Returns to E/P Strategies, Higgledy-Piggledy Growth, Analysts' Forecast Errors, and Omitted Risk Factors

The "E/P effect" remains an enigma.

Russell J. Fuller, Lex C. Huberts, and Michael J. Levinson

(*Reprinted with permission from The Journal of Portfolio Management*)

Russell J. Fuller is Manager of Strategy Development at Concord Capital Management in San Mateo (CA 94403).

Lex C. Huberts is a Research Analyst at Mellon Capital Management in San Francisco (CA 94105). He was a Research Analyst at Concord Capital Management while this research was being conducted.

Michael J. Levinson is a Research Analyst at BARRA in Berkeley (CA 94704).

The helpful comments of William F. Sharpe, Richard Thaler, and the participants at the finance workshop of the University of Auckland, New Zealand, are acknowledged. An earlier version of this paper was presented at the May 1992 Institutional Investor conference in New York.

High E/P (low P/E) investing has been a popular investment strategy for many years. A number of academic studies document that high E/P strategies have historically generated, on average, above-normal returns. Some examples are Basu [1983], Goodman and Peavey [1986], and Jaffe, Keim, and Westerfield [l989]. Fama and French [1992] also find positive abnormal returns associated with high E/P stocks, but they find an even stronger relationship between book value to price ratios (B/P) and abnormal returns.

One rationale offered as to why high E/P strategies might work comes out of studies describing what is referred to as "Higgledy Piggledy Growth" (see Little [1966], Brealey [1967, 1983], and Lintner and Glauber [1967]). These studies indicate that earnings changes appear to be randomly distributed over time. That is, past earnings changes are essentially uncorrelated with future earnings changes. This implies that past earnings changes cannot be forecast on the basis of simple time series models of earnings changes.

As we note in our 1992 article, a more extreme interpretation of Higgledy Piggledy Growth is that future earnings growth cannot be forecast at all![1] If this is true, and if one assumes a simple model where stock prices are solely a function of future earnings growth, then high E/P strategies *should* provide above-normal returns, or positive alphas. This is because the distribution of future earnings changes would be the same for all stocks. Consequently, by investing in high E/P stocks one would be paying a lower price for the same distribution of future earnings changes.

In our 1992 article, however, we reported that high E/P stocks tend to have low subsequent earnings growth, and low E/P stocks tend to have high subsequent growth. This suggests that investors can discriminate across companies according to future growth rates of the companies' earnings, and they set prices and E/P ratios accordingly. This finding argues against using Higgledy Piggledy Growth as a rationale for high E/P investing.

Because many studies report that high E/P investing historically has generated above-normal returns, we investigate E/P strategies to determine whether high E/P stocks have generated positive alphas and, if so, why. Specifically, we investigate not only the subsequent growth rate of earnings for stocks grouped by E/P quintile, but also analyst forecast errors. We also explore whether "omitted risk factors" might account for any abnormal returns associated with high E/P investing.

We find that high E/P stocks did generate positive alphas. Interestingly, there is an even more pronounced negative alpha associated with low E/P stocks. Unfortunately, neither earnings growth subsequent to forming E/P portfolios, nor analysts' forecast errors, nor omitted risk factors account for these abnormal returns. The "E/P effect" remains an enigma.

DATA AND METHODOLOGY

The data and methodology used here are the same as used in our 1992 article and are more fully described there. In general, the study covers the period 1973 through 1990. Only companies with either an October, November, December, or January fiscal year-end are included in the sample. Care is taken to insure that look-ahead and survivorship biases are not a factor. (See Banz and Breen [1986] for a discussion of the impact look-ahead and survivorship biases can have on financial studies.)

Each year the earnings-to-price (E/P) ratio for each company is determined by dividing fiscal year EPS by the stock price as of the following March 31. For example, for 1973 and a company with a December 31 fiscal year, the E/P ratio is determined by dividing its 1972 EPS by its March 31, 1973, price. In order to reduce the influence of outliers, we typically use the median rather than the mean of the variable examined.

A minimum market capitalization screen is used to insure that the stocks in the sample are representative of those from which institutional investors are likely to choose.[2] The number of stocks that meet the market capitalization requirement and have the necessary earnings data ranges from 887 stocks in 1973 to 1,179 stocks in 1990. Thus, one might think of the sample as representing (approximately) the top 1,000 stocks in terms of market capitalization for each year of the study.

For each year, stocks are ranked by E/P ratio and assigned to quintiles. The first quintile (Q1) contains the 20% of the stocks with the highest E/P ratios for that year; the fifth quintile (Q5) contains the 20% of the stocks with the lowest E/P ratios. Note that because stocks with negative earnings have the lowest E/P ratios of all, these stocks are all in Q5.

Finally, it may be argued that ranking stocks by E/P ratios guarantees that Q1 will be dominated by low-growth industries and Q5 will be dominated by high-growth industries. Consequently, we also construct industry-diversified E/P quintiles.

We do this by forming quintiles so that each quintile contains 20% of the companies *in each industry,* with Q1 containing the highest 20% of each industry in terms of E/P ratios, Q2 containing the next highest 20% of each industry in terms of E/P ratios, and so on. Thus, for the industry-diversified quintiles, Q1 contains not only 20% of all the utility stocks, but also 20% of the ethical drug stocks, 20% of the computer stocks, etc.

Note that for the industry-diversified quintiles it is possible Q1 may have stocks with lower E/P ratios than Q2 (and so on), but this occurs relatively infrequently. Because the use of industry diversification helps control for industry-related factors, we typically report the results for only the industry-diversified quintiles.

