)	$\hat{\delta}_p$ (3)	$t(\hat{\delta}_p)$ (4)	Hotelling's test results $\omega(\hat{\delta}_p)$ (5)	$F(\hat{\delta})$ (6)
Panel A							
Market value	*MV1*	1.189	0.976	0.0027	2.46	0.66	1.70
	MV2	1.040	0.989	0.0008	1.22	0.35	
	MV3	0.947	0.985	−0.0009	−1.33	−0.57	
	MV4	0.854	0.966	−0.0010	−1.09	0.81	
	MV5	0.686	0.904	−0.0025	−1.90	−0.25	
Earnings' yield	*EP1*	0.959	0.934	−0.0027	−1.78	0.26	3.55
	EP2	0.910	0.973	−0.0026	−2.99	−0.43	
	EP3	0.908	0.984	−0.0009	−1.38	−0.32	
	EP4	0.918	0.980	0.0017	2.25	0.33	
	EP5	1.025	0.976	0.0036	3.90	1.16	
Panel B							
Market value	*MV1**	1.189	0.980	0.0015	1.61	3.60	0.86
	*MV2**	1.026	0.990	−0.0002	−0.39	−1.34	
	*MV3**	0.938	0.988	−0.0008	−1.36	−4.53	
	*MV4**	0.861	0.974	−0.0004	−0.53	3.30	
	*MV5**	0.705	0.933	−0.0009	−0.90	−0.03	
Earnings' yield	*EP1**	1.038	0.962	−0.0020	−1.59	0.32	2.62
	*EP2**	0.935	0.977	−0.0018	−2.24	−0.88	
	*EP3**	0.908	0.986	−0.0010	−1.63	−2.59	
	*EP4**	0.901	0.982	0.0012	1.73	1.70	
	*EP5**	0.934	0.975	0.0026	3.30	2.45	

[a]Based on monthly data for the period 4/63–3/80 and ordinary least squares. The basic (or non-randomized) portfolios are formed by ranking securities on market value or earnings' yield, as appropriate. The randomized market value (earnings' yield) portfolios are formed by controlling for inter-portfolio differences in the earnings' yield (market value) variable.

Symbols are defined as follows: $\hat{\beta}_p$ = estimated systematic risk for portfolio p; $\rho(r'_p, r'_m)$ = coefficient of correlation between the return on portfolio p (net of the risk-free rate), r'_p, and that on the market index (net of the risk-free rate), r'_m; $\hat{\delta}_p$ = estimated differential (abnormal) return – estimated intercept for OLS regression of r'_p on r'_m; $t(\hat{\delta}_p)$ = t-value for $\hat{\delta}_p = 0$. Results for Hotelling's T^2-test of mean $\hat{\delta}_p$ are shown in columns (5) and (6): $\omega(\hat{\delta}_p)$ = vector of normalized weights associated with the T^2-statistic for $\hat{\delta} = 0$; and $F(\hat{\delta})$ = F-value corresponding to the T^2-statistic that the vector $\hat{\delta} = 0$. Selected fractiles from $\tilde{F}(n,d)$ distribution are:

	0.90	0.95	0.99
$\tilde{F}(5,120)$	1.90	2.29	3.17
$\tilde{F}(5,\infty)$	1.85	2.21	3.02

differential return for portfolio p, $\hat{\delta}_p$; and (4) the t-value pertaining to the null hypothesis $\hat{\delta}_p = 0$. Also shown are the results of Hotelling's T^2-test performed on the vector of abnormal returns applicable to the alternative sets of size and earnings' yield portfolios. While column (6) contains the value of the F-

statistic corresponding to the computed T^2-statistic relating to the hypothesis that the abnormal return vector $\hat{\delta}$ is equal to zero, the vector of normalized weights associated with the T^2-statistic, $\omega(\hat{\delta}_p)$, is shown in column (5).

Consider initially the results for the market value portfolios. It will be readily noted that the level of systematic risk ($\hat{\beta}_p$) declines quite dramatically and in a monotonic way as one moves from the portfolios consisting of small firms to those consisting of the larger ones. Since the correlation coefficients reported in column (2) suggest that these portfolios are equally well diversified (at least approximately), the difference in $\hat{\beta}_p$ can be attributed principally to the difference in the standard deviation of returns [see $\sigma(\tilde{r}_p)$ in table 3]. Moreover, consistent with the discussion in the previous section, size portfolio *MV1* seems to have earned a positive abnormal return of about 0.27% per month, while its large firm counterpart, *MV5*, experienced a negative abnormal return of about 0.25% per month. The magnitude of $\hat{\delta}_p$ for these two classes of firms, however, is considerably smaller in the case where the effects of differences in *E/P* ratios are controlled. Observe that the abnormal returns experienced by *MV1** and *MV5** amount to only about 0.15% and −0.09% per month, respectively. Results of both the univariate *t*-test and Hotelling's multivariate T^2-test, moreover, indicate that the $\hat{\delta}_p$ for portfolios *MV1*–MV5** are not statistically significant. In other words, the estimated abnormal returns for the five randomized size portfolios, as well as all linear combinations thereof, are not stochastically different from zero. This result, of course, is consistent with the hypothesis that market value or firm size per se did not have a significant effect on the risk-adjusted returns of NYSE firms during the seventeen-year period ending March 1980.

An examination of the CAPM results for the earnings' yield portfolios, on the other hand, leads to an entirely different conclusion regarding the effect of *E/P* ratios on performance. At the outset, observe from columns (1) and (2) of panel B that not only are the randomized portfolios *EP1*–EP5** equally well diversified, but they also have largely similar levels of systematic risk, at least when compared to their market value counterparts. This latter phenomenon suggests that the earnings' yield portfolios can be expected to be relatively less sensitive to problems with the assumed validity of the Sharpe–Lintner version of the two-parameter model than the market value counterparts.

