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MISSPECIFICATION OF CAPITAL ASSET PRICING
Empirical Anomalies Based on Earnings' Yields and Market Values

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This study documents empirical anomalies which suggest that either the simple one-period capital asset pricing model (CAPM) is misspecified or that capital markets are inefficient. In particular, portfolios based on firm size or earnings/price (E/P) ratios experience average returns systematically different from those predicted by the CAPM. Furthermore, the 'abnormal' returns persist for at least two years. This persistence reduces the likelihood that these results are being generated by a market inefficiency Rather, the evidence seems to indicate that the equilibrium pricing model is misspecified. However, the data also reveals that an E/P effect does not emerge after returns are controlled for the firm size effect, the firm size effect largely subsumes the E/P effect. Thus, while the E/P anomaly and value anomaly exist when each variable is considered separately, the two anomalies seem to be related to the same set of missing factors, and these factors appear to be more closely associated with firm size than E/P ratios

1. Introduction

The foundations of current financial theory are being challenged by empirical research that suggests that corporate earnings and firm size data can be used to create portfolios that earn 'abnormal' returns. The reported 'abnormal' returns range from just a few percent per year to almost forty percent. Such results, if true, are clearly inconsistent with the simple one period capital asset pricing models of Sharpe (1964), Lintner (1965) and Black (1972). However, the methodologies used to establish some of these anomalous results often contain important flaws [see Ball (1978)].

In sections 2 and 3, stock returns after the announcement of quarterly earnings are analyzed in a framework that avoids these problems. Two basic results emerge from the analysis of the quarterly data:

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(1) During 1976 and 1977, one could not systematically earn 'abnormal' returns by forming portfolios, on the basis of standardized unexpected earnings as defined by Latané and Jones (1977).
(2) During this same time period, earnings/price ratios could be used to create portfolios that systematically earned 'abnormal' returns of six to seven percent per quarter. Furthermore these 'abnormal' returns persisted for at least two quarters.

These results, jointly considered, are consistent with Ball's proposition that the pricing mechanism of the CAPM is misspecified but that capital markets are informationally efficient. By construction, the unexpected earnings portfolios are based upon an ephemeral event, so that any 'abnormal' returns on these portfolios most likely would reflect an informational lag. However, no such 'abnormal' returns are detected. In contrast, the persistence of 'abnormal' returns in the E/P portfolios is a phenomenon which probably reflects permanent, underlying factors of equilibrium pricing rather than a gross market inefficiency.

Section 4 explores the E/P anomaly in greater detail over longer historical time periods. The analysis is based upon portfolios formed with annual earnings/price ratios. The historical analysis documents the persistence and extent of the E/P effect between high and low E/P securities. Indeed, extremely high E/P securities experienced 'abnormal' returns of more than seven percent per year in the second year after being selected for inclusion in the high E/P portfolio.

The relationship between the E/P anomaly and value anomaly [see Banz (1978)] is investigated in section 5. The evidence indicates that the anomalous return behavior of low market value firms is perhaps even more astounding than the E/P anomaly. A portfolio of fifty small firms experienced average 'abnormal' returns of nearly fifteen percent per year for at least two years. Indeed, after controlling 'abnormal' returns for an E/P effect, a large and persistent market value effect is still detected. However, after controlling 'abnormal' returns for market value effects, one could not detect an independent E/P effect. Thus, although an E/P anomaly and value anomaly are detected when each variable is considered separately, the two anomalies seem to be related to the same set of factors. Furthermore, these factors appear to be more closely associated with firm size than with E/P ratios. The value anomaly largely subsumes any E/P effect.

2. Tests of the CAPM based on standardized unexpected earnings

The history of research that explores portfolio selection based on unexpected earnings is rather rich. Jones and Litzenberger (1970), Brown and

Kennelly (1972), Latané, Jones and Rieke (1974), Latané and Jones (1977), Joy, Litzenberger and McEnnally (1977), and Watts (1978), among others, have claimed that unanticipated earnings forecasts, based on publicly available information, can be used to systematically predict stock prices. These studies employ various models to forecast earnings. The forecasts are then used to derive an unexpected earnings figure. In this study, a model of Latané, Jones and Rieke (1974) and Latané and Jones (1977) is used. The reason for the choice is simple. Latané and Jones do not claim that their model is statistically superior to others or even measures true 'market' expectations. Rather, they simply claim that their model produces 'abnormal' profits. That is, on the basis of their standardized unexpected earnings (SUE), Latané and Jones report a mean spread between their high and low SUE portfolios of about forty percent on an annual basis. No other study reported such remarkable findings. However, a predictive test of the Latané and Jones technique might not be expected to generate such a large spread. For insofar as their model of quarterly earnings is misspecified [for example, see Foster (1977)], tests based on portfolios formed using their estimator of unexpected earnings could be biased against finding 'abnormal' returns.

The major result to be reported here is in marked contrast to the Latané and Jones findings. The evidence indicates that significant 'abnormal' returns cannot be systematically earned by grouping securities on the basis of their SUE. The drop from about forty percent to nothing is indeed precipitous. The major differences between this study and the Latané and Jones work are as follows. First, the earnings data are collected from the *Wall Street Journal* and not the Compustat tapes. Also, announcement dates are collected and not assumed. Furthermore, the data analyzed in this study are outside the sample period considered by Latané and Jones. Hence, any benefits of model selection due to hindsight are eliminated. Finally, the tests in this section are explicitly formulated in the CAPM framework.

2.1. The data

Beginning with the fourth quarter of 1975, corporate quarterly earnings and announcement dates are collected primarily from the *Wall Street Journal* for eight quarters. The net income figures for the previous twenty quarters, which are needed to calculate SUE, are obtained primarily from a 1978 version of the Compustat tapes. Also, most of the common shares data used to scale earnings are collected from the Compustat tapes. The sample consists of 566 New York Stock Exchange and American Stock Exchange stocks with fiscal year ends in December. The sample is a subset of 577 companies that Latané and Jones analyzed in a paper presented at the 1977

American Finance Association Meetings.[1] The data for their 577 companies extend through December of 1975.

Only 535 firms survived until the end of the sample period. Table 1 displays the distribution of quarterly earnings announcement dates by month of release after the quarter, i.e., the +1, +2, or +3 month. Firms with both positive and negative earnings announcements are included in table 1. The vast majority of firms reveal their first, second, and third quarter earnings within one month of the fiscal quarter end. Except for fourth quarter results, only a handful of firms delay release until the +3 month.

Table 1
Distribution of quarterly earnings announcements by month of release.

	Month of release[a]		
Quarter	+1	+2	+3
4/75	124	325	105
1/76	455	109	1
2/76	453	103	4
3/76	424	128	2
4/76	124	316	106
1/77	441	105	3
2/77	427	117	1
3/77	426	105	4

[a]The +1, +2, and +3 months are the first, second, and third months following the fiscal quarter close, respectively. The +1, +2, and +3 columns contain the number of firms in the sample that publicly released their quarterly earnings during that month.

2.2. *Portfolio selection*

The heart of the portfolio selection procedure is the earnings per share (EPS) forecast for each security. Latané and Jones found an extrapolative trend model with seasonal dummies to be an efficacious model. Their EPS forecast is defined as

$$\hat{E}_{21}=\hat{\theta}_0+\hat{\theta}_1\cdot 21+\hat{\theta}_2\cdot 441+\hat{\theta}_3 S_1+\hat{\theta}_4 S_2+\hat{\theta}_5 S_3, \tag{1}$$

[1]Latané and Jones supplied me with a list of the 577 companies that they used in their analysis. These companies had thirty-five quarters of complete data for earnings, dividends, and prices from June 1967 through December 1975 on a quarterly Compustat tape. All companies had fiscal years ending on December 31. For analysis in this paper 566 of the 577 companies were used. The numbers differ because ten companies were not contained on the CRSP daily master and return tapes and because I was not able to find the earnings announcements for one multinational company, Unilever Ltd.

where

$\hat{E}_{21}$ ≡ forecasted EPS at time 21 when the world is at time 20;
$\hat{\underline{\theta}}$ ≡ least-squares regression coefficients; $\hat{\theta}_1$ is the estimated coefficient on the time trend, $\hat{\theta}_2$ is the estimated coefficient on the time trend squared.
S ≡ seasonal dummies; $S_1=1$ if second quarter, $S_2=1$ if third quarter, $S_3=1$ if fourth quarter.