Exhibit 1 reports average E/P ratios and the corresponding average P/E ratio for each quintile over the entire time period of the study, 1973-1990. Note that the use of industry diversification results in a narrower range of E/P ratios across the quintiles — the range for the non-diversified quintiles is 0.163 to 0.022, versus a range of 0.148 to 0.039 for the industry-diversified quintiles.[3]

EXHIBIT 1

E/P and P/E Ratios by E/P Quintiles (1973-1990)

		Non-Diversified E/P Quintiles				
		(Hi E/P)				(Lo E/P)
	All Stocks	Q1	Q2	Q3	Q4	Q5
Avg. E/P	0.098	0.163	0.124	0.098	0.073	0.022
Avg. P/E	10.2	6.1	8.1	10.2	13.7	44.9
		Industry-Diversified E/P Quintiles				
		(Hi E/P)				(Lo E/P)
	All Stocks	Q1	Q2	Q3	Q4	Q5
Avg. E/P	0.099	0.148	0.115	0.098	0.078	0.039
Avg. P/E	10.1	6.7	8.7	10.2	12.8	25.6

Averages represent the arithmetic mean of the yearly medians for all stocks and for each E/P quintile.

RETURNS TO E/P QUINTILES

Portfolio returns are computed for each E/P quintile and for the entire sample of stocks, as follows.[4] Each year at the formation date all stocks within each quintile are assigned an equal weight.[5] Then a buy-and-hold strategy is followed for the next twelve months.

To estimate an alpha, monthly portfolio excess returns (ERs) are calculated by subtracting the Treasury bill return from the portfolio return each month. The E/P quintile portfolio excess returns are then regressed against the excess return for the entire sample. If the capital asset pricing model of Sharpe [1964] holds, the intercept from this regression should be zero; any non-zero intercept can be interpreted as a positive or negative alpha.[6]

Exhibit 2 lists the alpha, A, and the t-statistic associated with this alpha, t(A), for each quintile.[7] Notice that for the entire sample period, 7304 to 9103, the estimated alpha for the high E/P quintile, Q1, is a positive 3.4%, and its associated t-statistic of 4.34 is highly significant in the statistical sense.[8]

EXHIBIT 2

Estimates of Alpha

Equal-Weighted E/P Quintiles versus Equal-Weighted Index of All Sample Stocks (Industry-Diversified E/P Quintiles)

ER(Qi)t = A + B × ER (All Stocks, Eqwtd)t

All Months, 7304-9103	(Hi E/P)				(Lo E/P)	
	Q1	Q2	Q3	Q4	Q5	Q1 - Q5
A	3.4%	2.5%	0.3%	-1.6%	-4.7%	8.0%
t(A)	4.34	4.94	0.61	-2.84	-5.50	

Subperiod 7430-7903	Q1	Q2	Q3	Q4	Q5	Q1 - Q5
A	4.7%	3.1%	-1.1%	-3.1%	-3.8%	8.5%
t(A)	2.77	3.18	-1.41	-2.94	-2.41	

Subperiod 7904-8503	Q1	Q2	Q3	Q4	Q5	Q1 - Q5
A	4.0%	3.1%	-0.2%	-2.0%	4.7%	8.7%
t(A)	3.38	3.57	-0.29	-2.21	-3.20	

Subperiod 8504-9103	Q1	Q2	Q3	Q4	Q5	Q1 - Q5
A	1.7%	1.3%	2.2%	0.4%	-5.7%	7.4%
t(A)	1.93	1.69	2.49	0.43	-4.30	

The results are based on regressing the monthly excess return (ER) for each quintile, defined as the median return for the quintile minus the monthly T-bill return, against the excess return for an equally-weighted portfolio consisting of all sample stocks.

Annualized estimates of alpha (A) are produced by multiplying monthly estimates by twelve.

Thus, it appears that Q1 outperformed the sample as a whole, on a risk-adjusted basis, by over 3% per year. This result is relatively robust to the choice of the sample time period.

Notice that for each of the three different subperiods listed in Exhibit 2 the estimated alpha for Q1 is positive, ranging from 4.7% for the subperiod 7304-7903 to 1.7% for the more recent subperiod of 8504-9103. The estimated alpha for Q1 is also statistically significant in the first two subperiods and marginally significant in the most recent period — the t-statistic of 1.93 for the 8504-9103 subperiod is significant at the 6% level. The fact that the estimated alpha is smaller in the more recent subperiod is consistent with the relatively poor performance of "value" stocks during the 1985-1991 period.

It is interesting to note that the estimated alpha for Q2 is also positive and generally significant. As one would expect, the estimated alpha for Q3 is close to zero and not statistically significant. The results for Q4 are mixed. Q4's estimated alpha is negative and statistically significant in the two earlier subperiods, but in the most recent subperiod it is slightly positive, although not significant.

Perhaps the most interesting quintile is Q5, the lowest E/P quintile, as it has a large, negative, and statistically significant alpha in each of the three subperiods. This finding suggests that as an investment strategy it may be more important to avoid owning, or perhaps to sell short, low E/P stocks than to buy high E/P stocks.

It is well-known that the market capitalization of a firm's equity (firm size) is a major factor associated with stock returns. Consequently we investigate whether the E/P quintile returns are actually just a proxy for the size effect.

There are a number of ways one might attempt to disentangle the E/P factor from the size factor.[9] Perhaps the simplest method is not to include the months of January in the regressions for estimating alphas, as it is well-known that most, if not all, of the size effect occurs in the month of January (see Keim [1983], for example).

Exhibit 3 reports the results for the regression over the entire time period, but excluding the January months. Notice that while the estimated alpha for Q1 is reduced from 3.4% to 2.4% when the January months are excluded, it is still statistically significant.

Notice also the estimated alphas for Q2 through Q5 are essentially unchanged by excluding January months.

EXHIBIT 3

Estimates of Alpha Excluding January Months
Equal-Weighted E/P Quintiles versus Equal-Weighted Index of All Sample Stocks (Industry-Diversified E/P Quintiles)
ER(Qi)t = A + B × ER (All Stocks, Eqwtd)t

All Months Except January, 7304-9103	(Hi E/P) Q1	Q2	Q3	Q4	(Lo E/P) Q5	Q1 - Q5
A	2.4%	2.5%	0.6%	-1.0%	-4.7%	7.1%
t(A)	3.25	5.13	1.23	-1.81	-5.42	

The results are based on regressing the monthly excess return (ER) for each quintile, defined as the median return for the quintile minus the monthly T-bill return, against the excess return for an equally-weighted portfolio consisting of all sample stocks, with January months excluded.

Annualized estimates of alpha (A) are produced by multiplying monthly estimates by twelve.

