Overreaction, Underreaction, and the Low-P/E Effect

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David N. Dreman and Michael A. Berry

Although earnings surprises have been studied extensively, they have not been examined in the context of contrarian strategies. Positive and negative earnings surprises affect "best" (high-P/E) and "worst" (low-P/E) stocks in an asymmetric manner that favors worst stocks. Long-term reversion to the mean, in which worst stocks display above-market returns while best stocks show below-market results, regardless of the sign of the surprise, continues for at least 19 quarters following the news. These results are consistent with mispricing (overreaction to events) prior to the surprise, and a corrective price movement after the surprise is consistent with extant research on underreaction. The mispricing-correction hypothesis explains the superior returns of contrarian strategies noted here and elsewhere in the literature.

Empirical evidence supporting contrarian strategies has been a part of the literature since the early 1960s, corroborating the observations of Graham and Dodd and other value pioneers.[1] The early work of McWilliams, Miller and Widmann, Nicholson, Dreman, and Basu focused on the return advantage of low-P/E stocks.[2] Most of the early researchers discussed a low-P/E hypothesis, which was summarized by Basu as follows: Investors' original expectations of future growth of revenues and earnings for both high- and low-P/E stocks are overstated, leading to exaggerated optimism for the high-P/E and overpessimism for the low-PE group. Accordingly, the market systematically misprices these two P/E classes. Later, Dreman proposed the investor-overreaction hypothesis (IOH), a broader version of the low-P/E hypothesis, to explain the success of other contrarian strategies, in addition to low P/E, and posited a behavioral explanation to account for these findings.[3]

Until recently, these early results have not found wide acceptance in the academic community. Many researchers have offered evidence that the low-P/E effect is actually subsumed by the size effect, reflects some undisclosed risk premium, or is a spurious result caused by faulty research design.[4] Conrad and Kaul, moreover, showed that studies of contrarian investment strategies using cumulative abnormal returns are susceptible to upward biasing, a problem plaguing both sides of the debate.[5] Studies taking this and other issues into account, however, have demonstrated the persistence of contrarian effects. Lakonishok, Shleifer, and Vishny (LSV), for example, demonstrated that a number of contrarian strategies provided superior returns for some decades without higher systematic risk.[6] Thus, the existence of contrarian effects now appears widely accepted, although their explanation is another matter. In support of mispricing, several studies have drawn a clear link between news events and returns to contrarian strategies by showing that a significant fraction of the differential price movement takes place within several days of earnings announcements.[7]

The purpose of our work is twofold. First, we extend the foregoing research by examining stock price response to analysts' consensus quarterly forecast errors, or earnings surprises, an especially common and important informational event. Basu's paper on the effect of unexpected earnings on low- and high-P/E stocks is a precursor to this work.[8]

We found that analysts' errors have an asymmetrical impact on high- and low-P/E stocks. Positive surprises for "worst" stocks (lowest P/E quintile) result in significantly above-market returns but have a far more moderate impact on "best"

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stocks (highest P/E quintile). Similarly, negative surprises on best stocks result in significantly below market returns, with only a minor impact on worst stocks.

Second, we demonstrate that stocks are not immediately priced at the appropriate level after an earnings surprise. Rather, over a prolonged period of time (at least five years), stock prices revert to the mean, with low-P/E stocks outperforming and the high-P/E stocks underperforming the market. This evidence is consistent with the assumptions of both the low-P/E and the IOH hypotheses that investors initially misprice best and worst stocks because their expectations are too one-sided.

This finding provides some insight into the ongoing debate pertaining to overreaction versus underreaction. For example, De Bondt and Thaler, in two influential papers, presented evidence in support of a "winners/losers" hypothesis. They found that the worst-performing stocks in one period subsequently outperformed the market and that prior winners subsequently underperformed, a result they attributed to overreaction.[9] A number of other studies, however, have produced examples of underreaction. For example, Bernard and Thomas demonstrated that stock prices appear to underreact to recent earnings information.[10] Of particular interest is recent work by Abarbanell and Bernard showing that analysts do not learn fully from their mistakes: A positive surprise is likely to be followed by another positive surprise in the next quarter, and a negative surprise followed by another negative surprise.[11] Uncertainty, then, exists about whether investors underreact or overreact to earnings information.