For each EPS forecast, the previous 20 quarters of EPS data are used to estimate $\hat{\underline{\theta}}$. For example, to compute $\hat{E}_{22}$ one calculates the regression coefficients using data from the 2nd through 21st quarters of the sample. The time variable still only runs from 1 through 20.

With the predicted value, E_t, in hand the unexpected EPS is defined as

$$UE_t = E_t - \hat{E}_t, \tag{2}$$

where E_t is the reported EPS for quarter t. UE_t is not a residual since E_t was not included as a data point in the regression from which $\hat{E}_t$ was predicted. The unexpected earnings per share is scaled by the standard error of estimate from the regression equation associated with the prediction. The rescaled numbers are called standardized unexpected earnings (SUE). Thus,

$$\text{SUE}_{it} = (E_{it} - \hat{E}_{it})/\hat{\sigma}_{it} \tag{3}$$

is the SUE for company i in quarter t.

The +1 month SUE portfolios are based only on corporate quarterly earnings released in the +1 month after the fiscal quarter close. The high SUE portfolio contains the twenty securities with the highest SUE; the low SUE portfolio consists of twenty firms with the lowest SUE. Each twenty security portfolio is subdivided into two equal-weighted portfolios with ten securities. One portfolio contains the ten securities with the highest estimated betas, and the other consists of the ten firms with the lowest estimated betas. Weights are selected for the two ten-security portfolios so that the overall twenty security portfolio has an estimated beta equal to one.[2]

2.3. Results

For the +1 month SUE portfolios, daily portfolio returns from four slightly different three month holding periods are analyzed; the periods begin at the end of the months +1, +2, +3, and +4 following the fiscal quarter close.[3] For example, consider the firms that released fourth quarter earnings

[2]This weighting scheme was independently derived and used by Watts (1978).

[3]Appendix 1 in Reinganum (1979) contains an analysis of the +2 month SUE portfolios. The results for these portfolios were consistent with the +1 month findings.

in January, a +1 month. The SUE portfolio returns are analyzed in each of the following four three-month periods: (February, March, April), (March, April, May), (April, May, June), and (May, June, July). This technique is like four different trading rules. Under the first rule, the investor assumes the portfolio positions immediately after the information is known and holds the position for three months maintaining the initial portfolio weights on a daily basis. Under the second, third, and fourth rules, the investor only assumes the position after delays of one, two and three months, respectively, and then holds it for three months. One can think of this scheme as a way to detect if 'abnormal' returns persist through time.

Since the beta risk of the high and low SUE portfolios is constructed to be one, the difference in the expected returns between these portfolios should equal zero under the null hypothesis that the CAPM accurately describes asset pricing. Table 2 contains the estimated means of the differences in daily returns between the high and low +1 month SUE portfolios. Portfolio weights on individual securities are based upon the betas estimated with the sixty days of daily data immediately preceding the three month holding periods using an equal-weighted NYSE-AMEX market index.[4] Table 2 reveals that even if one acted immediately after the extreme SUE securities were identified, the mean 'abnormal' returns are not statistically different from zero. The difference in daily means between the high SUE and low SUE portfolios for the overall period is only 0.000280 and its standard error is 0.000295. As might be expected, 'abnormal' returns do not appear as one delays action. Hence, the SUE evidence does not contradict the CAPM.

2.4. *Concluding remarks*

The results reported in this section indicate that 'abnormal' returns cannot be earned over the period studied by constructing portfolios on the basis of firms' standardized unexpected earnings as defined by Latané and Jones. While these results are consistent with the CAPM, they suggest an interpretation that extends beyond the CAPM. In particular, the results offer support for the assumption of market efficiency. The logic behind this statement stems from the fact that the composition of the high and low SUE portfolios naturally changes from quarter to quarter. Thus, one does not expect this technique to identify a group of securities that persistently exhibit 'abnormal' returns, because the selection criterion is based on an ephemeral event. Instead, the SUE tests are designed to detect one-time 'blips' in the

[4]Reinganum (1979) also uses portfolio weights extimated during the portfolio holding periods. Although these weights cannot be used for trading rules, they can be used for sensitivity analysis. While the weights differ from those used in table 2, the conclusions are the same. The mean 'abnormal' returns are not statistically different from zero. The SUE do not demonstrate ability to systematically discriminate between risk-adjusted returns.

Table 2
Mean differences in daily returns between the high and low standardized unexpected earnings portfolios of identical beta risk.

Quarter	Portfolio position taken at end of month[a] +1	+2	+3	+4
All	0.280 (0.950)	0.158 (0.533)	0.410 (1.485)	−0.057 (−0.180)
4/75	−1.795 (−2.227)	−1.013 (−1.585)	−0.416 (−0.653)	−0.156 (−0.265)
1/76	0.782 (0.746)	1.178 (1.024)	2.120 (2.182)	0.550 (0.637)
2/76	0.700 (0.823)	0.279 (0.310)	0 212 (0 282)	0.163 (0.218)
3/76	0.479 (0.591)	0.537 (0.735)	0.287 (0.387)	0.344 (0.427)
4/76	−0.236 (−0.265)	0.081 (0.099)	1.125 (1.343)	0.103 (0.065)
1/77	1.025 (1.430)	0.202 (0.293)	0 213 (0.310)	−0.970 (−1.372)
2/77	1.067 (1.291)	0.603 (0.682)	0.151 (0.175)	−0.355 (−0.510)
3/77	0.189 (0.297)	−0.633 (−0.804)	−0.449 (−0.650)	−0.106 (−0.127)

[a]The portfolios analyzed in this table only contain firms that released quarterly earnings in the month immediately following the fiscal quarter close. The identical beta portfolio weights are estimated using the sixty days of daily return data immediately preceding the three month portfolio holding periods. Betas are market model estimates using an equal-weighted NYSE–AMEX market index. Reported daily means are multiplied by 1000. T-values are in parentheses. The +1 through +4 months refer to the first through fourth months following the fiscal quarter close. The means for each quarter are based upon three months of trading day returns, regardless of whether the three-month period begins at the end of the +1, +2, +3, or +4 month.

returns of specific securities. Thus, if extraordinary returns systematically appeared, this might suggest either a market disequilibrium or an equilibrium with informational lags due to transaction and search costs. But the evidence reported in this section does not support this scenario. Rather, the evidence, along with the findings of the following sections, suggests another interpretation. Namely, that when the criteria for inclusion in a portfolio are based on ephemeral events, and when these events are accurately measured so that only information actually available to investors is used, then tests of market efficiency may not be very sensitive to the model of equilibrium employed. That is, market efficiency tests on ephemeral signals are probably robust with respect to reasonable equilibrium models. Indeed, tests in subsequent sections indicate that the CAPM may not be an entirely adequate model of equilibrium.

3. Tests of the CAPM based on quarterly *E/P* ratios

The proposition that high earnings/price ratio securities outperform low earnings/price ratio securities dates back at least to Nicholson (1960). As recently as 1977 Basu claims that the returns of extreme *E/P* portfolios reflected a market inefficiency. In this section, the major result to be reported is that an 'abnormal' return of about 0.1 percent per day on average can be earned by forming portfolios based on *E/P* ratios. That is, the mean return of a high *E/P* portfolio exceeds the mean return of a low *E/P* portfolio by about 0.1 percent per day, even after adjusting for beta risk. Ignoring transaction costs, this mean spread is greater than six percent per quarter, and it persists for at least two quarters.