These results suggest that the estimated alpha for high E/P stocks is positive, even when controlling for firm size. On the other hand, the alpha for high E/P stocks is probably overstated if the researcher does not control for firm size.

The findings we report in Exhibits 2 and 3 are consistent with most of the previous studies on E/P strategies. Thus, if our conclusion that high E/P stocks historically have generated positive alphas is true, the next question is "why?" What are the economic and investor behavioral factors that caused this result?

HIGGLEDY PIGGLEDY REVISITED

In our 1992 article we examined the correlation between earnings changes during adjacent years as well as lagged years. As do Brealey [1967] and others, we found the average correlation coefficients for adjacent and lagged years' earnings changes to be close to zero when all stocks are included in the sample. We also found that the average correlation coefficients for adjacent and lagged years' earnings changes are close to zero when each E/P quintile is considered as a separate sample.

Even if the correlation of single-year earnings changes is close to zero, however, it could still be the case that multi-year earnings growth rates are positively correlated. One might also argue that multi-year earnings growth rates are more important to investors in determining stock prices than are single-year earnings changes.

Consequently, for this article we extend this line of analysis by examining the correlation between past four-year EPS growth rates and subsequent (future) four-year growth rates. For example, for E/P quintiles formed at the end of March 1976 (denoted 7603), each company's EPS growth rate over the previous four years (1971 to 1975) would be correlated with that same company's growth rate over the subsequent four years (l975 to 1979). The results are summarized in Exhibit 4.

EXHIBIT 4

Year-by-Year Correlation Coefficients of Four-Year EPS Growth Rates (Industry-Diversified E/P Quintiles)

Formation Date	Earnings Years	All Stocks	(Hi E/P) Q1	Q2	Q3	Q4	(Lo E/P) Q5
7603	71-75 & 75-79	-0.074	0.000	0.111	-0.212	-0.126	-0.051
7703	72-76 & 76-80	0.015	-0.099	0.227	-0.063	0.092	0.017
7803	73-77 & 77-81	0.008	-0.032	0.107	0.106	0.067	-0.095
7903	74-78 & 78-82	0.007	-0.010	-0.056	0.099	0.015	0.046
8003	75-79 & 79-83	-0.058	-0.171	0.004	-0.096	0.015	0.027
8103	76-80 & 80-84	-0.089	-0.203	-0.073	-0.021	-0.116	-0.062
8203	77-81 & 81-85	-0.138	-0.268	-0.174	0.024	-0.087	-0.122
8303	78-82 & 82-86	-0.121	-0.137	-0.170	-0.215	-0.012	0.165
8403	79-83 & 83-87	-0.114	0.040	-0.191	-0.235	-0.074	-0.072
8503	80-84 & 84-88	-0.081	-0.096	-0.058	0.006	-0.168	0.039
8603	81-85 & 85-89	-0.049	0.034	-0.018	-0.073	-0.081	-0.013
Average		-0.063	-0.086	-0.027	-0.062	-0.043	-0.011

Correlation coefficients are for the four-year percentage EPS growth rate prior to the formation date (T = 0) of the E/P portfolios correlated with the four-year percentage EPS growth rate subsequent to the portfolio formation date.

As is the case with both the adjacent and the lagged years, the average correlation coefficients for the four-year growth rates are close to zero. This is true for all stocks as well as for each of the E/P quintiles when they are treated as a separate sample. This implies that multi-year earnings growth rates cannot be forecast on the basis of simple time series models of earnings growth, just as single-year earnings cannot.

The fact that earnings growth rates are not correlated over time does not imply that earnings changes are literally determined by a random number generator. If investors can distinguish between low- and high-growth companies, and assuming that prices are set in a rational manner so as to incorporate investors' forecasts of earnings growth, one might observe high E/P companies generating relatively low subsequent earnings growth (and vice versa for low E/P companies). This, in fact, has been the case.

Exhibit 5 reports by E/P quintile the excess annualized eight-year growth rate *subsequent* to the date portfolios are formed. Excess growth is determined as the median eight-year growth rate of the companies within each E/P quintile minus the median eight-year growth rate for quintile 3 — thus, the excess growth rate for Q3 is always zero.

EXHIBIT 5

Excess Annualized Eight-Year Growth Rates (Industry-Diversified E/P Quintiles)

Formation Date	Median Growth for Q3	Excess Eight-Year Growth Rates (Hi E/P) Q1	Q2	Q3	Q4	(Lo E/P) Q5	Q1 - Q5
7303	10.6%	-3.8%	-0.8%	0.0%	-0.9%	2.7%	-6.6%
7403	8.5%	-3.3%	0.3%	0.0%	1.3%	1.8%	-5.1%
7503	7.1%	-4.9%	-2.8%	0.0%	0.0%	3.6%	-8.5%
7603	8.0%	-4.0%	-1.7%	0.0%	1.0%	2.9%	-6.9%
7703	7.1%	-2.5%	-1.0%	0.0%	1.6%	1.9%	-4.4%
7803	5.0%	-1.8%	-0.4%	0.0%	1.5%	4.2%	-6.0%
7903	4.4%	-2.1%	-3.4%	0.0%	-0.1%	2.6%	-4.7%
8003	2.2%	-1.1%	-0.8%	0.0%	2.1%	3.0%	-4.1%
8103	4.8%	-2.9%	0.0%	0.0%	0.9%	0.5%	-3.3%
8203	5.7%	-6.6%	-4.2%	0.0%	-1.4%	0.5%	-7.2%
Average	6.3%	-3.3%	-1.5%	0.0%	0.7%	2.4%	-5.7%

Note that for every portfolio formation period the excess annualized eight-year growth rate is negative for Q1 and positive for Q5, and, as shown in the last column of Exhibit 5, the difference between Q1 and Q5 is quite large. On average, the earnings growth rate for Q1 is 5.7% less per year, compounded for eight years, than that of Q5.[10]

Also, note that for six of the ten portfolio formation dates, the excess growth rate increases monotonically from Q1 to Q5.