We believe the "overreaction" nomenclature is too general in that it has been used in the finance literature to refer to many disparate phenomena. The number of reacting agents (investors, analysts, prices, etc.) and sources of information being reacted to (earnings, prices, etc.) has made clear-cut comparisons difficult.

Our observations are consistent with the postevent drift observed by Abarbanell and Bernard and other researchers. Our findings indicate that stock prices, like analysts' forecasts, do not fully adjust to new information quickly. The price drift we observe may indicate a corrective reaction to significant mispricing. Thus, we believe that the mispricing or overreaction occurs prior to the measurement of the event occurrence (earnings surprise) and the corrective process or underreaction occurs following the event. Rather than being mutually exclusive, so-called overreaction and underreaction studies may play complementary and interactive roles in the hypothesis we propose.

We also examined the size and frequency of analysts' errors. We found that, contrary to the supposition of La Porta, Lakonishok, Shleifer, and Vishny (LLSV), analysts' errors do not favor low- over high-P/E (or worst over best) stocks in either size or number.[12]

THE MISPRICING-CORRECTION HYPOTHESIS

We suggest calling the idea that the original mispricing is followed by corrective price action the mispricing-correction hypothesis (MCH). The MCH proposes an explanation for the low-P/E and other contrarian effects.

The MCH posits that investors often overvalue the prospects of best and undervalue the prospects of worst investments. The positive or negative developments of the recent past are extrapolated well into the future, pushing prices to excessive premiums or discounts.

Earnings surprises elicit two distinct classes of price response. The first category is event triggers, which we define as unexpected positive news on a stock believed to have a poor outlook or negative information for a stock believed to have excellent prospects. Such news leads investors to reappraise their previous expectations and results in significant price changes. An event trigger thus would be a positive surprise on a low-P/E stock or a negative surprise on a high-P/E issue.[13]

Specifically, the MCH predicts that postevent-trigger performance for best and worst investments will be asymmetric. Investments previously considered to be best underperform, and those previously considered to be worst significantly outperform the market as both revert toward a mean valuation. The MCH also posits that the maximum price impact resulting from earnings surprises is produced by event triggers.

The second surprise category is reinforcing events. These surprises reinforce an investor's current perceptions of best and worst stocks and, as a result, are predicted to have a lesser impact on stock price movements than do event triggers. Positive surprises for high-P/E stocks reinforce the market perception of "best," and negative surprises on low-P/E stocks reinforce the perception of "worst."

The MCH also predicts that surprises should have a negligible net effect on the middle P/E quintiles, which are neither significantly overvalued nor undervalued.

We used positive and negative earnings surprises to test price reactions to new information. These surprises provide the most commonly available source of good or bad news in the marketplace. The highest and lowest P/E quintiles are used to demonstrate the effects of surprises on best and worst stocks, respectively.

In summary, if investors show differential reactions by overpricing stocks they believe have the best potential and undervaluing stocks they believe possess the worst in a systematic and predictable manner, the MCH should yield the following results:

- The market-adjusted return differential between lowest and highest P/E quintiles on positive earnings surprises favors low-P/E stocks.
- The market-adjusted return differential between lowest and highest P/E quintiles experiencing negative earnings surprises favors low-P/E stocks.
- The absolute return differential between event triggers (positive surprise low P/E + negative surprise high P/E) and reinforcing events (negative surprise low P/E + positive surprise high P/E) favors event triggers.
- The net impact of surprises should be significant only on the extreme quintiles and have minimum impact on the 60 percent of stocks in the middle quintiles.

Our results confirm all four predictions of the MCH.

We posited that the two salient features of the MCH—mispricing prior to measurement of returns and the corrective process afterwards—explain the results of LSV and other contrarian findings, as well as the original low-P/E effect.[14]

METHODOLOGY

We analyzed quarterly earnings and estimates derived from the Abel Noser data base. These data cover a yearly maximum of 1,331 companies from January 1973 through March 1993.[15] After matching with the Compustat data base and retaining those companies with fiscal years ending in March, June, September, and December, the sample size was reduced to 995 companies. For one-year holding periods, we included as portfolio formation periods Quarters 1 to 77, where Quarter 1 corresponds to April through June 1973. For five-year holding periods, we formed portfolios in Quarters 1 to 61.