3.1. The data

The quarterly earnings data and firm sample are identical to those in section 2. Earnings/price ratios are computed as the quarterly net income divided by the value of the common stock. The value of the common stock is calculated with both pre- and post-earnings announcements prices. The closing price on the last day of the fiscal quarter is the pre-announcement price. Thus, prices used in this ratio do not reflect information contained in the public announcement of earnings. The post-announcement price is the closing one on the day the earnings announcement appeared in the *Wall Street Journal.* If capital markets rapidly incorporate information into prices, then rankings based upon post-announcement prices should reflect only the equilibrium effect between *E/P* ratios and asset pricing; that is, scaling by post- rather than pre-announcement prices eliminates any noise due to unanticipated earnings from the equilibrium relationship between *E/P* ratios and asset pricing.

3.2. Portfolio selection

Portfolios are formed on the basis of the ranked quarterly *E/P* ratios for firms that released earnings during the +1 month after the fiscal quarter end. Hence, portfolios are formed on the basis of earnings information that is at most one month old. The twenty highest and twenty lowest firms in the ranking with positive *E/P* ratios become the high and low *E/P* portfolios, respectively. In a manner identical to that described in section 2, each twenty security portfolio is constructed to have an estimated beta equal to one.

3.3. Results

Since the high and low E/P portfolios are constructed to have identical beta risks, the null hypothesis is that the difference in expected returns equals zero. Table 3 presents the estimated mean differences in daily returns between the high and low E/P portfolios formed with earnings released in the $+1$ months.[5] Portfolio weights on individual securities are based upon the betas estimated with the sixty days of daily return data immediately preceding the three-month holding periods using an equal-weighted NYSE–AMEX market index.[6] Results are reported for portfolio positions assumed at the ends of months $+1$, $+2$, $+3$, and $+4$ and held for three months in each case. This technique is designed to test whether 'abnormal' returns persist through time.

For the overall period, the mean 'abnormal' returns are positive; the null hypothesis that the mean difference between portfolio returns is zero is rejected. The data also reveal that the magnitudes of the 'abnormal' returns across purchase dates do not change very much; even if one waited to act on the earnings information for three months, a mean 'abnormal' daily return of 0.1132 percent could be earned. Table 3 also reveals that one might very well accept the null hypothesis in any given quarter. In almost all quarters, though, the estimated means are positive. When one considers all the quarters together, the positive effect is estimated more precisely than in any one subperiod.

The differences in mean daily returns between the high and low E/P portfolios can be interpreted as 'abnormal' returns in table 3, because the two portfolios have equivalent beta risk. Portfolio weights are based upon betas estimated by regressing daily security returns against daily market returns. However, work by Scholes and Williams (1977) indicates that the stochastic process generating daily security returns may differ from this 'market model' process. The sensitivity of the results to this possibility can also be investigated. The University of Chicago's Center for Research in Security Prices (CRSP) has computed Scholes–Williams beta estimates with a value-weighted NYSE–AMEX market index for firms on their daily return tape each year. CRSP assigns securities to various control portfolios based upon their Scholes–Williams beta estimates. The daily control portfolio return is subtracted from the daily security return to get the daily 'abnormal' or 'excess' security return. The daily 'abnormal' returns of the high and low E/P portfolios can be constructed by just averaging (equal-weights) the 'abnormal' returns of the individual securities within these portfolios.

[5]Appendix 2 in Reinganum (1979) presents the findings for the $+2$ month E/P portfolios. These results are consistent with the discussion of the $+1$ month findings.

[6]Reinganum (1979) shows that using portfolio weights based upon betas estimated with the daily return data from the three-month holding periods does not significantly alter the results reported in table 3.

Table 3
Mean differences in daily returns between the high and low *E/P* portfolios of identical beta risk.

	Portfolio positions taken at end of month[a]			
Quarter	+1	+2	+3	+4
All	1.204	1.284	1.298	1.132
	(3.50)	(3 52)	(3.65)	(3.34)
4/75	1.591	0.198	0.300	0 038
	(1.76)	(0.23)	(0 36)	(0.04)
1/76	0.692	2.082	2.122	1.599
	(0.66)	(1.53)	(1.51)	(1.68)
2/76	−0.013	0.039	0.992	1.356
	(−0.01)	(0.04)	(0.81)	(1.11)
3/76	2.038	2.934	1.779	0.732
	(1.47)	(2.24)	(1.70)	(0.73)
4/76	1.708	1.608	1.965	2.458
	(2.39)	(2.46)	(2.61)	(2.53)
1/77	1.989	0.989	−0.164	−0.319
	(2.30)	(0.97)	(−0 19)	(−0.35)
2/77	0.334	0.834	0.381	1.415
	(0.38)	(0.85)	(0.42)	(1.54)
3/77	1.361	1.506	3.038	1.853
	(1.39)	(1.69)	(3.65)	(2.23)

[a]The portfolios analyzed in this table only contain firms that released quarterly earnings in the month immediately following the fiscal quarter close. The identical beta portfolio weights are estimated using the sixty days of daily return data immediately preceding the three month portfolio holding periods. The *t*-values are in parentheses. Reported daily means are multiplied by 1000. Earnings are scaled by closing prices on the last day of the fiscal quarter. The +1 through +4 months refer to the first through fourth months following the fiscal quarter close. The means for each quarter are based upon three months of trading day returns, regardless of whether the three-month period begins at the end of the +1, +2, +3, or +4 month.

The differences in the CRSP mean daily 'abnormal' returns between the +1 month high and low *E/P* portfolios are displayed in table 4. While the point estimates of the overall mean difference seem to tail off as one postpones the portfolio purchase date, the difference in 'abnormal' returns still ranges in the six percent to seven percent per quarter vicinity. Furthermore, the point estimates for the overall period are easily within one standard error of the point estimates contained in table 3. In addition, the *t*-values for the overall period are greater than three, and the mean differences within each subperiod are almost always positive. The results in table 4 indicate anomalous returns for at least six months; the high *E/P* securities outperform the low *E/P* securities even after beta risk adjustment.

Table 4
Mean differences in excess returns of the high and low E/P portfolios.

Quarter	Portfolio positions taken at end of month[a] +1	+2	+3	+4
All	1.202	1.103	1.066	0.937
	(3.81)	(3.56)	(3.45)	(3.08)
4/75	1.763	0.038	−0.067	0.142
	(1.59)	(0.05)	(−0.08)	(0.20)
1/76	0.491	1.443	1.633	0.867
	(0.54)	(1.53)	(1.64)	(0.90)
2/76	−0.043	0.040	0.933	1.589
	(−0.50)	(0.04)	(1.02)	(1.58)
3/76	2.595	2.569	1.101	0.657
	(2.70)	(2.66)	(1.20)	(0.75)
4/76	1.734	1.778	2.300	1.900
	(2.31)	(2.46)	(3.02)	(2.47)
1/77	1.454	0.421	−0.320	−0.427
	(2.03)	(0.57)	(−0.43)	(−0.55)
2/77	0.343	1.022	0.178	0.990
	(0.41)	(1.09)	(0.20)	(1.13)
3/77	1.345	1.538	2.693	1.862
	(1.47)	(1.68)	(3.04)	(2.25)

[a]The portfolios analyzed in this table only contain firms that released quarterly earnings in the month immediately following the fiscal quarter close. Excess security returns used to construct portfolio excess portfolio returns are those computed by CRSP for their Beta Excess Return Tape. The t-values are in parentheses. Reported daily means are multiplied by 1000. Earnings are scaled by closing prices on the last day of the fiscal quarter. The +1 through +4 months refer to the first through fourth months following the fiscal quarter close. The means for each quarter are based upon three months of trading day returns, regardless of whether the three-month period begins at the end of the +1, +2, +3, or +4 month.