These similarities notwithstanding, it would appear that the five earnings' yield portfolios have earned abnormal returns that are by no means homogeneous. Note in this connection that the abnormal returns experienced by these earnings' yield portfolios range from −0.20% per month for *EP1** to 0.26% per month for *EP5**. Consequently, an arbitrage portfolio that had a 'long' position in *EP5** and, simultaneously, a 'short' position in *EP1** could have earned about 0.46% per month (or about 5.5% per annum) more than a randomly selected portfolio of equivalent risk. In addition, Hotelling's T^2-test confirms that from a statistical viewpoint the vector of $\hat{\delta}_p$ for portfolios *EP1*–EP5** is significant at the 5% level or higher. The results in column (4) indicate that this can be attributed principally to the three randomized portfolios *EP3*–EP5**. In short, these findings are consistent with the statement that there appears to have been a significant relation between *E/P* ratios and risk-adjusted returns for NYSE firms during the period April 1963–March 1980.

Although the preceding discussion has been based on CAPM results obtained in the context of the equally-weighted index, sensitivity analysis reveals that those conclusions are not altered in any substantive way if the value-weighted NYSE index was used instead. Similarly, an application of the Dimson (1979) methodology leads to the inference that the relative abnormal return performance of the randomized earnings' yield portfolios cannot be explained in terms of measurement biases stemming from non-synchronous or infrequent trading. Some evidence regarding these issues is included in the appendix to this paper.

3.3. Results on interaction effects

To summarize, the empirical results presented above confirm the presence of a significant earnings' yield effect on the NYSE during the period April 1963–March 1980. But, was this effect homogeneous across alternative market value classes? In other words, to what extent did the *E/P* effect vary between small and large NYSE firms? An examination of this issue should permit one to determine whether or not there existed an interaction effect between earnings' yield and firm size.

Actual rates of return and selected market model results for earnings' yield portfolios pertaining to each of five market value classes are presented in table 5. These earnings' yield portfolios were constructed by ranking, annually, securities included in a given market value class (i.e., size portfolio *MV1–MV5*) on the basis of their *E/P* ratios, and the market model regression was specified in excess return form to include lagged, contemporaneous and leading market return terms [see eq. (2) in the appendix]. The Dimson-based market model was considered to be particularly appropriate in this instance because, as discussed in the appendix, it attempts to control for the effect of estimation biases due to infrequent trading and, therefore, should permit a better assessment of the interaction between the *E/P* effect and firm size.

In general the *E/P* effect, which was observed in the case of the aggregate sample of NYSE firms, also seems to be present in each of the market value categories. To see this more clearly, fig. 1 contains a scatter diagram of $\bar{r}_p/\sigma(\tilde{r}_p)$ and $\hat{\delta}_p$ versus market value for the alternative sets of earnings' yield portfolios. In all five size classes, the common stock of high *E/P* firms (i.e., designated 4 and 5) have experienced higher risk-adjusted returns than the

Actual returns and selected results for market model with lagged, contemporaneous and leading market return variables: Market value portfolios classified by earnings' yield.[a]

Portfolio		Actual returns			Equally-weighted NYSE index					Value-weighted NYSE index				
MV class	*EP* class	$\bar{r}_p$ (1)	$\sigma(\tilde{r}_p)$ (2)	$\bar{r}_p/\sigma(\tilde{r}_p)$ (3)	$\sum\hat{\beta}_p$ (4)	$\hat{\rho}$ (5)	$\hat{\delta}_p$ (6)	$t(\hat{\delta}_p)$ (7)	$F(\hat{\delta})$ (8)	$\sum\hat{\beta}_p$ (9)	$\hat{\rho}$ (10)	$\hat{\delta}_p$ (11)	$t(\hat{\delta}_p)$ (12)	$F(\hat{\delta})$ (13)
MV1	*1*	0.0123	0.0817	0.151	1.366	0.941	−0.0001	−0.08	3.79	1.821	0.791	0.0042	1.20	3.27
	2	0.0137	0.0708	0.193	1.197	0.956	0.0025	1.72		1.622	0.826	0.0060	2.16	
	3	0.0119	0.0683	0.174	1.159	0.957	0.0009	0.64		1.587	0.831	0.0043	1.60	
	4	0.0156	0.0675	0.231	1.079	0.954	0.0051	3.62		1.485	0.829	0.0082	3.11	
	5	0.0155	0.0727	0.213	1.133	0.947	0.0048	2.88		1.556	0.804	0.0079	2.63	
MV2	*1*	0.0105	0.0725	0.145	1.194	0.946	−0.0007	−0.41	3.05	1.671	0.861	0.0027	1.06	3.46
	2	0.0083	0.0634	0.132	1.073	0.962	−0.0022	−1.77		1.521	0.866	0.0009	0.40	
	3	0.0108	0.0593	0.183	1.011	0.966	0.0007	0.64		1.417	0.871	0.0036	1.75	
	4	0.0112	0.0580	0.194	0.900	0.952	0.0018	1.44		1.237	0.862	0.0044	2.14	
	5	0.0145	0.0608	0.238	1.005	0.953	0.0043	3.36		1.402	0.852	0.0072	3.26	
MV3	*1*	0.0068	0.0654	0.103	1.089	0.925	−0.0038	−2.21	2.38	1.564	0.897	−0.0008	−0.38	2.72
	2	0.0061	0.0571	0.106	0.937	0.938	−0.0037	−2.65		1.369	0.886	−0.0011	−0.58	
	3	0.0085	0.0552	0.155	0.917	0.962	−0.0011	−1.01		1.318	0.907	0.0015	0.93	
	4	0.0112	0.0545	0.206	0.905	0.956	0.0017	1.51		1.247	0.891	0.0043	2.50	
	5	0.0120	0.0572	0.209	0.903	0.945	0.0025	1.89		1.271	0.880	0.0051	2.67	
MV4	*1*	0.0076	0.0618	0.123	0.910	0.866	−0.0020	−0.92	1.30	1.372	0.914	0.0005	0.27	1.91
	2	0.0062	0.0528	0.118	0.828	0.916	−0.0029	−1.96		1.235	0.916	−0.0007	−0.44	
	3	0.0071	0.0497	0.142	0.754	0.939	−0.0016	−1.36		1.099	0.916	0.0005	0.34	
	4	0.0098	0.0516	0.190	0.810	0.946	0.0008	0.69		1.180	0.907	0.0031	2.01	
	5	0.0107	0.0517	0.208	0.829	0.947	0.0016	1.39		1.166	0.904	0.0040	2.59	
MV5	*1*	0.0048	0.0527	0.092	0.668	0.760	−0.0034	−1.43	1.79	1.099	0.902	−0.0018	−1.11	1.80
	2	0.0052	0.0466	0.111	0.651	0.840	−0.0030	−1.69		1.062	0.955	−0.0014	−1.42	
	3	0.0046	0.0450	0.102	0.622	0.881	−0.0034	−2.26		0.966	0.952	−0.0017	−1.79	
	4	0.0059	0.0444	0.132	0.639	0.887	−0.0022	−1.53		0.963	0.920	−0.0004	−0.37	
	5	0.0089	0.0442	0.202	0.646	0.899	0.0008	0.61		0.946	0.912	0.0026	2.07	