The portfolios were based on quintiles of trailing 12-month P/E multiples. To control for nominal earnings, we deleted observations with P/E multiples that were negative, zero, or greater than 60. We then grouped the three middle quintiles together to form a single portfolio containing 60 percent of the sample. If a company subsequently showed a missing return, we deleted that company from the portfolio for the remainder of the holding period. We found that entering a return of –100 percent for delisted companies did not affect the results except to produce a slightly lower market return. The mean value of the P/E multiples and several other market statistics for the three portfolios are given in Table 1. The surprises are presented as percentages of forecast and actual earnings, although only the sign of the surprise enters into the analysis. For one-year holding periods, we calculated quarterly returns (annualized) for each of four successive quarters to measure the initial response to the earnings surprise. We also calculated returns for five-year holding periods to examine long-term return behavior. The annualized total returns are market adjusted using the Abel Noser index as a market proxy. To minimize upward biasing of returns, we used holding period returns, not cumulative returns.[16]

One-tailed *t*-tests were performed on the mean paired difference between portfolio and market returns, as well as for other cases as specified in the paper.

RESULTS

Discussion of our empirical results is divided into four sections. The first section examines returns to the low-, high-, and middle-P/E groupings for all surprises; the second analyzes the response of each portfolio to positive and negative surprises separately; the third section considers the differential price impact of the two surprise categories—event triggers and reinforcing events; and the last section looks at the prolonged effect of reversion to the mean for holding periods up to five years.

Performance of the Full Sample

Figure 1 shows the results of measuring average annual market-adjusted returns for the middle three quintiles combined and extreme quintiles for both the quarter in which the surprise occurred and a one-year holding period. It presents the aggregate returns performance of the sample under the impact of all positive and negative surprises. The market return (geometric mean) for the entire sample was 16.5 percent over all overlapping one-year holding periods.

In the surprise quarter, the low-P/E quintile outperformed all other quintiles (7.1 percent above

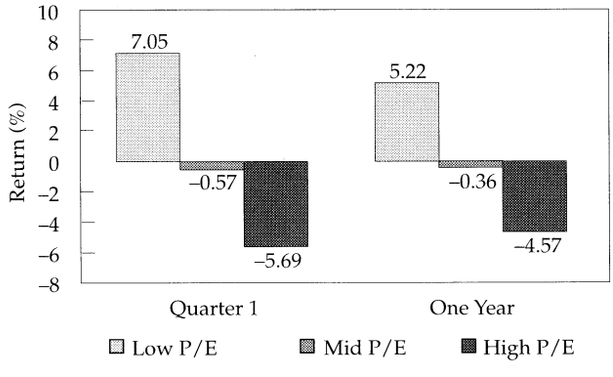
Table 1. Sample Summaries

Portfolio	Actual EPS[a]	Forecast EPS[a]	P/E	Surprise (% ACT)[b]	Surprise (% FORE)[c]	Number of Observations
All Surprises						
Low P/E	2.52	2.62	6.59	−31.93	−6.00	10,068
Mid P/E	1.82	1.89	11.37	−19.66	−3.70	30,333
High P/E	1.19	1.24	23.23	−25.31	−7.52	10,103
Sample	1.83	1.90	12.79	−23.24	−4.92	50,504
Positive Surprises						
Low P/E	3.13	2.59	6.49	16.48	31.84	4,486
Mid P/E	2.22	1.89	11.20	16.73	23.50	12,773
High P/E	1.66	1.35	23.29	21.68	33.25	4,257
Sample	2.30	1.93	12.61	17.66	27.17	21,516
Negative Surprises						
Low P/E	2.07	2.78	6.68	−82.25	−42.28	4,807
Mid P/E	1.60	2.04	11.48	−56.85	−28.94	14,249
High P/E	0.85	1.30	23.86	−83.00	−51.88	4,192
Sample	1.56	2.06	12.72	−66.82	−35.84	23,248

[a] Actual and forecast earnings per share are average over the study period and reflect fully adjusted values.
[b] (Actual − Forecast)/|Actual|.
[c] (Actual − Forecast)/|Forecast|.

market returns) and the high-P/E quintile underperformed all other quintiles (5.7 percent below market returns). Low-P/E stocks also outperformed high-P/E stocks by 9.8 percent over the one-year holding period. The average market-adjusted return of the middle quintiles is not significantly different from zero. Table 2 provides total annualized returns (not market adjusted), and return measures and significance levels are presented in Table 3. In most cases, the results are significant at the 1.0 percent level or 0.1 percent level.