Although the conclusions drawn from table 4 do not differ from those drawn from table 3, the experimental technique does. In fact, the computation of 'abnormal' returns in table 4 involved a different market index (value-weighted versus equal-weighted NYSE–AMEX returns), different beta estimates (Scholes–Williams versus 'market model'), and different security weighting procedures. Thus, the evidence in table 4 not only corroborates the findings in table 3 but strongly suggests that the E/P anomaly is not an artifact of methodology in this time period.

The numerical results in table 3 can be pictured vividly and perhaps better illustrated with the aid of graphs. Figs. 1 and 2 show the performances of the

+1 month high and low E/P portfolios purchased at the end of months +1 and +4, respectively. Each graph plots the cumulative average 'abnormal' returns (CAAR) for the first fifty trading days after each portfolio is bought. Since the high and low E/P portfolio are constructed to have betas of one, CAAR can be constructed for each portfolio as well as their difference. The market return is subtracted from the high and low portfolio returns to calculate their 'abnormal' performances separately. Under the null hypothesis, all the CAAR should fluctuate randomly about zero. If there is a

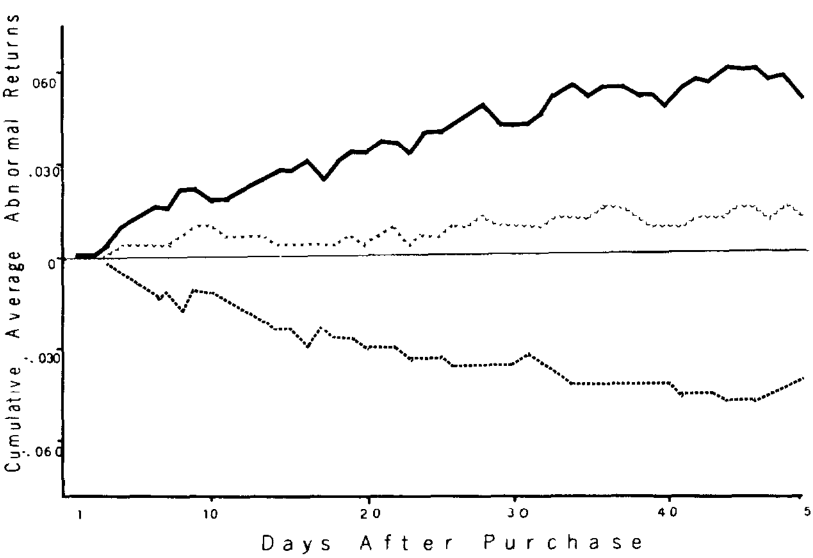

Fig. 1. Difference in cumulative average 'abnormal' returns between the high E/P and low E/P portfolios (————). Cumulative average 'abnormal' return of the high E/P portfolio (vvvvv). Cumulative average 'abnormal' return of the low E/P portfolio (·····) Since the estimated beta of each E/P portfolio is 1.0, the difference between the daily portfolio return and the daily market return can be viewed as an 'abnormal' return. Portfolio returns are tracked for eight three-month periods The initial event date ($t=0$) for each period is the last trading day of the month immediately following the fiscal quarter close. The 'abnormal' portfolio return for day t, averaged over the eight periods, is calculated as follows:

$$AAR(t)=\sum_{q=1}^{8}(R_{p,t,q}-R_{m,t,q})/8.0$$

The cumulative average 'abnormal' portfolio for day T is just the summation of the daily average 'abnormal' returns. That is,

$$CAAR(T)=\sum_{t=1}^{T}AAR(t).$$

The high and low E/P portfolios only contain firms that released quarterly earnings information in the month immediately following the fiscal quarter close.

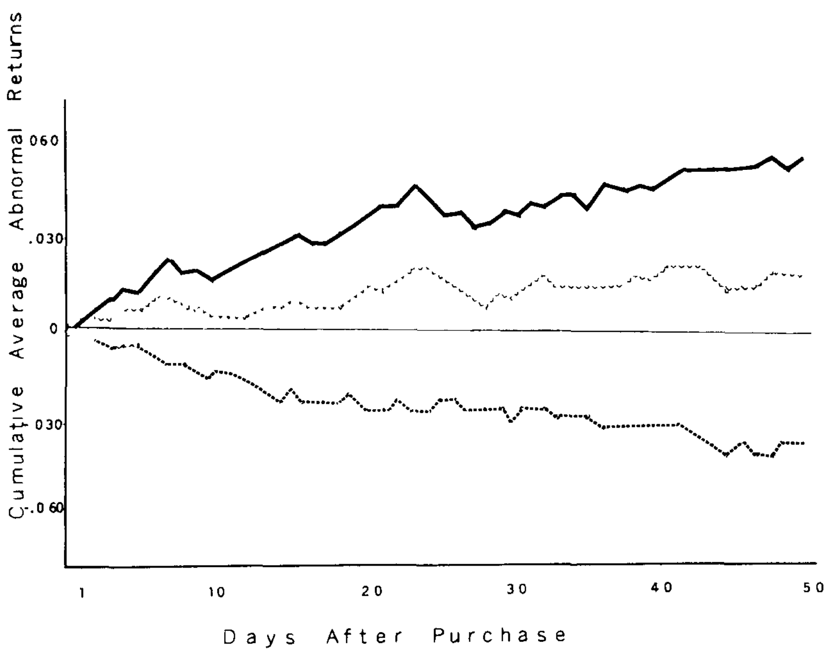

Fig 2. Difference in cumulative average 'abnormal' returns between the high E/P and low E/P portfolios (———) Cumulative average 'abnormal' return of the high E/P portfolio (vvvvv) Cumulative average 'abnormal' return of the low E/P portfolio (·····) Since the estimated beta of each E/P portfolio is 1.0, the difference between the daily portfolio return and the daily market return can be viewed as an 'abnormal' return. Portfolio returns are tracked for eight three-month periods. The initial event date ($t=0$) for each period is the last trading day of the fourth month following the fiscal quarter close. The 'abnormal' portfolio return for day t, averaged over the eight periods, is calculated as follows.

$$AAR(t)=\sum_{q=1}^{8}(R_{p,t,q}-R_{m,t,q})/8.0$$

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$$CAAR(T)=\sum_{t=1}^{T}AAR(t).$$

The high and low E/P portfolios only contain firms that released quarterly earnings information in the month immediately following the fiscal quarter close.

one-time effect on prices, the CAAR should adjust to the new level and then vacillate about that level. But the graphs do not demonstrate either of these patterns. Instead, one sees the CAAR of the difference in portfolio returns steadily trending up throughout the portfolio holding periods. The upward trend appears even after action is delayed for three months. The CAAR of the low E/P portfolios exhibit a persistent negative trend in both graphs. The CAAR of the high E/P portfolios trend upward, but not as markedly as the CAAR of the low E/P portfolios drift down in this time period. The graphs clearly illustrate that the mean 'abnormal' returns of the E/P portfolio positions reported in table 3 are not due to extraordinarily large 'abnormal' returns earned during the first couple of days the portfolios are held. Rather, the evidence indicates that the model is consistently misspecified; on average 'abnormal' returns can be earned on a day-to-day basis.

All previously reported results are based upon portfolios formed using E/P ratios computed by dividing quarterly net income by closing prices on the last day of the fiscal quarter. However, by scaling earnings by a post- rather than pre-earnings announcement price and re-ranking securities, the stability of the E/P proxy can be further investigated. Although not shown, the differences in mean daily 'abnormal' returns between the high and low E/P portfolios based on announcement day prices are virtually identical to those in table 3.[7] One can still earn significant 'abnormal' returns for at least six months. In fact, a closer examination of the similarity between the results reveals that the composition of securities within the high and low E/P portfolios is virtually identical in each case. That is, for the two sets of high and low E/P portfolios in any given quarter, about eighteen (out of twenty) firms are common to the corresponding component portfolios. That scaling by post-announcement prices does not alter the anomalous findings probably reflects two things: first, that E/P ratios do indeed proxy for a variable omitted from the simple CAPM; and secondly, that the pre-announcement prices incorporate, to a large extent, the quarterly earnings information of the extreme E/P securities.