[a]Based on monthly data for period 4/63–3/80 and ordinary least squares. Portfolios were formed by ranking securities on the basis of their earnings' yield (*EP*) in a given market value (*MV*) class.

Symbols are defined as follows: $\bar{r}_p$ = mean monthly return on portfolio *p*; $\sigma(\tilde{r}_p)$ = standard deviation of monthly return on portfolio *p*; $\sum\hat{\beta}_p$ = aggregated (Dimson) systematic risk coefficient for portfolio *p*, i.e., sum of the slope coefficients for lagged contemporaneous and leading monthly market return variables; $\hat{\rho}$ = estimated coefficient of multiple correlation for market model in excess form, with lagged, contemporaneous and leading market return variables; $\hat{\delta}_p$ = estimated differential (abnormal) return − estimated OLS intercept; $t(\hat{\delta}_p)$ = *t*-value for $\delta_p = 0$; and $F(\hat{\delta})$ = *F*-value corresponding to Hotelling's T^2-test statistic that the vector $\boldsymbol{\delta} = 0$. Selected fractiles from the $\tilde{F}(n,d)$ distribution are reported in table 4.

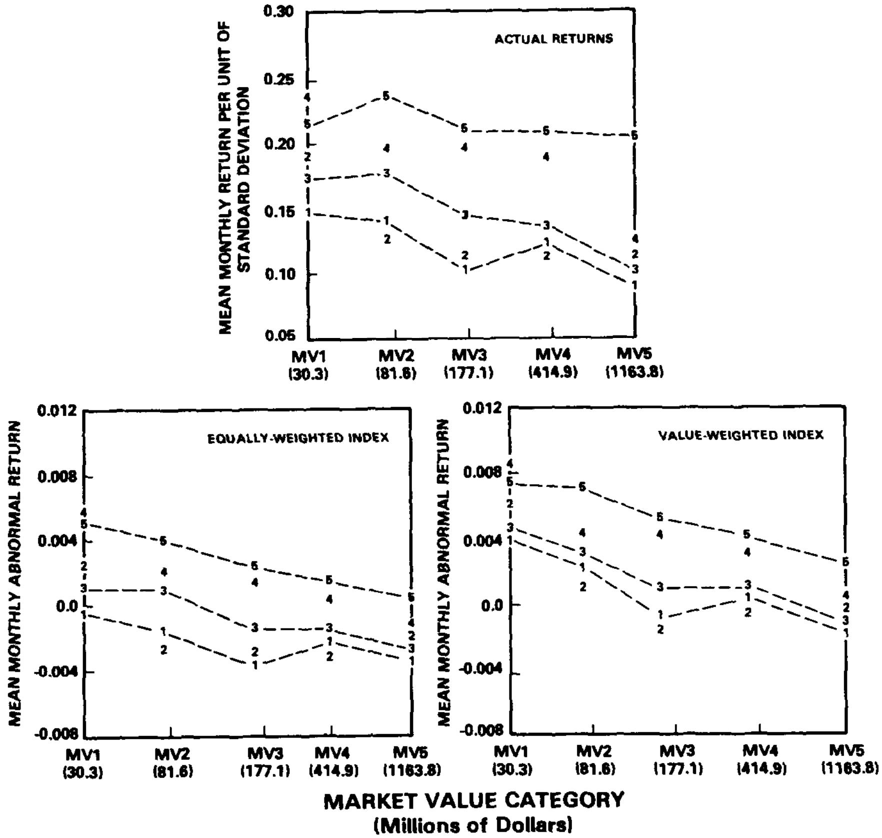

Fig. 1. Plots of mean monthly return per unit of standard deviation, $\bar{r}_p/\sigma(r_p)$, and mean monthly abnormal return, $\bar{\delta}_p$, for earnings' yield portfolios by market value category in the period April 1963–March 1980.

common stock of their low E/P counterparts (i.e., 1 and 2). A closer examination of the configuration of $\bar{\delta}_p$ in fig. 1, however, suggests that the earnings' yield effect becomes somewhat weaker as one moves from the smallest size class (*MV1*) to the largest (*MV5*), i.e., the difference in the abnormal returns between the high and low E/P portfolios seems to be somewhat smaller for size category *MV5* when compared to *MV1* for instance. This inference, in fact, is confirmed by Hotelling's T^2-test results, which are reported in columns (8) and (13) of table 5. In particular, note that the vectors of abnormal returns for only size classes *MV1* to *MV3* are significant at the 5% level or higher. A survey of the t-values shown in columns (7) and (12) — coupled with a scrutiny of the normalized weights associated with the T^2-statistic — indicate that this result can be attributed, by and large, to the high E/P portfolios 4 and 5. It would appear, therefore, that the earnings' yield effect is not entirely independent of firm size.