That is, the excess growth rate for Q1 is less than that of Q2, which is less than that of Q3 which is less than that of Q4, which is less than that of Q5. We view this as strong evidence that, on average, investors are able to discriminate across companies on the basis of future earnings growth.

As we report in our 1992 article, there is considerable regression toward the mean in terms of earnings changes over time. This begs the question of whether the lower eight-year earnings growth rates for Q1 and Q2 relative to Q4 and Q5 are simply the result of Q1 and Q2 generating relatively low earnings growth in, say, only the first year after the E/P quintiles are formed, and average growth thereafter.

To address this issue, we compute single-year EPS changes for each of the "forward" years (denoted T + 1 through T + 8) in the eight-year period subsequent to the portfolio formation dates. To illustrate, consider the E/P quintiles formed on 7303: The earnings change in the forward year T + 1 is based upon a comparison of fiscal 1973 EPS to fiscal 1972 EPS; the earnings change in the forward year T + 2 is based upon a comparison of fiscal 1974 EPS to fiscal 1973 EPS; and so forth, so that the earnings change in the forward year T + 8 is based upon a comparison of fiscal 1980 EPS to fiscal 1979 EPS.

This process is then repeated for E/P quintiles formed on 7403, 7503, and so forth, through 8203. The average single-year excess EPS changes over all portfolio formation dates for each of the forward years T + 1 through T + 8 are reported in Exhibit 6 for each E/P quintile.

EXHIBIT 6

Average Single-Year Excess EPS Changes for Forward Years T + 1 Through T + 8 (Industry-Diversified E/P Quintiles)

Forward Year	Q3 Avg. EPS Change	Excess EPS Change (Hi E/P) Q1	Q2	Q3	Q4	(Lo E/P) Q5	Q1 - Q5
T + 1	10.2%	-9.9%	-3.6%	0.0%	3.7%	8.6%	-18.5%
T + 2	8.6%	-3.3%	-1.2%	0.0%	1.2%	3.7%	-7.0%
T + 3	8.8%	-1.7%	-0.6%	0.0%	0.5%	1.9%	-3.6%
T + 4	9.5%	-1.8%	-1.4%	0.0%	0.7%	1.1%	-2.9%
T + 5	9.2%	-0.9%	-1.3%	0.0%	-0.7%	1.3%	-2.2%
T + 6	8.6%	-1.0%	0.4%	0.0%	0.1%	1.0%	-2.0%
T + 7	7.2%	0.2%	-0.2%	0.0%	0.3%	1.7%	-1.5%
T + 8	6.8%	-0.3%	-1.4%	0.0%	0.9%	0.9%	-1.2%

Annual earnings changes are computed as the percentage change between fiscal EPS in year T + X compared to year T + X - 1, where T + X represents T + 1, T + 2, ..., T + 8; for example, for the formation date 7303 and for T + 1, the results represent the percentage changes in EPS from fiscal 72 to fiscal 73 for companies with October, November, and December fiscal years and for fiscal 73 to fiscal 74 for companies with January fiscal years. Observations whose absolute value > 300% are excluded from the sample, as are observations with negative earnings in year T.

Excess earnings changes are computed as the difference between the median earnings change for a quintile and the median earnings change for Q3.

As is readily apparent from the last column of Exhibit 6, the difference in earnings growth between Q1 and Q5 is quite large in the forward years T + 1 and T + 2, averaging -18.5% and -7.0%, respectively. Thus, a disproportionate part of the differences in eight-year EPS growth rates between Q1 and Q5 can be attributed to the first two years of the eight-year period.

Nevertheless, for each of the forward years T + 1 through T + 8 the difference between Q1 and Q5 single-year EPS changes is negative. Also, for each of the forward years T + 1 through T + 4 the earnings change increases monotonically across E/P quintiles.

We suspect that the very large differences in EPS growth in the forward year T + 1 occur because investors correctly identify unusual and temporary swings in earnings. For example, if investors believe that a company has just reported unusually high earnings, they might assign a low price to those earnings, resulting in a high E/P ratio. If they are correct, and next year's earnings decline, then the excess EPS change in year T + 1 will likely be a large negative number.[11]

Given the results presented in Exhibit 6, we conclude that investors are able to forecast *excess* EPS growth at least four years, and perhaps as many as eight years, into the future, *on average.* At the same time, as we document in our 1992 article, there is a large variance in the EPS growth rates for companies *within* each E/P quintile.

That is, within each E/P quintile there are some companies that generate very high growth rates and some that generate very low growth rates. Thus, at the individual company level there may be very large forecast errors of earnings growth.

This raises the question whether there are systematic differences in the earnings growth forecast errors across E/P quintiles. For example, suppose investors systematically underestimate the earnings growth for high E/P companies and overestimate the earnings growth of low E/P companies. If this is the case, such a systematic bias in the estimates of earnings growth might account for the reported positive alphas for high E/P portfolios and the negative alphas for low E/P portfolios.

ANALYSTS' FORECAST ERRORS

So far we have used the word, "forecast," as a reference to the *implicit* forecasts incorporated in E/P ratios — that is, we assume that high E/P stocks sell at low prices relative to current earnings because investors expect the companies to generate low earnings growth, and vice versa. We now consider the *explicit* forecasts of analysts, as reported by I/B/E/S.

Specifically, we match the companies in the I/B/E/S historical data base with those companies in our original sample. The I/B/E/S historical data base includes data from 1976 and does not contain forecasts for every company in our original sample. Thus, the sample using actual forecasts is both smaller and covers three years fewer than our original sample.

Exhibit 7 reports by E/P quintile the average forecast of excess single-year EPS change for the forward years T + 1 through T + 8. While the results are not directly comparable, note the similarity between Exhibits 7 and 6.