In addition to persistent 'abnormal' returns, positively correlated E/P rankings over the time would be additional evidence that E/P ratios proxy for determinants of equilibrium not considered by the CAPM. Under the null hypothesis of independent rankings, the test statistic, the Kendall Tau coefficient, assumes values between -1 and $+1$ and is symmetrically distributed about its mean value of zero. A tau equal to $+1$ would imply that the rankings perfectly coincide; a tau of -1 would mean that one ranking is the exact inverse of the other. Table 5 presents the Kendall Tau coefficients for the E/P rankings of each quarter compared with the rankings of every other quarter, using rankings based on earnings scaled by pre-announcement prices. All the tau values in table 5 are positive. Furthermore, one would reject the null hypothesis of independent rankings at the 0.001 level in favor of the alternative of positive association.

Another measure of portfolio composition constancy is frequency with which individual firms are in the top fifty (high E/P) and bottom fifty (low

[7]Results based on month-end closing prices reported in appendix 3 in Reinganum (1979) do not alter this finding.

Table 5
Kendall Tau coefficients for E/P rankings between quarters [a]

Quarter	Quarter 4/75	1/76	2/76	3/76	4/76	1/77	2/77	3/77
4/75	1.00	0.42	0.46	0.42	0.52	0 29	0.31	0.30
1/76	0.42	1.00	0.50	0.36	0.33	0.49	0.33	0.25
2/76	0.46	0.49	1.00	0.53	0.38	0.39	0.52	0.35
3/76	0 42	0.36	0.53	1.00	0.39	0.32	0.42	0.51
4/76	0.52	0.33	0.38	0.39	1.00	0.34	0.32	0.31
1/77	0.29	0.49	0.39	0.32	0.34	1.00	0.38	0.29
2/77	0.31	0.33	0.52	0.42	0.32	0,38	1.00	0.45
3/77	0.30	0.25	0.35	0.51	0.31	0.29	0.45	1.00

[a]The Kendall Tau coefficient assumes values between -1 and $+1$ and is symmetrically distributed about its mean value of zero. A tau equal to $+1$ would imply that the E/P ranking of securities between quarters coincide perfectly. A tau of -1 would mean that one ranking is the exact inverse of the other

Table 6
Number of firms which appeared in the extreme E/P groups in exactly n quarters.[a]

E/P group	Number of quarters, n: 1	2	3	4	5	6	7	8
High E/P	69	48	21	19	8	3	2	3
Low E/P	96	56	17	13	9	5	2	0
Expected number under H_0	201	73	15	2	<1	<1	<1	<1

[a]This table contains the actual and expected frequency with which individual firms are in the top 50 (high E/P) and bottom 50 (low E/P) part of the E/P ranking during the eight qiarters of the sample

E/P) portion of the E/P ranking during the eight quarters of the sample. Table 6 displays these frequencies. For example, three firms appeared in the high E/P group in all eight quarters; on the other hand, sixty-nine firms were selected for inclusion in the high E/P group in only one quarter. Table 6 also contains the expected number of firms that should appear in a fifty firm portfolio in exactly n quarters under the null hypothesis that each firm in the sample has equal probability of being selected. As can be seen, with random selection, one expects many more firms to be selected one or two times for inclusion in the extreme E/P groups than actually are. However, almost no firms are expected to appear five or more times, even though many do. Not only does this benchmark indicate a significant core of firms being selected for inclusion in the extreme E/P groups four or more times, but it also indicates that many firms are systematically excluded. Thus, this evidence supports the contention that the composition of E/P portfolios tends to be stable over time.

3.4. Concluding remarks

The evidence presented in this section seems to indicate that something is wrong with the capital asset pricing model. On the basis of earnings/price ratios, one can form portfolios that earn 'abnormal' returns of between six and seven percent per quarter. That is, the mean spread between high and low E/P portfolios of equivalent beta risk is about 0.1 percent per day. The most striking feature of the 'abnormal' returns is that they persist and do not diminish for at least six months. This persistence reduces the likelihood that these results are being generated by informational inefficiencies. Rather, the evidence seems to suggest that the equilibrium pricing model is misspecified.

To reconcile the fact that E/P ratio portfolios detect a model misspecification with the fact that standardized unexpected earnings portfolios do not detect a model inconsistency requires an interpretation of the evidence which is consistent with both findings. The E/P evidence indicates that either the CAPM is wrong or that capital markets are inefficient or both. However, the persistence of the 'abnormal' returns, along with the unexpected earnings results, seems to rule out a market inefficiency explanation. The interpretation to emerge from the data is that capital markets are informationally efficient, but that the simple capital asset pricing model incorrectly specifies the equilibrium pricing mechanism. Thus, the evidence is consistent with Ball's conjecture that E/P ratios proxy for a determinant of equilibrium omitted from the two-parameter model. However, as the evidence from section 5 demonstrates, even E/P ratios do not matter after security returns are controlled for the market value of common stock effect.

4. Tests of the CAPM based on annual E/P ratios

The evidence of the previous section shows that during 1976 and 1977 high E/P securities experienced higher average returns than low E/P securities of similar beta risk. This portion of the study extends the E/P analysis back through time and analyzes the performances of intermediate as well as extreme E/P firms. The historical data corroborate the major finding of the quarterly E/P data. In particular, a high E/P portfolio experienced average returns of about thirteen percent a year more than the average returns of low E/P portfolios during the second year after each was identified, even though the low E/P portfolio had a higher estimated beta.

The methodology in this section differs from the one described in section 3. First, earnings are gathered from the Compustat tapes and announcement dates are not collected at all, because the quarterly findings indicated that the E/P anomaly did not appear to be an information effect. Secondly, annual earnings rather than quarterly earnings are used to compute E/P ratios. The reasons for the change are twofold: (1) the use of annual earnings should reduce the seasonality embedded in quarterly earnings; and (2) by using the annual tape, E/P ratios can be computed back until 1962, which permits full utilization of the daily CRSP NYSE–AMEX data bases. The final difference between procedures is that portfolio compositions are updated annually rather than quarterly.

4.1. The annual data

Data for the historical analysis were gathered from two sources. Corporate annual earnings for the years 1962 through 1975 came from a 1978 version of the Compustat Merged Annual Industrial Tape produced by CRSP. The merged tape includes Compustat's research file, so that firms not currently doing business can nonetheless be analyzed in earlier periods. Stock prices, returns, and common share data are collected from the CRSP daily master and return tapes.

To qualify for inclusion in the sample a firm had to meet the following requirements. First, the firm's fiscal year end month must be December. Secondly, the firm's annual earnings, year-end price and common shares data must be available on the Compustat and CRSP data bases, respectively. No other requirements on availability of past data or future data were used to select the sample. The number of firms which met these requirements in any given year ranged from about seven hundred in the mid-1960s to about twelve hundred in the mid-1970s. Firms are continually dropping out of the sample while others are entering the sample, for reasons such as mergers, bankruptcies, new listings, and data availability.