Further evidence on this latter point is provided in table 6, which shows more directly the effect of varying firm size per se on the performance of securities included in each of five mutually exclusive E/P categories. As before, the size portfolios in table 6 were constructed by partitioning firms included in a given earnings' yield class (i.e., portfolios *EP1–EP5*) on the basis of the market value of their common stock. With the exception of *EP5*, the abnormal return vectors for the other four earnings' yield classes are not significantly different from zero at the 5% level or higher. The normalized vector of weights associated with the maximum T^2-statistic for category *EP5*, moreover, reveals that the rejection of the null hypothesis can be attributed to the abnormal return performance of not only small high E/P firms, but also the somewhat larger high E/P firms included in size groups 2–4.[13] In addition, multiple comparison tests lead one to infer that the abnormal returns experienced by the smallest firms (i.e., group 1) are not stochastically different — at even the 10% level — from the corresponding returns for firms included in any of the other four size portfolios (i.e., groups 2–5), a remark which applies to all five earnings' yield categories.

These results, in short, are consistent with the statement that while the earnings' yield and market value anomalies appear, in fact, to be interrelated,

[13] The normalized weights underlying the T^2-statistics for *EP5* are as follows:

Market index	Size portfolio/group 1	2	3	4	5
Equally-weighted	0.246	0.233	0.268	0.168	0.085
Value-weighted	0.130	−0.035	0.373	0.269	0.193

Note that about 52% of the weight underlying the maximum T^2 statistic for the equally-weighted case can be accounted for by size portfolios 3–5. The comparable figure for the statistic pertaining to the situation involving the value-weighted index is 85%. Incidentally, the quartiles from the five pooled distributions of market values (as of January 1963–79) for each of the size portfolios applicable to *EP5* are as follows:

Market value (millions of $)	Size portfolio/group 1	2	3	4	5
Lower quartile	13.9	34.2	57.5	102.0	311.1
Median	21.7	44.0	74.7	159.5	569.8
Upper quartile	29.5	55.1	100.8	238.5	987.8

A comparison of the median values shown above with the distribution of market values for the entire sample (see panel A of table 1) indicates that size groups 3–5 cannot be said to contain small firms per se, i.e., those belonging to the lowest market value quintile (*MV1*) on the exchange. On the contrary, they include firms with market values comparable to those contained in the second, third and fourth quintiles of the NYSE.

Table 6

Actual returns and selected results for market model with lagged, contemporaneous and leading market return variables: Earnings' yield portfolios classified by market value.[a]

Portfolio		Actual returns			Equally-weighted NYSE index					Value-weighted NYSE index				
EP class	*MV* class	$\bar{r}_p$ (1)	$\sigma(\tilde{r}_p)$ (2)	$\bar{r}_p/\sigma(\tilde{r}_p)$ (3)	$\sum\hat{\beta}_p$ (4)	$\hat{\rho}$ (5)	$\hat{\delta}_p$ (6)	$t(\hat{\delta}_p)$ (7)	$F(\hat{\delta})$ (8)	$\sum\hat{\beta}_p$ (9)	$\hat{\rho}$ (10)	$\hat{\delta}_p$ (11)	$t(\hat{\delta}_p)$ (12)	$F(\hat{\delta})$ (13)
EP1	*1*	0.0120	0.0790	0.152	1.299	0.940	0.0002	0.12	1.58	1.759	0.832	0.0040	1.32	1.43
	2	0.0082	0.0702	0.116	1.147	0.904	−0.0028	−1.31		1.665	0.895	0.0004	0.21	
	3	0.0051	0.0617	0.083	0.975	0.894	−0.0048	−2.51		1.430	0.921	−0.0021	−1.27	
	4	0.0055	0.0551	0.099	0.804	0.870	−0.0035	−1.88		1.258	0.938	−0.0015	−1.09	
	5	0.0053	0.0488	0.109	0.584	0.729	−0.0025	−1.06		0.993	0.898	−0.0011	−0.72	
EP2	*1*	0.0097	0.0726	0.134	1.215	0.954	−0.0016	−1.03	2.01	1.641	0.824	0.0020	0.70	0.49
	2	0.0068	0.0587	0.115	0.985	0.945	−0.0032	−2.41		1.415	0.883	−0.0005	−0.25	
	3	0.0063	0.0547	0.115	0.904	0.932	−0.0032	−2.33		1.319	0.902	−0.0007	−0.44	
	4	0.0065	0.0514	0.126	0.771	0.917	−0.0023	−1.60		1.150	0.914	−0.0002	−0.13	
	5	0.0055	0.0447	0.124	0.638	0.890	−0.0025	−1.76		0.998	0.956	−0.0008	−0.92	
EP3	*1*	0.0123	0.0678	0.181	1.185	0.963	0.0012	0.91	1.30	1.633	0.847	0.0046	1.83	1.51
	2	0.0079	0.0600	0.131	1.007	0.963	−0.0022	−1.98		1.429	0.866	0.0006	0.29	
	3	0.0080	0.0550	0.146	0.892	0.959	−0.0014	−1.31		1.290	0.911	0.0011	0.67	
	4	0.0086	0.0503	0.170	0.811	0.946	−0.0005	−0.39		1.186	0.913	0.0018	1.25	
	5	0.0066	0.0432	0.153	0.608	0.897	−0.0013	−0.97		0.920	0.926	0.0004	0.31	
EP4	*1*	0.0136	0.0696	0.195	1.155	0.957	0.0026	1.86	1.56	1.601	0.828	0.0059	2.18	1.64
	2	0.0121	0.0564	0.215	0.944	0.962	0.0024	2.18		1.296	0.878	0.0051	2.72	
	3	0.0110	0.0561	0.195	0.891	0.951	0.0015	1.25		1.247	0.871	0.0041	2.11	
	4	0.0111	0.0529	0.209	0.815	0.941	0.0020	1.62		1.151	0.882	0.0044	2.50	
	5	0.0090	0.0448	0.201	0.674	0.912	0.0007	0.58		0.965	0.912	0.0027	2.07	
EP5	*1*	0.0159	0.0719	0.221	1.156	0.946	0.0050	3.05	3.59	1.560	0.807	0.0084	2.82	2.23
	2	0.0151	0.0682	0.221	1.053	0.951	0.0047	3.21		1.469	0.820	0.0077	2.83	
	3	0.0143	0.0614	0.232	0.976	0.950	0.0044	3.26		1.361	0.838	0.0072	3.05	
	4	0.0129	0.0590	0.219	0.951	0.949	0.0031	2.40		1.309	0.870	0.0059	2.90	
	5	0.0109	0.0519	0.210	0.802	0.934	0.0020	1.51		1.146	0.894	0.0042	2.60	