EXHIBIT 7

Average Forecast of Single-Year Excess EPS Change (Industry-Diversified E/P Quintiles)

Forward Year	Forecast EPS Change for Q3	Average Forecast of Excess EPS Change (Hi E/P) Q1	Q2	Q3	Q4	(Lo E/P) Q5	Q1 - Q5
T + 1	14.3%	-9.0%	-3.3%	0.0%	5.2%	16.0%	-25.0%
T + 2	13.2%	-3.9%	-1.3%	0.0%	2.3%	5.6%	-9.5%
T + 3	12.8%	-2.4%	-0.7%	0.0%	1.5%	3.9%	-6.3%
T + 4	12.7%	-1.8%	-0.8%	0.0%	1.1%	2.8%	-4.6%
T + 5	11.9%	-0.7%	0.3%	0.0%	1.5%	2.9%	-3.6%
T + 6	12.2%	-1.6%	0.1%	0.0%	0.6%	2.6%	-4.2%
T + 7	12.2%	-1.3%	-0.2%	0.0%	0.5%	1.9%	-3.2%
T + 8	11.6%	-0.4%	0.3%	0.0%	1.5%	3.1%	-3.5%

For each company, forecasts of EPS change for Year T + 1 are based on the mean IBES forecast (as of March 31 of that year) of EPS for the current fiscal year, compared to the actual earnings reported for year T + 0. For example, for E/P portfolios formed on 7603, and assuming a December fiscal year-end, the forecast (as of 7603) is for the fiscal EPS ending 7612. The forecast of EPS change for T + 1 is based on the forecast for 7612 EPS compared to the actual 7512 EPS. Forecasts of EPS change for Year T + 2 are based on the forecast of EPS for Year T + 2 (as of March 31 of Year T + 2). For example, for portfolios formed on 7603, the forecast of EPS for Year T + 2 (as of 7703) is for the fiscal year ending 7712. The forecast of EPS change for Year T + 2 is based on the forecast of 7712 EPS compared to the actual earnings reported for fiscal 7612. Forecasts of EPS change for Years T + 3, ..., T + 8 are determined in a similar manner. Companies with negative earnings are excluded from the calculations.

For each formation date, and for each of the forward years, the forecast of excess EPS change for each E/P quintile is computed by subtracting the median forecast of EPS change across the companies in the Q3 quintile from the median forecast of EPS change across the companies in each of the E/P quintiles. The mean, over all quintile formation dates, of these median E/P quintile forecasts of excess EPS change is presented above for each of the forward years, T + 1, ..., T + 8.

For example, note in Exhibit 6 that the actual excess EPS change for Q1 companies for year T + 1 is -9.9%, while in Exhibit 7 the analysts' forecast of excess EPS change for Q1 companies for year T + 1 is -9.0%. Similarly, the analysts forecast a large positive increase in year T + 1 for Q5 companies of 16.0% (Exhibit 7), while the actual EPS change for Q5 companies in year T + 1 is also large (8.6%, Exhibit 6).

It is important to understand when examining the results reported in Exhibit 7 for the forward years T + 2, ..., T + 8 that the forecasts we use were all made approximately nine months before the end of the fiscal year in question. That is, the forecasts for the forward years were not made 2, 3, ..., 8 years in advance. As explained in more detail in Exhibit 7, for the forward years T + 2 through T + 8 we maintain the same E/P ranking as determined for year T + 1. Then we record the forecast of EPS for year T + X as of March 31 in year T + X, where X represents the forward year 1, 2, ..., 8.

Now, note in Exhibit 7 that the difference between Q1 and Q5 EPS changes was forecast to be a large negative number in year T + 1. This difference was then forecast to decrease steadily in each of the forward years, but in fact the forecast difference remains negative as far out as the year T + 8. This is a pattern that is very similar to that of the actual difference between the Q1 and Q5 EPS changes reported in Exhibit 6. The similarity between the results in Exhibit 7 (forecasts of EPS changes) and Exhibit 6 (actual EPS changes) suggests that, on average, analysts' forecasts of excess EPS changes mirror actual excess EPS changes reasonably well.

Exhibit 8 reports data concerning the actual forecast errors of the analysts. This forecast error is defined as the difference between the mean of the analysts' EPS forecasts (as of March 31) and the company's actual EPS for the fiscal year in question, divided by the company's actual EPS for the previous fiscal year. That is,

$$\text{Forecast Error } (T + X) = [\text{Forecast } (T + X) - \text{Actual } (T + X)]/\text{Actual } (T + X - 1)$$

where X represents the forward years, 1, ..., 8.

EXHIBIT 8

Average Forecast Errors of Single-Year Excess EPS Changes Across E/P Quintiles (Industry-Diversified E/P Quintiles)

Forward Year	Median Forecast Error for Q3	Average Excess Forecast of EPS Change (Hi E/P) Q1	Q2	Q3	Q4	(Lo E/P) Q5	Q1 - Q5
T + 1	4.4%	1.2%	1.0%	0.0%	-0.1%	1.4%	-0.2%
T + 2	4.5%	1.0%	1.5%	0.0%	0.6%	1.6%	-0.6%
T + 3	5.2%	-0.3%	-0.5%	0.0%	0.1%	1.1%	-1.4%
T + 4	4.5%	0.9%	0.5%	0.0%	0.6%	0.4%	0.5%
T + 5	4.8%	-0.3%	0.3%	0.0%	-0.6%	1.1%	-1.4%
T + 6	4.8%	-0.4%	0.2%	0.0%	-0.6%	2.3%	-2.7%
T + 7	4.7%	0.4%	1.0%	0.0%	0.6%	2.1%	-1.7%
T + 8	5.7%	0.9%	1.0%	0.0%	0.1%	0.6%	0.3%

For each company, forecast errors for the forward year T + X are computed as:

$$[\text{Forecast } (T + X) - \text{Actual } (T + X)]/\text{Actual } (T + X - 1)$$

where X represents the forward year 1, ...,8. Companies with negative earnings in the base year are excluded from the calculations. See Exhibit 7 for comments on how average excess forecast errors for each E/P quintile for each of the forward years T + 1, T + 2, ..., T + 8 are determined.

Thus, a positive forecast error indicates that the analysts' forecasts were too high, and vice versa. The second column of Exhibit 8 lists the median forecast error for Q3 companies for each of the forward years T + 1 through T + 8. Note that the forecast errors for this quintile are in the 4% to 5% range. This suggests that, on average, analysts' forecasts were high by 4% to 5%.

This is also true for companies in the other quintiles, and is consistent with the findings of other studies that have reported that analysts' forecasts tend to be somewhat optimistic (see, for example, De Bondt and Thaler [1990] and Stickel [1990]).