4.2. Portfolio selection

Each year all firms within the sample are ranked on the basis of their E/P ratios. Earnings/price ratios are computed as annual income after extraordinary items and discontinued operations divided by the value of the common stock at the fiscal year end. That is, annual earnings are divided by the value of the common as of December 31. As with the quarterly data, only firms with positive E/P ratios are considered for inclusion in the E/P portfolios. The distribution of annual E/P ratios is then broken down into deciles. The daily returns of firms with E/P ratios in the highest decile are combined to form the daily return of portfolio *EP10*. Similarly, the daily returns of firms in the other E/P deciles are comgined to create the daily returns of the other nine E/P portfolios, *EP1* through *EP9*. Although the number of firms in each portfolio varies from year to year (because the eligible sample changes yearly), over the fourteen year period there are about ninety-five firms in each portfolio on average. No special weighting scheme is employed to risk adjust E/P portfolios for beta; equal weights are applied to all securities. Preliminary analysis of the data revealed that 'market model' beta estimates were close to one. Thus, in this section, the equal-weighted NYSE–AMEX market index will serve as the control portfolio against which E/P portfolio returns are compared.[8]

4.3. Annual results for ten E/P portfolios

To understand the presentation of results in this section, some basic nomenclature must be explained. Let Y denote the fiscal (and calendar) year from which E/P ratios are computed. For example, when 1964 annual earnings are used in the numerator of the E/P ratio, Y is 1964. Let $Y+1$ denote the twelve month period beginning on April 1 of the calendar year following year Y. Let $Y+2$ stand for the twelve month period starting on January 1 of the second calendar year after year Y. Portfolio returns in this section are tracked and analyzed in both the $Y+1$ and $Y+2$ years.

For table 7, the daily returns in years $Y+1$ of each E/P decile portfolio are stacked into one long time-series vector. The results of this table can be interpreted as illustrating the average E/P effects for the fourteen year overall period. The danger of such an interpretation is that the statistical underpinnings of the tests may be violated. In particular, one worries whether the parameters of the distributions can possibly be stationary over a fourteen year period with securities shifting in and out of the E/P portfolios. However, it may be the case that rotation of securities in and out of the E/P portfolios actually tends to preserve the parameters of the portfolios over time. Furthermore, differences between the high and low E/P portfolios consistently appear in the year-by-year results.[9]

For each of the E/P portfolios in the $Y+1$ years, five basic pieces of information are presented in table 7: (1) the mean daily excess return; (2) the estimated portfolio beta; (3) the average number of firms (in percent) within the portfolio that are listed on the American Stock Exchange; (4) the median E/P ratio for each E/P class averaged over the fourteen years; and (5) the daily autocorrelations of the excess returns through lag three. For table 7 an excess return is computed as the daily E/P portfolio return minus the equal-weighted NYSE–AMEX market return. The results show that the average

[8]All tests were also conducted using the value-weighted NYSE-AMEX market index These results are in appendix 4 in Reinganum (1979). The evidence led to conclusions similar to those drawn in the text.

[9]The year-by-year E/P portfolio results are contained in appendix 5 in Reinganum (1979)

Table 7
Mean excess daily returns of ten E/P portfolios in years $Y+1$ (based on equal-weighted NYSE–AMEX index).[a]

Portfolio	Mean excess returns	Beta	Average percent on AMEX	Average median E/P	Autocorrelations of excess returns 1	2	3
EP1	−0.124 (−1 80)	1 12 (131.7)	24.10%	0.032	0.09	0.03	0.02
EP2	−0.176 (−3.44)	1 00 (155.1)	17.94%	0.050	0.13	0.06	0.06
EP3	−0.227 (−4 77)	0.96 (161.1)	16.00%	0.064	0.16	0.07	0.06
EP4	−0.209 (−4.44)	0.90 (157 5)	15.32%	0.076	0.16	0.08	0.10
EP5	−0.109 (−2.47)	0.90 (169 4)	13.91%	0.086	0.13	0.07	0.11
EP6	−0.147 (−3.13)	0.83 (160 1)	13 44%	0.096	0.20	0.12	0.10
EP7	−0.070 (−1.48)	0.86 (157.4)	17.58%	0.107	0 13	0.08	0.07
EP8	0.058 (1.15)	0.82 (145.5)	16.50%	0.121	0.21	0.09	0.08
EP9	0.103 (2.00)	0.88 (142.2)	20.27%	0.139	0.14	0.04	0.06
EP10	0.165 (3.02)	0.95 (138.8)	35.86%	0.181	0.03	0.04	0.05

[a]Mean excess returns reported above are multiplied by 1000. T-values are in parentheses. An excess return is defined as the daily portfolio return less the equal-weighted NYSE–AMEX market return. Betas are market model estimates using this index. *EP1* is the lowest E/P portfolio; *EP10* is the highest E/P portfolio. The return statistics are based on 3505 daily observations from 1963 to 1977. The table also contains the percentage of firms within each portfolio, averaged over 14 years, that are listed on the American Stock Exchange. The average median E/P column contains the value of the median E/P ratio for reach portfolio averaged over the 14 years of the study.

return of portfolio *EP10* is more than four percent per year greater than the average return implied by its beta risk. In fact, the mean return of *EP10* is almost ten percent per year higher than the mean return of *EP3* which has equivalent estimated beta risk. It is also interesting to note that AMEX firms comprise the greatest proportion of firms for any portfolio in *EP10*. Hence, the portfolio with the largest mean 'abnormal' return contains more AMEX firms than any other portfolio. Thus, in part, the E/P effect may be correlated with a stock exchange effect. The most obvious difference between the two exchanges is that smaller firms, in general, are traded on the *AMEX*. So the E/P anomaly may be related to the market value of firms.

Although not shown, the same excess return statistics were calculated using $Y+2$ year data. Portfolio *EP10* still possesses a positive mean 'abnormal' return of about 4.5 percent per year. Furthermore, the fifty highest *E/P* firms within this portfolio still have a mean 'abnormal' return of slightly more than seven percent on an annual basis in the $Y+2$ years. Indeed, *EP10* still earns an average return of about eight percent per year more than *EP5*, which has identical estimated beta risk. Thus, the 'abnormal' returns persist through time.

4.4. Concluding remarks

The annual data bear out the initial conclusions drawn from the quarterly data. In particular, the average returns of high *E/P* securities are greater than the average returns of low *E/P* securities of equivalent beta risk. Furthermore, these 'abnormal' returns persist for at least two years from the portfolio formation date. The persistence of 'abnormal' returns for two years reduces the likelihood that the anomaly is due to a market inefficiency. Rather, the evidence indicates that the CAPM incorrectly specifies the equilibrium pricing mechanism.

In light of Roll's criticism of empirical tests of the CAPM, one might argue the evidence only proves that the equal-weighted market index is not on the efficient frontier. But this critique does not go to the heart of the matter, because there is no a priori reason to expect that the inefficiency should be systematically related to an *E/P* effect. Furthermore, the preliminary evidence from work being done to expand the market index indicates that results based on broader indices do not greatly differ from those based on NYSE–AMEX indices [for example, see Stambaugh (1979)]. Thus, one may feel confident in concluding that the *E/P* anomaly arises because the true equilibrium pricing mechanism is not well approximated empirically by the simple one-period CAPM.

5. Relationships between the *E/P* and value anomalies

In a recently completed dissertation, Banz (1978) reported a nonlinear relationship between the aggregate market value of a firm's common stock and the stock's mean return. In particular he found that firms with very small market values (relative to the rest of the market) had large and positive residual returns. The problem to be explored here is whether the value anomaly and the *E/P* anomaly are two independent effects or whether both anomalies proxy for the same missing factors.

As a first step of the analysis, the value effect should be established on the sample of firms used to discover the *E/P* anomaly. To this end, the entire set of stocks in the *E/P* sample are ranked on the basis of their December 31 market values each year. The daily returns of securities with market values in the lowest decile of this ranking are equal-weighted to form the daily return of portfolio *MV1*. Daily returns of securities in each of the other value deciles are also equal-weighted to form the daily returns of the remaining *MV* portfolios, *MV2* through *MV10*. The ten *MV* decile portfolios are analyzed in a fashion identical to the ten *E/P* decile portfolios.