[a]Based on monthly data for the period 4/63–3/80 and ordinary least squares. Portfolios were formed by ranking securities on the basis of their market value (*MV*) in a given earnings' yield (*EP*) class.

Symbols are defined as follows: $\bar{r}_p$ = mean monthly return on portfolio p; $\sigma(\tilde{r}_p)$ = standard deviation of monthly return on portfolio p; $\sum\hat{\beta}_p$ = aggregated (Dimson) systematic risk coefficient for portfolio p, i.e., sum of the slope coefficients for lagged contemporaneous and leading monthly market return variables; $\hat{\rho}$ = estimated coefficient of multiple correlation for market model in excess form, with lagged, contemporaneous and leading market return variables; $\hat{\delta}_p$ = estimated differential (abnormal) return − estimated OLS intercept; $t(\hat{\delta}_p)$ = t-value for $\hat{\delta}_p = 0$; and $F(\hat{\delta})$ = F-value corresponding to Hotelling's T^2-test statistic that the vector $\hat{\delta} = 0$. Selected fractiles from the $\tilde{F}(n, d)$ distribution are reported in table 4.

the effect of differences in firm size on common stock returns of NYSE firms, at least for the period investigated, seems to have been of secondary importance when compared with the effect of E/P ratios.

3.4. A test for earnings information effects

One final issue remains outstanding. Essentially, to what extent can the differential performance of the various earnings' yield portfolios be attributed to the release of fourth quarter earnings information? Recall that while the randomized E/P and size portfolios were formed by employing market value and earnings' yield information as of the beginning of a given year, the computation of their monthly rates of return was lagged by three months on the assumption that the earnings number used in the determination of the E/P ratio would not have been available prior to April 1. In order to assess the degree to which the results reported above are sensitive to this assumption, the risk–return analysis was repeated but in this instance by using portfolio returns which reflected, instead of a three-month lag, a six-, nine- and twelve-month lag, respectively, i.e., the returns for the randomized portfolios for year T were computed for the twelve-month period commencing July 1 and October 1 of year T, as well as January 1 of year $T+1$ respectively.

Table 7 shows for each of these three alternative dates, the estimated abnormal return for randomized portfolio p, $\hat{\delta}_p$, the related t-value in parenthesis, and the F-statistic for Hotelling's T^2-test of the null hypothesis that the abnormal return vector, $\hat{\delta}$, is equal to zero. To facilitate comparisons with results discussed previously, the abnormal return estimates based on portfolio returns that reflected a three-month lag (i.e., commencing April 1 of each year) are also included in table 7. It will be readily noted that the relative performance of both sets of randomized portfolios is virtually insensitive to the assumption as to whether the portfolio holding periods reflect a three-, six-, nine- or twelve-month lag from the December year-end.

Furthermore, the issue as to whether the abnormal return performance of the randomized E/P portfolios was homogeneous over the twelve-month period following the assumed earnings announcement date of April 1 also was tested. This was accomplished by first classifying the monthly abnormal returns for each of the five randomized portfolios into two groups representing the first half of year T (i.e., April–September) and the second half (i.e., October–March of the following year), respectively. The difference between the vectors of abnormal returns applicable to these two time frames then were tested in the context of the Hotelling T^2-methodology. The computed F-values associated with the null hypothesis of no difference in abnormal returns between the two periods are 0.68 and 0.27 for the situations involving the equally-weighted and value-weighted market indexes,

Table 7

The effect of altering the holding period commencement date on the performance of the randomized portfolios: Equally-weighted (panel A) and value-weighted (panel B) indexes.[a]