More relevant to this article are the excess forecast errors across E/P quintiles. Notice that on average the excess forecast errors are small, ranging from zero to plus or minus 2%, and display no strong monotonic pattern across E/P quintiles.

The last column in Exhibit 8 reports the difference in the average forecast errors for Q1 companies and Q5 companies. Notice that these differences tend to be negative, suggesting that analysts overestimated the actual earnings of Q5 companies by more than they did the Q1 companies. But, again, these differences are small and not statistically significant.

In our judgment, the differences in analysts' forecast errors between Q1 and Q5 companies are too small to explain the differences between the alphas associated with these two E/P quintiles. Note that the differences (Q1-Q5) range between +0.5% and -2.7% (Exhibit 8), while the difference between the alphas is 8.0% over all months (Exhibit 2) and 7.1% over all months except January (Exhibit 3).

Thus, we believe it is unlikely that overly optimistic forecasts of the Q5 companies' earnings, relative to those of Q1 companies, account for the differential performance between these E/P quintiles over the eighteen years covered in this study.[12]

It is worth noting that our finding that analysts forecast errors are very similar across E/P quintiles is consistent with our previous observation that the earnings growth subsequent to forming the E/P quintiles is low for the high E/P quintile companies and high for the low E/P quintile companies. As we argue earlier, if stock prices are based upon expected earnings growth, then a high E/P ratio provides an *implicit* forecast of low earnings growth, and vice versa.

Thus, on average both investors (who determine prices and E/P ratios) and analysts were able to discriminate correctly across companies on the basis of subsequent earnings growth. (In fact, one might interpret these two findings as evidence that the analysts' estimates of earnings recorded by I/B/E/S are good proxies for the actual estimates of earnings growth that investors use in setting prices.)

Unfortunately, these findings also imply that on average stocks are fairly valued, and therefore do not help explain the anomalous result of a positive alpha associated with high E/P stocks and a negative alpha associated with low E/P stocks.

ARE OMITTED RISK FACTORS THE SOURCES OF ALPHA?

One possible explanation of the E/P anomaly is that high and low E/P stocks have different exposures to risk factors beyond the systematic market risk that is captured by betas. To investigate this possibility, we use the BARRA performance analysis system (PERFAN), which is based upon a complex, multi-factor model that attempts to control for systematic risk (beta), fifty five industry classifications, and thirteen other "risk" factor exposures.[13]

PERFANs were run for both the equal-weighted Q1 and Q5 portfolios over the entire time period of our study, using the equal-weighted portfolio of all our sample stocks as a benchmark. Statistics from the two PERFANS are reported in Exhibit 9.

EXHIBIT 9

BARRA PERFAN Analysis

Benchmark: Equal-Weighted Portfolio of All Sample Stocks Time Period: All Months, 7304-9103

	Beta Relative to All Stocks		
	Q1	Q5	Q1 - Q5
Beta	1.00	1.08	-0.08

	Average Risk Factor Exposures		
	Q1	Q5	Q1 - Q5
Earnings/Price	**0.60**	**-0.74**	**1.34**
Variability in Markets	-0.02	0.28	-0.30
Success	-0.08	-0.05	-0.03
Size	-0.04	-015	0.11
Trading Activity	0.08	0.12	-0.04
Growth	-0.28	0.49	-0.77
Book/Price	0.36	-0.14	-0.50
Earnings Variability	0.02	0.42	-0.40
Financial Leverage	0.05	0.21	-0.16
Foreign Income	0.02	0.01	0.01
Labor Intensity	-0.08	-0.04	-0.04
Yield	0.24	-0.40	0.64
LoCap	0.03	0.02	0.01

	Contributions to Alpha		
	Q1	Q5	Q1 - Q5
Beta Timing	-0.1%	0.4%	-0.5%
Return to E/P	**1.9%**	**-2.4%**	**4.3%**
Return to Size	0.2%	0.2%	0.0%
Return to Book/Price	1.3%	-0.6%	1.9%
Return to Variability in Markets	0.1%	-0.8%	0.9%
Other Risk Factors	-0.3%	-0.7%	0.4%
All Industry Factors	0.2%	0.0%	0.2%
Specific Asset Selection	0.0%	-0.6%	0.6%
Total Alpha	**3.3%**	**-4.5%**	**7.8%**

Betas are measured relative to the sample of all stocks.

Average risk factor exposures are expressed in units of each factor's cross-sectional standard deviation.

Contributions to alpha are expressed as annualized percentage total return.

First note at the top of Exhibit 9 that the average beta is 1.00 for Q1 and 1.08 for Q5. Thus, the low E/P stocks tend to have higher systematic risk than the high E/P stocks. (Note that the betas are measured relative to the benchmark, which in this case is the equally-weighted portfolio consisting of the entire sample of stocks.)

The middle part of Exhibit 9 lists the average BARRA risk factor exposures over the entire time period of the study. A risk factor exposure represents the amount (measured in units of the cross-sectional standard deviation of the factor exposures in the benchmark portfolio) by which the average risk factor exposures of a portfolio exceed the average risk factor exposures of the benchmark.

To illustrate the interpretation of these risk factor exposures, consider the earnings/price (E/P) exposures. On average over the entire time period, the Q1 portfolio had an E/P ratio that was 0.60 standard deviations above the mean E/P ratio for the entire sample; the Q5 portfolio had an E/P ratio that was -0.74 standard deviations below the mean E/P ratio for the sample.

By looking down the third column (Q1 - Q5), one can quickly spot the major differences between the two portfolios. Obviously, the largest difference is associated with the E/P ratio, with the Q1 portfolio having an E/P ratio 1.34 standard deviations larger than the Q5 portfolio. The other risk factor exposures are in line with what one might expect.

With respect to growth, Q1 is -0.77 standard deviations below Q5; with respect to book/price and dividend yield, Q1 is 0.50 and 0.64 standard deviations above Q5, respectively. The only other large differences are related to stock price variability (variability in markets) and earnings variability; As one might expect, Q5 companies tend to have more volatile stock prices and earnings.