5.1. Annual results for ten *MV* portfolios

In table 8 five pieces of information are presented for the ten *MV* portfolios in years $Y+1$: (1) the mean excess daily returns; (2) the estimated portfolio beta; (3) the average percentage of firms within the portfolio listed on the American Stock Exchange; (4) the median value of the firms within the portfolio averaged over the fourteen years; and (5) the first three daily autocorrelations of the excess returns. Excess returns are calculated by subtracting the daily return of the equal-weighted NYSE–AMEX index from the daily portfolio return. Betas are market model estimates using this index.[10] The results in table 8 are computed by stacking the fourteen years of daily portfolio returns into one time-series vector.[11] The potential pitfalls of such a summarization of results were discussed earlier.

In table 8 one observes that for the lowest market value portfolios, *MV1* through *MV4*, the estimated portfolio betas are virtually one. Hence, the excess returns of these portfolios can be interpreted directly as 'abnormal' returns. Portfolio *MV1* possesses a mean daily 'abnormal' return of 0.05 percent or more than twelve percent on an annual basis in the $Y+1$ years. For the next decile portfolio, *MV2*, the 'abnormal' daily return has dropped to only 0.02 percent or just slightly over four percent per year. For all other MV portfolios, the point estimates of the excess returns are negative. Thus, positive anomalous return behavior is detected only for firms in the lower two value deciles and is especially pronounced in the firms of portfolio *MV1* with the smallest market values. Portfolios *MV1* and *MV2* stand out not only because of their positive 'abnormal' returns but also because each portfolio is heavily populated with firms that trade on the American Stock Exchange. In portfolio *MV1*, on average more than eighty percent of the firms within the portfolio are listed on the AMEX. For portfolio *MV2*, the percentage is just about fifty. As with the high *E/P* portfolio, positive 'abnormal' returns seem to be associated with the AMEX. Of course, as table 8 indicates, the stock exchange effect might more precisely be described as a value effect.

[10]In appendix 4 in Reinganum (1979) results based on a value-weighted NYSE–AMEX index are presented. Interpretations of the evidence are not altered by the change of index.

[11]The market value portfolio results on a year-by-year are reported in appendix 5 in Reinganum (1979)

Table 8
Mean excess daily returns of ten *MV* portfolios in years $Y+1$ (based on equal-weighted NYSE–AMEX index).[a]

Portfolio	Mean excess returns	Beta	Average percent on AMEX	Average median value	Autocorrelations of excess returns 1	2	3
MV1	0.500 (6.42)	1.00 (101.7)	82.61%	8.3	0.06	0.03	0.06
MV2	0.193 (3.47)	1.02 (144.9)	48.35%	20.0	−0.05	0.01	−0.00
MV3	−0.033 (−0.71)	1.00 (171.3)	23.81%	34.1	0.01	−0.00	0.02
MV4	−0.050 (−1.11)	1.00 (177.1)	11.29%	54.5	0.05	−0.02	0.00
MV5	−0.115 (−2.60)	0.94 (170.3)	8.59%	86.1	0.09	0.04	0.01
MV6	−0.193 (−4.18)	0.88 (160.9)	4.42%	138.3	0.20	0.07	0.11
MV7	−0.189 (−3.99)	0.90 (156.8)	4.35%	233.5	0.27	0.17	0.16
MV8	−0.214 (−4.00)	0.83 (135.9)	2.71%	413.0	0.37	0.22	0.17
MV9	−0.292 (−5.14)	0.83 (126.3)	2.46%	705.3	0.38	0.23	0.21
MV10	−0.343 (−4.79)	0.82 (96.3)	1.60%	1,759.0	0.37	0.25	0.21

[a]Mean excess returns reported above are multiplied by 1000. *T*-values are in parentheses. An excess return is defined as the daily portfolio return less the equal-weighted NYSE–AMEX market return. Betas are market model estimates using this index. *MV1* is the lowest *MV* portfolio; *MV10* is the highest *MV* portfolio. The return statistics are based on 3505 daily observations from 1963 to 1977. Median values are stated in terms of millions of dollars. Only the average of the median values during the 14 years of the study is presented in the table. Similarly, the percentage of firms within each portfolio that are traded on the American Stock Exchange, averaged over 14 years, is presented.

The daily returns of the *MV* portfolios during the $Y+2$ years were also analyzed. The similarities between the $Y+1$ year and $Y+2$ year results are striking. Even a year after the portfolios have been identified, the small firms in *MV1* continue to earn 'abnormal' returns of about 0.05 percent per day. Not only do 'abnormal' returns for small firms persist, but they persist at about the same level in the second year as in the first year. The return behaviors of the larger *MV* portfolios are also very similar to the results reported in table 8. Thus, the conclusions drawn from the $Y+2$ year results are almost identical to those drawn from the $Y+1$ year data. Namely, one can earn 'abnormal' returns that persist for at least two years by forming portfolios based on the market value of the stock.

5.2. Interactions between the E/P and value effects

With the value anomaly replicated in the E/P stock sample, attention can now be directed to the issue of whether the E/P and value anomalies are related or independent. As a first descriptive step in the analysis, firms are classified by both the market value of the common stock and E/P ratios. Firms are classified according to which value decile and E/P decile they jointly belong. Table 9 contains the two-way classification scheme averaged over the fourteen portfolio formation periods. Casual observation of the table reveals a slightly positive correlation between low E/P ratios and large market values. But perhaps the most striking characteristic of the classifications is the paucity of firms with large market values and high E/P ratios. Firms with high E/P ratios tend to be classified in the low market value deciles. One plausible hypothesis is that E/P ratios indirectly proxy for the same factors that generate the value anomaly.

Table 9

Average number of firms in value by E/P decile categories from 1962 through 1975.[a]

Value deciles in dollars	E/P deciles									
	0.042	0.058	0.070	0.081	0.091	0.101	0.114	0.128	0.153	0.916
13,885,509	12.4	7.1	5.9	5.7	6.6	6.5	7.6	8.4	12.0	21.9
26,362,480	8.0	6.5	6.0	7.0	7.6	8.1	11.1	11.3	12.1	16.1
43,859,952	8.1	4.9	7.1	7.5	7.8	8.0	11.9	10.9	12.9	14.9
68,086,944	5.3	7.1	8.2	7.6	8.9	9.0	10.0	12.3	13.3	12.1
108,477,280	6.5	9.1	7.6	10.0	9.1	11.2	8.9	11.8	10.6	9.0
174,785,568	6.3	9.5	10.1	9.5	11.9	11.3	10.2	11.0	8.8	5.0
309,664,512	7.7	9.9	12.9	12.6	11.6	9.4	8.3	8.0	7.7	5.4
530,984,960	8.3	10.8	10.9	12.2	11.0	11.1	10.0	7.4	7.9	3.7
956,984,832	10.1	11.4	13.4	12.1	10.9	11.2	9.7	6.9	4.9	2.5
34,765,234,200	21.4	17.6	11.9	9.6	8.5	7.6	5.9	5.4	2.8	2.4

[a]Firms are classified according to which value decile and E/P decile they jointly belong. The upper cutoff points for the value and E/P deciles are also presented.

To test whether E/P ratios can generate any additional 'abnormal' returns above and beyond those detected in small firms, one might like to subdivide the MV portfolios into sub-portfolios based on E/P ratios. The classification scheme selected for this paper is to form twenty-five portfolios based on E/P ratios and market values. The placement of a firm in a given portfolio depends on the firm's E/P ratio and the market value of its common stock. The cutoff point for inclusion in portfolios is jointly based on E/P quintiles and MV quintiles. The reason two-way classifications are chosen at the quintile rather than the decile level is that in some years no firms would be included in a portfolio constructed with a two-way decile classification. For example, in 1966 no firms were simultaneously in the highest MV decile and the highest E/P decile. Clearly, with this classification scheme, the number of securities within each E/P-MV portfolio will not be the same for all such portfolios. The largest portfolios tend to be the highest E/P, lowest MV and the lowest E/P, highest MV one. Regardless of the number of securities in an E/P-MV portfolio, within each portfolio equal weights are applied to the security returns.