Holding period for year T commences as of the beginning of:	$\hat{\delta}_p$ (t-value in parentheses) *MV1** (1)	*MV2** (2)	*MV3** (3)	*MV4** (4)	*MV5** (5)	Hotelling's $F(\hat{\delta})$ (6)	$\hat{\delta}_p$ (t-value in parentheses) *EP1** (7)	*EP2** (8)	*EP3** (9)	*EP4** (10)	*EP5** (11)	Hotelling's $F(\hat{\delta})$ (12)
Panel A												
April, year T	0.0015	−0.0002	−0.0008	−0.0004	−0.0009	0.86	−0.0020	−0.0018	−0.0010	0.0012	0.0026	2.62
	(1.61)	(−0.39)	(−1.36)	(−0.53)	(−0.90)		(−1.59)	(−2.24)	(−1.63)	(1.73)	(3.30)	
July, year T	0.0018	−0.0007	−0.0008	−0.0007	−0.0012	1.14	−0.0021	−0.0018	−0.0012	0.0012	0.0023	3.05
	(1.84)	(−1.22)	(−1.27)	(−0.87)	(−1.12)		(−1.79)	(−2.17)	(−1.99)	(1.79)	(2.76)	
Oct., year T	0.0021	−0.0008	−0.0008	−0.0008	−0.0017	1.58	−0.0020	−0.0017	−0.0013	0.0010	0.0022	2.65
	(2.15)	(−1.30)	(−1.43)	(−0.96)	(−1.51)		(−1.71)	(−2.02)	(−2.22)	(1.44)	(2.40)	
Jan., year $T+1$	0.0020	−0.0012	−0.0009	−0.0012	−0.0017	1.69	−0.0029	−0.0020	−0.0015	0.0009	0.0026	3.50
	(1.98)	(−1.88)	(−1.60)	(−1.46)	(−1.45)		(−2.60)	(−2.38)	(−2.43)	(1.31)	(2.81)	
Panel B												
April, year T	0.0056	0.0031	0.0022	0.0023	0.0011	1.47	0.0014	0.0011	0.0019	0.0041	0.0056	3.20
	(2.13)	(1.76)	(1.60)	(2.05)	(1.85)		(0.83)	(0.78)	(1.36)	(2.73)	(3.24)	
July, year T	0.0059	0.0027	0.0023	0.0020	0.0009	1.61	0.0012	0.0012	0.0017	0.0042	0.0054	3.56
	(2.28)	(1.51)	(1.68)	(1.84)	(1.45)		(0.73)	(0.82)	(1.26)	(2.77)	(3.13)	
Oct., year T	0.0065	0.0029	0.0024	0.0021	0.0006	1.97	0.0015	0.0015	0.0018	0.0042	0.0055	3.22
	(2.51)	(1.62)	(1.76)	(1.94)	(0.95)		(0.93)	(1.02)	(1.30)	(2.75)	(3.07)	
Jan., year $T+1$	0.0063	0.0025	0.0023	0.0017	0.0005	1.98	0.0006	0.0012	0.0016	0.0040	0.0058	3.81
	(2.42)	(1.34)	(1.63)	(1.47)	(.084)		(0.35)	(0.82)	(1.11)	(2.67)	(3.31)	

[a]Based on monthly data for the period 1963–80 and ordinary least squares. The randomized portfolios — *MV1**–*MV5** and *EP1**–*EP5** — were formed annually on the basis of market value and earnings' yield information as of January 1, year T, while the monthly returns were computed for the twelve-month period commencing the alternative dates indicated above.

Symbols are defined as follows: $\hat{\delta}_p$ = estimated differential (abnormal) return for portfolio p — estimated OLS intercept for conventional market model in excess return form; and $F(\hat{\delta}) = F$-value corresponding to Hotelling's T^2-statistic for the test that the vector $\hat{\delta} = 0$. Selected fractiles from the $\tilde{F}(n, d)$ distribution reported in table 4.

respectively. Since these $F(5,97)$-statistics are well below even the critical value at the 10% level [i.e., $F(5,120)=1.90$], it seems reasonable to infer that the abnormal return performance of the randomized E/P portfolios was not significantly different during the two non-overlapping six-month periods following earnings release.

Accordingly, it seems that the E/P effect described previously cannot be attributed to information effects arising from the release of earnings per se. Indeed, these results constitute the strongest evidence for the Ball (1978) hypothesis that the earnings' yield anomaly can be better explained in terms of misspecification of the two-parameter equilibrium model rather than in terms of information efficiency of capital markets.

4. Some concluding remarks

The empirical findings reported in this paper indicate that, at least during the 1963–80 time period, the returns on the common stock of NYSE firms appear to have been related to earnings' yield and firm size. In particular, the common stock of high E/P firms seem to have earned, on average, higher risk-adjusted returns than the common stock of low E/P firms. This E/P effect, furthermore, is clearly significant even after experimental control was exercised over differences in firm size, i.e., after the effect of size, as measured by the market value of common stock, was randomized across the high and low E/P groups. On the other hand, while the common stock of small NYSE firms appear to have earned considerably higher returns than the common stock of large NYSE firms, the size effect virtually disappears when returns are controlled for differences in risk and E/P ratios.

Further analysis for possible effects of interaction between E/P ratios and market values of common stock suggests that firm size may have an indirect effect on the risk-adjusted returns of NYSE common stocks. Essentially, it appears the strength of the earnings' yield effect seems to vary inversely with firm size. More specifically, the results show that the E/P effect is sufficiently weak for larger than average NYSE firms that from a stochastic viewpoint it either is not significant or, at best, is marginally significant. In addition, the empirical findings indicate that the E/P anomaly cannot be attributed to earnings information effects and, as such, attest to the descriptive validity of Ball's hypothesis that the E/P anomaly probably implies a misspecification of the equilibrium pricing model rather than capital market efficiency per se.[14]

[14]A contrary position can be found in Dreman (1978), who argues that the E/P anomaly can be better explained in terms of a mispricing of securities. According to him, this mispricing can be attributed largely to the bias in market expectations regarding earnings and earnings growth of low and high E/P firms. Specifically, while future earnings/growth of high E/P firms are believed to be systematically underestimated, those for low E/P firms are systematically overestimated. The important issue as to why the behavior of market participants is not influenced by 'learning', however, is not addressed.

In conclusion, the findings presented here suggest that the effect of earnings' yield and size on expected returns is substantially more complicated than previously documented in the literative. While neither E/P nor size can be considered to cause expected returns, the evidence lends credence to the view that, most likely, both variables are just proxies for more fundamental determinants of expected returns for common stocks.

Appendix

This appendix presents and discusses some empirical results on the extent to which the CAPM findings reported in section 3.2 are sensitive to: (1) the choice of a market index, and (2) the effect of measurement biases attributable to infrequent or non-synchronous trading. The evidence indicates that those findings are, indeed, robust with respect to both of these issues.