The BARRA PERFAN system attempts to identify the sources of alpha. This is termed “contributions to alpha,” and summary data are reported at the bottom of Exhibit 9. First consider the total alpha, which is 3.3% and -4.5% for Q1 and Q5, respectively, making the difference in total alpha between Q1 and Q5 equal to 7.8%. It is worth noting that this difference in total alpha based on the sixty-nine-factor BARRA model is very close to the 8.0% difference in alpha estimated by the single factor model (see Exhibit 2).

The industry exposures relative to the benchmark are not listed to conserve space. Given our methodology for creating industry-diversified portfolios, however, one would not expect to see large differences in terms of industry exposures, so the contribution to alpha associated with industry exposures should be small. The PERFAN results are consistent with this expectation. Note that the contribution to alpha from all industry factors is only 0.2% and 0.0% for Q1 and Q5, respectively.

Clearly the most important factor in determining the difference in alpha between Q1 and Q5 is the return to E/P. A high E/P exposure contributes 1.9% to Q1's alpha and a low E/P exposure contributes -2.4% to Q5's alpha, making the differential contribution to alpha associated with E/P equal to 4.3%.

It is interesting to note that firm size did not affect the differential performance between Q1 and Q5. This is because the average size factor exposures are quite similar for Q1 and Q5, -0.04 and -0.15, respectively. As a result, the contribution to alpha associated with size is 0.2% for both Q1 and Q5.

As noted previously, in addition to the E/P and size factors, there are eleven other risk factors in the BARRA model. Of these eleven, only book/price and variability in markets made a significant contribution to alpha. The sum of the contributions to alpha associated with the remaining nine risk factors is listed as "other risk factors" in Exhibit 9. Note that these nine risk factors contribute only -0.3% to Q1's alpha and -0 7% to Q5's alpha, making the differential contribution to alpha 0.4%.

Book/price (B/P) is a relatively important factor in determining the differential alpha between Q1 and Q5, accounting for 1.9% of the difference. Variability in markets is another important factor, accounting for 0.9% of the difference between alphas. Of course, one might expect these two variables to be highly correlated with E/P — certainly E/P and B/P are related variables. Although less obvious, it also seems likely that E/P and variability in markets are related — in particular, low E/P stocks tend to have high stock price variance.

As noted above, E/P, B/P, and variability in markets account for 4.3%, 1.9%, and 0.9%, respectively, of the difference in contribution to alpha between Q1 and Q5. These three sum to 7.1%, leaving only 0.7% out of a total difference in performance of 7.8% between Q1 and Q5. If one assumes that the contributions to alpha from B/P and variability in markets are simply the result of having selected stocks on the basis of industry-relative E/P ratios, then only a small amount of the differential performance between Q1 and Q5 is left to be explained.

While one might disagree with this assumption, it appears to us that very little of the E/P anomaly can be explained by other risk factors. At least the twelve additional risk factors and the fifty-five industry factors in the BARRA PERFAN model do not account for the E/P effect. This makes it difficult to accept Ball's [1978] argument that E/P is a catchall proxy for omitted risk factors in asset pricing.

SUMMARY AND CONCLUSIONS

Over the eighteen-year-period of this study, 7304-9103, high E/P stocks generated above-normal returns, and low E/P stocks generated below-normal returns. This is consistent with the findings of previous studies, and with the argument that stocks are incorrectly priced across E/P groups.

The major question we explore is the issue of what factor(s) account for, or explain, the anomalous returns to high and low E/P stocks. We look particularly at the earnings growth of companies subsequent to forming E/P portfolios, as well as analysts' forecast errors. We also use BARRA's performance analysis system to see if any of the factors in its multi-factor model could account for the abnormal returns.

Subsequent earnings growth does not appear to account for the abnormal returns, as high E/P stocks tend to generate low subsequent earnings growth, and low E/P stocks tend to generate high subsequent earnings growth. This is consistent with correct pricing of stocks across E/P groups, not incorrect pricing.

Analysts' forecast errors were approximately equal across E/P quintiles. Thus, analysts' forecast errors do not appear to be the source of the positive alphas associated with high E/P stocks and the negative alphas associated with low E/P stocks. Finally, BARRA's multi-factor model did not provide an answer to the E/P puzzle.

We can only speculate as to what drives the abnormal returns associated with high and low E/P stocks. One possible explanation is that the E/P anomaly is time period-specific, although eighteen years is a rather long time period. It may also be the case that there are behavioral biases among investors that cause them systematically to underprice high E/P stocks and overprice low E/P stocks. Such irrational behavior is also difficult to accept, given the magnitude of the abnormal returns and the length of time over which the phenomenon has persisted. For now, the "E/P effect" remains an enigma.

ENDNOTES

[1] See fuller, Huberts, and Levinson [1992]. It is worth pointing out again, as we did in our 1992 article, that the authors of the original Higgledy, Piggledy studies state only that earnings changes tend to be uncorrelated over time and do not necessarily imply that earnings cannot be predicted.

[2] The market value of an individual company's common stock was required to be equal to or greater than 0.0001 times the market value of the S&P 500 as of March 31 of each year. To illustrate, on March 31, 1990, the market value of the S&P 500 was approximately $2.2 trillion, making the minimum market value screen equal to $220 million.

[3] In preparing this article we discovered, to our chagrin, a programming error associated with our 1992 article. Thus, the average E/P ratios reported in Exhibit 1 here are not identical to those reported error affect in Table 1 of the 1992 article. While this programming error affected the magnitude of the results reported in the 1992 article, its general conclusions are unchanged. (A corrected version of the 1992 article is available upon request.)

[4] The term, "return," refers to total return, i.e., price change plus dividends received during the period divided by beginning of period price. All returns are initially measured over one-month periods.

[5] We also formed portfolios by capitalization-weighting each stock in the portfolio on the formation date, and then following a buy-and-hold strategy over the next twelve months. The results obtained using the cap-weighted portfolios were qualitatively the same as those obtained using equal-weighted portfolios.