Tables 10 and 11 contain the mean excess returns and estimated betas of the twenty-five E/P-MV portfolios in years $Y+1$ based on the equal-weighted index, respectively. An excess return is defined as the daily return of the E/P-MV portfolio less the equal-weighted NYSE–AMEX market daily return. As is true of the other tables in this section, the statistical results in these tables are calculated by stacking the fourteen years of daily return data into one time-series vector. By reading across a given row in table 10, one observes the effect of varying market values while roughly holding constant the E/P ratios. Similarly, in each column one can assess the effect of changing E/P ratios while holding market values roughly constant. Thus, the purpose of this two-way classification is to hold one anomaly constant and to investigate the impact of the other.

In table 10 one observes a value effect across all E/P levels. The smallest firms in a given E/P quintile systematically outperform the high market value firms in that quintile, and this result is true for each of the five E/P quintiles. One can formally test whether the mean excess returns of the lowest MV portfolios are equal to those of the highest MV portfolios within each E/P class. The test can be formulated within Zellner's seemingly unrelated regression framework. One first estimates the contemporaneous covariance matrix for all twenty-five portfolios and then simultaneously tests the five appropriate linear constraints. If one ignores the approximation of the true covariance matrix by the sample one, then the appropriate test statistic has an F distribution under the null hypothesis [Theil (1971, p. 314)]. The five and one percent limits for $F(5, \infty)$ are 2.21 and 3.02, respectively. However, since each portfolio contains 3505 observations, the one percent significance level is probably a more appropriate criterion for testing the hypothesis than

Table 10
Mean excess returns of twenty-five E/P-MV portfolios in years $Y+1$ (based on equal-weighted NYSE-AMEX index).[a]

E/P quintile	MV quintile: Lowest	2	3	4	Highest
Lowest	0 540	0 001	−0 088	−0 285	−0.348
	(3.89)	(0.01)	(−0.99)	(−3 90)	(−4 17)
2	0.331	−0 100	−0.308	−0 294	−0 318
	(2.53)	(−1.17)	(−4 71)	(−4.71)	(−4 70)
3	0.303	−0.119	−0 220	−0 181	−0.262
	(2.81)	(−1.66)	(−3.72)	(−3.08)	(−3.91)
4	0.240	−0.028	−0.119	−0.058	−0.209
	(2 71)	(−0 45)	(−1 89)	(0.83)	(−2 71)
Highest	0.375	0.029	−0.005	−0.082	−0.229
	(4.87)	(0.48)	(−0 07)	(−0 96)	(−1 89)

[a]The mean excess returns reported above are multiplied by 1000. T-values are in parentheses. An excess return is defined to be the daily portfolio return less the equal-weighted NYSE–AMEX market return. The statistics are based on 3505 daily observations from 1963 to 1977. The placement of a firm in a given portfolio depends on the firm's E/P ratio and the market value of its common stock.

Table 11
Estimated betas of twenty-five E/P-MV portfolios in years $Y+1$ (based on equal-weighted NYSE–AMEX index)[a]

E/P quintile	MV quintile: Lowest	2	3	4	Highest
Lowest	1 17	1 19	1 11	1 00	0.92
	(68.1)	(83 5)	(100 4)	(104 6)	(88 1)
2	1.10	1.08	0.93	0.85	0 81
	(66 6)	(100 6)	(113 9)	(113 9)	(102.4)
3	0.98	0 96	0.85	0 82	0 75
	(72 5)	(106.2)	(120 7)	(121.4)	(101 9)
4	0 92	0 89	0 81	0 81	0.76
	(82 9)	(118 7)	(111.8)	(99.2)	(86.1)
Highest	0.93	0.94	0.89	0.95	0.86
	(96 1)	(124 4)	(102 3)	(89 3)	(56 5)

[a]Betas are market model estimates using an equal-weighted NYSE–AMEX market index. T-values are in parentheses. The statistics are based on 3505 daily observations from 1963 to 1977.

the five percent level. The computed value of the test statistic is 8.28; one would reject the null hypothesis. Thus, the evidence indicates the presence of a substantial value effect irrespective of a security's E/P ratio.

The evidence does not weigh heavily in favor of an E/P effect after controlling portfolio returns for market values in table 10. In fact, within the low MV quintile, the lowest E/P securities possess a mean excess return greater than that of the highest E/P securities. Within this group of securities, the predicted E/P effect may be reversed. Again, one can simultaneously test for an E/P effect in each MV quintile using the methodology described above. The computed value of the test statistic is 1.12. Thus, at the one percent significance level one could not reject the null hypothesis. Thus, after controlling 'abnormal' returns for the value effect, an E/P effect is not detected in the $Y+1$ years.

Tests conducted with the $Y+2$ year data corroborated the finding that E/P ratios do not discriminate between excess returns after one controls for market values. The hypothesis that the highest and lowest E/P securities within each MV quintile possessed identical mean excess returns could not be rejected at the one percent significance level. Thus, the evidence from the $Y+2$ years indicated that high E/P securities did not systematically outperform low E/P securities after the market value effects were removed from the 'abnormal' returns. However, the hypothesis that the highest and lowest MV securities within each E/P quintile have identical mean excess returns was rejected at the one percent level.

5.3. *Concluding remarks*

Undoubtedly one goal of scientific inquiry is to reduce the complexity of the world by applying some sort of Occam's Razor. The evidence in this section suggests such a simplification. In particular, the evidence indicates that the E/P anomaly and value anomaly proxy for the same set of factors missing from the specification of the simple one-period CAPM. However, the evidence also reveals that this set of factors is much more closely associated with firm size than with E/P ratios. Thus, the tests demonstrate that the value effect subsumes the E/P effect.

6. Summary and conclusions

The evidence in this study strongly suggests that the simple one-period capital asset pricing model is misspecified. The set of factors omitted from the equilibrium pricing mechanism seems to be more closely related to firm size than E/P ratios. The misspecification, however, does not appear to be a market inefficiency in the sense that 'abnormal' returns arise because of transaction costs or informational lags. Rather, the source of the misspecification seems to be risk factors that are omitted from the CAPM as is evidenced by the persistence of 'abnormal' returns for at least two years.

In sections 2 and 3, quarterly earnings data, primarily collected from 1976 and 1977 issues of the *Wall Street Journal*, were analyzed in two distinct ways. Portfolios formed on the basis of standardized unexpected earnings exhibited no 'abnormal' return behavior; capital markets rapidly incorporated any new information contained in these ephemeral signals into prices. On the other hand, the same earnings data were used to create high E/P portfolios that systematically outperformed low E/P portfolios, even after beta risk adjustment. In fact, the 'abnormal' returns of about six to seven percent per quarter persisted for at least six months. Analysis of the annual data over longer time periods in section 4 documented the persistence of the anomalous E/P results. Even during the second year after its formation, the high E/P decile portfolio experienced significant 'abnormal' returns; a fifty-firm subset of this portfolio earned 'abnormal' returns of about seven percent per year during the second year.

Section 5 explored the relationship between the E/P anomaly and the market value anomaly. An analysis of the E/P sample firms revealed that within this sample small firms systematically experienced average rates of return significantly greater than those of large firms with equivalent beta risk for at least two years. After controlling returns for any E/P effect, a strong firm size effect still emerged. But, after controlling returns for any market value effect, a separate E/P effect was not found. Hence, while an E/P anomaly and value anomaly exist when each variable is considered separately, the two anomalies seem to be related to the same set of missing factors, and these factors appear to be more closely associated with firm size than E/P ratios.

One must surely conclude that alternative models of capital market equilibrium ought to be seriously considered and tested. For evidence in this study clearly demonstrates that, at least for portfolios based on firm size or E/P ratios, the simple one-period capital asset pricing model is an inadequate empirical representation of capital market equilibrium.

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