Figure 1. Annualized Market-Adjusted Holding Period Returns, All Earnings Surprises, 1973–93



The Impact of Surprise

If the MCH is correct, good news affects best and worst stocks in an asymmetric manner. A favorable surprise on a worst investment should change investor expectations and send the stock price higher. A positive surprise on a best stock should not change expectations, however, thus having less effect on price.

Table 2. Annualized Total Returns (percentages)

Portfolio	Quarter 1	Quarter 2	Quarter 3	Quarter 4	One-Year Holding Period
All Surprises					
Low P/E	23.29	21.57	20.40	21.52	21.69
Mid P/E	15.67	16.42	15.45	16.92	16.12
High P/E	10.58	12.56	12.93	11.58	11.91
Sample	16.24	16.77	16.03	16.85	16.47
Market	16.24	16.77	16.03	16.85	16.47
Positive Surprises					
Low P/E	36.33	23.96	21.89	21.84	25.86
Mid P/E	27.74	18.40	17.03	17.19	20.01
High P/E	22.88	16.54	16.28	11.74	16.79
Sample	28.65	19.39	18.14	17.18	20.76
Negative Surprises					
Low P/E	12.04	18.61	17.45	20.94	17.21
Mid P/E	4.37	13.22	13.09	15.30	11.41
High P/E	−2.30	8.92	9.98	11.76	6.94
Sample	4.76	13.62	13.43	15.94	11.85

Table 3. Annualized Market-Adjusted Returns (percentages)

Portfolio	Quarter 1	Quarter 2	Quarter 3	Quarter 4	One-Year Holding Period
All Surprises					
Low P/E	7.05***	4.84**	4.37**	4.62**	5.22**
Mid P/E	−0.57	−0.36	−0.59	0.10	−0.36
High P/E	−5.69**	−4.22*	−3.06	−5.28**	−4.57*
Sample	0.00	0.00	0.00	0.00	0.00
Low minus High	12.74***	9.06**	7.43*	9.90**	9.97**
Positive Surprises					
Low P/E	20.05***	7.24***	5.87***	4.97**	9.39***
Mid P/E	11.51***	1.62*	0.98	0.37	3.54***
High P/E	6.63**	−0.24	0.30	−5.13**	0.32
Sample	12.41***	2.62***	2.11***	0.33	4.29***
Low minus High	13.42**	7.48*	5.57	10.10***	9.07**
Negative Surprises					
Low P/E	−4.17*	1.84	1.38	4.07*	0.74
Mid P/E	−11.89***	−3.54***	−2.95***	−1.54*	−5.06***
High P/E	−18.58***	−7.90***	−5.99**	−5.12*	−9.54***
Sample	11.49***	3.15***	−2.61***	−0.91	−4.62***
Low minus High	14.41***	9.74**	7.37*	9.19**	10.28**

*** = significant at the 0.001 level.
** = significant at the 0.010 level.
* = significant at the 0.050 level.

Figure 2 shows market-adjusted returns for positive surprises for both Quarter 1 and the one-year holding period. During the surprise quarter, low-P/E stocks have a large response to positive surprises (20.1 percent above the market, annualized). The above-market return on high-P/E stocks, however, is relatively small (6.6 percent) and does not last for more than one quarter. Positive surprises result in the lowest P/E group outperforming the highest P/E quintile by more than 13 percent in the surprise quarter. After one year, the performance advantage is 9.1 percent, displaying remarkably little deterioration. The market-adjusted return on high-P/E stocks receiving positive surprises is insignificant in the one-year holding period, conforming to the MCH prediction that good news on best stocks is not unexpected and is discounted quickly.

The MCH also predicts that negative surprises have demonstrably different effects on best and worst asset classes. Bad news on an unpopular investment has little effect on investors. Expectations are low, and such news is taken in stride. Conversely, the possibility of unfavorable news for a best investment is not expected. When it occurs, it has a far more damaging effect on stock price than is the case for worst assets. The high-P/E group should thus show below-market returns and underperform low-P/E stocks experiencing negative surprises.

Figure 3 shows that, in the surprise quarter, negative surprises are devastating to the high-P/E quintile (18.5 percent below the market), whereas the lowest P/E quintile has a far smaller response to negative surprises (–4.2 percent). On negative surprises, the lowest P/E stocks outperformed the highest group by 14.4 percent in the quarter, and after one year, the differential still favors the lowest P/E group by 10.3 percent. As with high-P/E stocks experiencing positive surprises, the lowest P/E quintile in this case shows an insignificant market-adjusted return for the one-year holding period. Thus, we concluded that both positive and negative surprises have powerful asymmetric effects between best and worst stocks.