[6] These estimates of alphas should not be confused with a true CAPM equilibrium alpha estimated by regressing portfolio excess returns against the excess returns of a value-weighted index used as a proxy for the market portfolio of all risky assets. Rather, because they result from regressing the excess returns for each quintile against the excess return the entire sample, the alphas in Exhibit 2 should be thought of as the risk adjusted differential performance of each E/P quintile relative to universe of stocks from which the E/P quintiles are formed. We also regressed the E/P quintile excess returns against the value-weighted S&P 500 excess returns with qualitatively similar results.

[7] The betas for each quintile are close to 1.0, except for Q5, which has a beta of approximately 1.07, and all the beta coefficients statistically significant. All the regression R-squares are at the 0.96 or greater level. Complete regression results are available from the authors.

[8] Given the number of monthly observations in all regressions, one can safely assume that a t-statistic with an absolute value of 2.0 or more is statistically significant at the 5% level or less.

[9] For example, along the lines of Fama and MacBeth [1973] we estimated the following monthly cross-sectional regressions: dependent variable was the individual stock's excess return; the independent variables were the stocks' beta, the stocks' E/P quintile ranking (from I to 5), the stocks' size quintile ranging (from 1 to 5), and the standardized product of the E/P and size quintile rankings. (The last variable is a check to see if there were interaction effects between E/P and size quintile rankings.) The mean of the time series of monthly coefficients for each of the independent variables was then examined to determine whether the coefficients are significantly different from zero. We found that all three coefficients were significantly different from zero and had the expected sign. These results suggest that both E/P and size help explain returns, but the effects of the two variables cannot be completely disentangled.

[10] In some cases one needs to be cautious when interpreting the results for Q5, as it contains those companies with negative earnings. However, in this case the results are probably *understated* for Q5 because any company with negative earnings in the base year T was excluded from the calculation of earnings growth, and, as Ettredge and Fuller [1991] have shown, companies with negative earnings tend to have very large earnings changes in subsequent years.

[11] According to the results reported in Exhibit 6, the differences in single-year earnings changes across E/P quintiles clearly decrease over time, which might be interpreted as evidence of regression

toward the mean. One should be cautious in drawing such an inference because the results are potentially subject to survivorship bias. This is because, in order to be included in the results for Exhibit 6, a company had to remain in business as an independent entity over the entire eight-year period, T + 1 through T + 8 (One should be similarly cautious when interpreting the results in Exhibits 5, 7, and 8.)

[12] One interesting finding concerning analysts' forecast errors (not reported in Exhibit 8) is that the average absolute value of the forecast error is consistently larger for both Q1 and Q5 companies than for Q2, Q3, and Q4 companies. Because the absolute value of the forecast error indicates how much, plus or minus, the analysts' estimates missed the mark, this suggests that it is more difficult to forecast earnings for the extreme E/P quintiles than for the middle E/P quintiles.

[13] Specifically, we use the BARRA E2 model. A more complete description of this model can be found in Fogler [1990].

REFERENCES

Ball, R. "Anomalies in Relationships between Securities' Yields and Yield-Surrogates." *Journal of Financial Economics*, 15 (1978), pp . 103-126.

Banz, R.W., and W. Breen. "Sample-Dependent Results Using Accounting and Market Data: Some Evidence." *Journal of Finance*, September 1986, pp. 567-577.

Basu, S. "The Relationship Between Earnings' Yield. Market Value and Return for NYSE Common Stocks: Further Evidence." *Journal of Financial Economics*, 12, 1 (June 1983), pp. 129-156.

Brealey, R.A. "The Behavior of Earnings," in *An Introduction to Risk and Return from Common Stocks.* Cambridge, MA: The MIT Press, 1983 (2nd ed.), Chapter 5, pp. 83-100.

———. "The Statistical Properties of Successive Changes in Earnings." Paper presented to the Seminar on the Analysis of Security Prices, University of Chicago, May 1967.

De Bondt, W.F.M., and R. Thaler. ''Do Security Analysts Overreact?" *American Economic Review,* May 1990, pp. 52-57.

Ettredge, M., and R.J. Fuller. "The Negative Earnings Effect." *Journal of Portfolio Management*, Spring 1991, pp. 27-33.

Fama, E.F., and K.R. French. "The Cross-Section of Expected Returns." *Journal of Finance,* 47, 2 (June 1992), pp. 427-466.

Fama, E.F., and J.D. MacBeth. "Risk, Return, and Equilibrium: An Empirical Test." *Journal of Political Economy,* 81 (May/June 1973), pp. 607-636.

Fogler, R. "Common Stock Management in the 1990s." *Journal of Portfolio Management,* 16, 2 (Winter 1990), pp. 26-35.

Fuller, R., L. Huberts, and M. Levinson. "It's Not Higgledy-Piggledy Growth!" *Journal Portfolio Management,* Winter 1992, pp. 38-45.

Goodman, D.A., and J.W. Peavey. "The Interaction of Firm Size and Price-Earnings Ratios on Portfolio Performance," *Financial Analysts Journal*, 42, 1 (1986), pp. 9-12.

Jaffe, J., D. Keim. and R. Westerfield. "Earnings Yields, Market Values and Stock Returns." *Journal of Finance*, 44 (1989), pp. 135-148.

Keim, D. "Size-Related Anomalies and Stock Return Seasonality: Further Empirical Evidence." *Journal of Financial Economics*, 12 (June 1983), pp. 13-32.

Lintner, J., and R. Glauber. "Higgledy, Piggledy Growth in America." Paper presented to the Seminar on the Analysis of Security Prices, University of Chicago, May 1967. Reprinted in J.H. Lorie and R.A. Brealey, eds., *Modern Developments in Investment Management.* Hinsdale, IL: The Dryden Press, 1978, 2nd ed.

Little, I.M.D. *Higgledy Piggledy Growth Again.* Oxford: Basil Blackwell, 1966.

Sharpe, W. "Capital Asset Prices: A Theory of Market Equilibrium Under Conditions of Risk." *Journal of Finance,* 19, 3 (1964), pp. 353-366.

Stickel, S.E. "Predicting Individual Analyst Earnings Forecasts." *Journal of Accounting Research*, 28, 2 (Autumn 1990), pp. 409-417.