A.1. Market index issue

The risk–return relationships discussed in section 3.2 were determined on the basis of the two-parameter model and the equally-weighted NYSE index produced by CRSP. In the light of Roll's (1977, 1978) criticisms of empirical tests of the CAPM, coupled with the results reported in table 3, it seemed appropriate to test the sensitivity of these findings to the use of an alternative surrogate for the 'market' portfolio. Table 8 presents the CAPM-parameter estimates for the various size and earnings' yield portfolios that were obtained by employing the value-weighted NYSE index in the context of the conventional market model. A quick survey of those results reveals that while the relative performance of the basic and randomized E/P and MV portfolios is identical to that presented in table 4, at least three facets should be highlighted.

First, as might be expected given the weighting scheme underlying the market index, the correlation coefficients shown in column (2) indicate that the level of diversification for large firm portfolios is considerably higher than that for the small firms. On the other hand, this characteristic is not shared by the earnings' yield portfolios *EP1*–EP5** because they are randomized with respect to firm size. Second, estimates of abnormal returns, $\hat{\delta}_p$, seem to be particularly sensitive to the use of the alternative versions of the NYSE index. For example, the value-weighted index yields a $\hat{\delta}_p$ of 0.0056 for portfolio *EP5**, which is more than double the 0.0026 estimate obtained by using the equally-weighted index. Third, some caution should be exercised in interpreting the results pertaining to the relative performance of the randomized size portfolios *MV1*–MV5** in particular. Since Hotelling's T^2-test indicates the vector of $\hat{\delta}_p$ for these five portfolios is not stochastically different from zero, the most appropriate inference is the returns earned by

Table 8

Some CAPM results for basic (panel A) and randomized (panel B) market value and earnings' yield portfolios based on the value-weighted NYSE–CRSP index.[a]

		CAPM statistic				Hotelling's test results	
	Portfolio	$\hat{\beta}_p$ (1)	$\rho(r'_p, r'_m)$ (2)	$\hat{\delta}_p$ (3)	$t(\hat{\delta}_p)$ (4)	$\omega(\hat{\delta}_p)$ (5)	$F(\hat{\delta})$ (6)
Panel A							
Market value	*MV1*	1.360	0.829	0.0067	2.44	−0.94	1.75
	MV2	1.256	0.888	0.0042	2.15	−0.51	
	MV3	1.200	0.928	0.0022	1.49	2.29	
	MV4	1.137	0.957	0.0016	1.57	−1.89	
	MV5	1.008	0.988	−0.0006	−1.14	2.05	
Earnings' yield	*EP1*	1.304	0.945	0.0002	0.18	1.10	3.65
	EP2	1.164	0.926	0.0003	0.19	−3.72	
	EP3	1.139	0.919	0.0020	1.36	−2.62	
	EP4	1.133	0.899	0.0047	2.82	1.76	
	EP5	1.224	0.867	0.0070	3.30	4.48	
Panel B							
Market value	*MV1**	1.378	0.844	0.0056	2.13	0.64	1.47
	*MV2**	1.263	0.907	0.0031	1.76	−0.23	
	*MV3**	1.195	0.935	0.0022	1.60	−0.92	
	*MV4**	1.131	0.952	0.0023	2.05	0.60	
	*MV5**	0.998	0.982	0.0011	1.85	0.91	
Earnings' yield	*EP1**	1.340	0.925	0.0014	0.83	0.45	3.20
	*EP2**	1.192	0.926	0.0011	0.78	−0.77	
	*EP3**	1.146	0.926	0.0019	1.36	−2.47	
	*EP4**	1.128	0.914	0.0041	2.73	1.74	
	*EP5**	1.153	0.894	0.0056	3.24	2.05	

[a]Based on monthly data for the period 4/63–3/80 and ordinary least squares. The basic (or non-randomized) portfolios are formed by ranking securities on market value or earnings' yield, as appropriate. The randomized market value (earnings' yield) portfolios are formed by controlling for inter-portfolio differences in the earnings' yield (market value) variable.

Symbols are defined as follows: $\hat{\beta}_p$ = estimated systematic risk for portfolio p; $\rho(r'_p, r'_m)$ = coefficient of correlation between the return on portfolio p (net of the risk-free rate), r'_p, and that on the market index (net of the risk-free rate), r'_m; $\hat{\delta}_p$ = estimated differential (abnormal) return – estimated intercept for OLS regression of r'_p on r'_m; $t(\hat{\delta}_p) = t$-value for $\hat{\delta}_p = 0$. Results for Hotelling's T^2-test of mean $\hat{\delta}_p$ are shown in columns (5) and (6): $\omega(\hat{\delta}_p)$ = vector of normalized weights associated with the T^2-statistic for $\hat{\boldsymbol{\delta}} = 0$; and $F(\hat{\boldsymbol{\delta}}) = F$-value corresponding to the T^2-statistic that the vector $\hat{\boldsymbol{\delta}} = 0$. Selected fractiles from $\tilde{F}(n, d)$ distribution are reported in table 4.

both small and large firms are statistically indistinguishable from the corresponding returns predicted by the Sharpe–Lintner version of the CAPM.

A.2. Non-synchronous/infrequent trading issue

Consequent to Roll's (1981) arguments regarding the effect of measurement biases that might arise because of non-synchronous or infrequent trading especially in the case of small firms, the relative performance of the various randomized portfolios was also tested in the context of the methodology proposed by Dimson (1979). More specifically, Dimson shows that when assets are subject to infrequent trading the sum of the coefficients pertaining to the lagged, contemporaneous and leading 'market' return variables provides an unbiased estimate of the asset's systematic risk. Accordingly, the following market model regression was estimated and selected results are included in table 9:

$$r_{p,t}-r_{f,t}=\hat{\delta}_p+\hat{\beta}'_p(r_{m,t-1}-r_{f,t-1})+\hat{\beta}_p(r_{m,t}-r_{f,t})$$
$$+\hat{\beta}''_p(r_{m,t+1}-r_{f,t+1}),\qquad t=1,2,\dots,204. \tag{2}$$

Observe that although the aggregated β coefficients are generally larger than the conventional systematic risk estimates, especially in the case of the value-weighted index, the estimated abnormal returns $\hat{\delta}_p$ are virtually identical to those discussed previously (see tables 4 and 8). This seems to be particularly true for the randomized earnings' yield portfolios, *EP1*–EP5**. In short, application of the Dimson technique suggests that the effect of estimation biases stemming from infrequent trading is not sufficiently large to alter the inferences and conclusions discussed in section 3.2 regarding the relative abnormal return performance of the randomized earnings' yield and size portfolios.

Table 9

Estimated parameters (with t-values in parentheses) for market model with lagged, contemporaneous, leading market return variables: Randomized market value (panel A) and earnings' yield (panel B) portfolios.[a]

Estimated equation: $r'_{p,t}=\hat{\delta}_p+\hat{\beta}'_p r'_{m,t-1}+\hat{\beta}_p r'_{m,t}+\hat{\beta}''_p r'_{m,t+1}$

	Equally-weighted NYSE index						Value-weighted NYSE index					
	Estimated parameters				Aggregated beta	Hotelling's	Estimated parameters				Aggregated beta	Hotelling's
Portfolio	$\hat{\delta}_p$ (1)	$\hat{\beta}'_p$ (2)	$\hat{\beta}_p$ (3)	$\hat{\beta}''_p$ (4)	$(\hat{\beta}'_p+\hat{\beta}_p+\hat{\beta}''_p)$ (5)	$F(\hat{\delta})$ (6)	$\hat{\delta}_p$ (7)	$\hat{\beta}'_p$ (8)	$\hat{\beta}_p$ (9)	$\hat{\beta}''_p$ (10)	$(\hat{\beta}'_p+\hat{\beta}_p+\hat{\beta}''_p)$ (11)	$F(\hat{\delta})$ (12)
Panel A												
*MV1**	0.0015	0.045	1.187	−0.029	1.202	0.89	0.0050	0.221	1.369	0.049	1.639	1.37
	(1.54)	(2.58)	(69.7)	(−1.72)			(1.95)	(3.61)	(22.8)	(0.82)		
*MV2**	−0.0002	−0.001	1.026	0.002	1.027		0.0027	0.136	1.257	0.062	1.455	
	(−0.40)	(−0.08)	(100.7)	(0.24)			(1.56)	(3.31)	(31.2)	(1.54)		
*MV3**	−0.0007	−0.022	0.940	0.009	0.927		0.0019	0.083	1.190	0.056	1.329	
	(−1.25)	(−2.09)	(91.2)	(0.89)			(1.41)	(2.59)	(38.0)	(1.79)		
*MV4**	−0.0002	−0.043	0.865	0.008	0.831		0.0021	0.037	1.129	0.047	1.213	
	(−0.29)	(−3.04)	(62.1)	(0.58)			(1.92)	(1.41)	(44.4)	(1.86)		
*MV5**	−0.0007	−0.055	0.711	0.005	0.661		0.0011	−0.012	0.998	0.018	1.004	
	(−0.66)	(−2.82)	(37.2)	(0.24)			(1.86)	(−0.90)	(74.1)	(1.36)		

Panel B												
*EP1**	−0.0020	0.021	1.037	−0.013	1.045	2.93	0.0010	0.147	1.337	0.022	1.505	3.19
	(−1.64)	(1.00)	(49.2)	(−0.61)			(0.61)	(3.81)	(35.4)	(0.59)		
*EP2**	−0.0018	−0.011	0.935	0.013	0.937		0.0008	0.098	1.187	0.077	1.362	
	(−2.25)	(−0.75)	(64.4)	(0.90)			(0.54)	(2.89)	(35.6)	(2.32)		
*EP3**	−0.0009	−0.021	0.910	0.004	0.893		0.0016	0.082	1.142	0.054	1.277	
	(−1.49)	(−1.95)	(85.2)	(0.39)			(1.17)	(2.48)	(35.3)	(1.65)		
*EP4**	0.0014	−0.032	0.906	−0.007	0.867		0.0039	0.066	1.125	0.031	1.222	
	(2.07)	(−2.59)	(73.9)	(−0.59)			(2.62)	(1.85)	(32.1)	(0.88)		
*EP5**	0.0028	−0.033	0.939	−0.002	0.903		0.0054	0.070	1.149	0.049	1.268	
	(3.40)	(−2.15)	(62.1)	(−0.16)			(3.13)	(1.70)	(28.5)	(1.21)		

[a] Based on monthly data for the period 4/63–3/80 and ordinary least squares.

The symbols are defined as follows: $r'_{p,t}$ = return on portfolio p in month t in excess of the corresponding risk-free rate, i.e., $r'_{p,t} = r_{p,t} - r_{f,t}$; $r'_{m,t}$ = return on the market index in month t in excess of the corresponding risk-free rate, i.e., $r'_{m,t} = r_{m,t} - r_{f,t}$; $\hat{\delta}_p$ = estimated differential (abnormal) return – estimated OLS intercept; $\hat{\beta}'_p$ = slope coefficient for lagged market return; $\hat{\beta}_p$ = slope coefficient for contemporaneous market return; $\hat{\beta}''_p$ = slope coefficient for leading market return; and $F(\hat{\delta}) = F$-value corresponding to Hotelling's T^2-statistic for the test that vector $\hat{\delta} = 0$. Selected fractiles from the $\tilde{F}(n, d)$ distribution are reported in table 4.

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