Figure 2. Annualized Market-Adjusted Holding Period Returns, All Positive Surprises, 1973–93

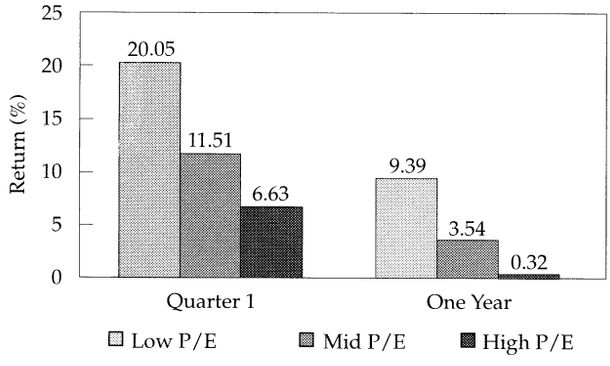
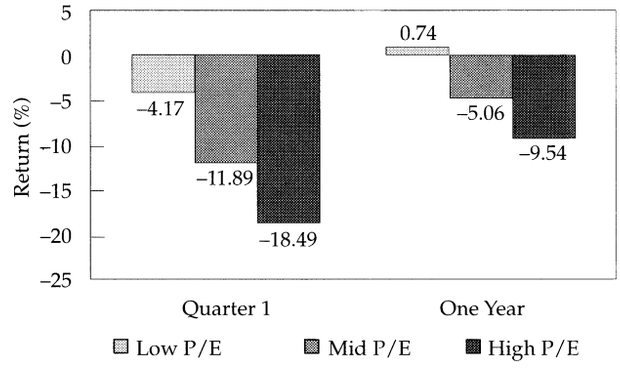


Figure 3. Annualized Market-Adjusted Holding Period Returns, All Negative Surprises, 1973–93



Event Triggers and Reinforcing Events

The next question was whether event triggers cause a larger surprise impact than do reinforcing events, the two information categories proposed by the MCH.

Recall that an event trigger is defined as a positive surprise on a low-P/E stock or a negative surprise on a high-P/E stock. The MCH predicts that event triggers cause a change in investor perceptions followed by a reevaluation of the stocks in the extreme asset classes. A reinforcing event is a negative surprise on a low-P/E stock or a positive surprise on a high-P/E stock. According to the MCH, reinforcing events do not change investor perceptions and therefore should not have the same price impact as event triggers. The MCH thus projects that return differentials for the extreme asset classes should be larger for event triggers than for reinforcing events.

Figure 4 shows market-adjusted returns for event triggers and reinforcing events for all positive and negative earnings surprises. The market-adjusted returns in each case are taken from the results detailed in the two preceding sections. The findings clearly indicate that the net impact of event triggers is far greater than that of reinforcing events. In Quarter 1, the absolute impact for event triggers is 38.5 percent versus 10.8 percent (annualized) for reinforcing events (t = 4.01, a significance level of 0.1 percent, for the mean paired difference between the return differential of the two event triggers and that of the two reinforcing events). For the one-year holding period, the mean return differential for event triggers is 18.9 percent and that for reinforcing events is very small (t = 2.70, a 1 percent level of significance, for the difference between the event triggers and reinforcing events). The absolute price impact of event triggers is therefore far greater than that of reinforcing events, as the MCH predicts.

Five-Year Holding Periods and Reversion to the Mean

Figure 5 shows the robustness of the effects of reversion to the mean when the portfolios are held intact for the 19 quarters following the surprise. The lowest P/E group receiving negative surprises shows a negative market-adjusted return only in the surprise quarter. All returns in the subsequent 19 quarters are positive. Conversely, the highest P/E portfolio receiving positive surprises outperforms the market only in the initial quarter and then underperforms in the following 19 quarters. Low-P/E stocks receiving positive surprises outperform the market in all 20 quarters, and high-P/E stocks reporting negative surprises underperform in all 20 quarters measured.

Table 4 shows the major differences in market-

Figure 4. Return Effects of Positive and Negative Surprises and of Event Triggers and Reinforcing Events

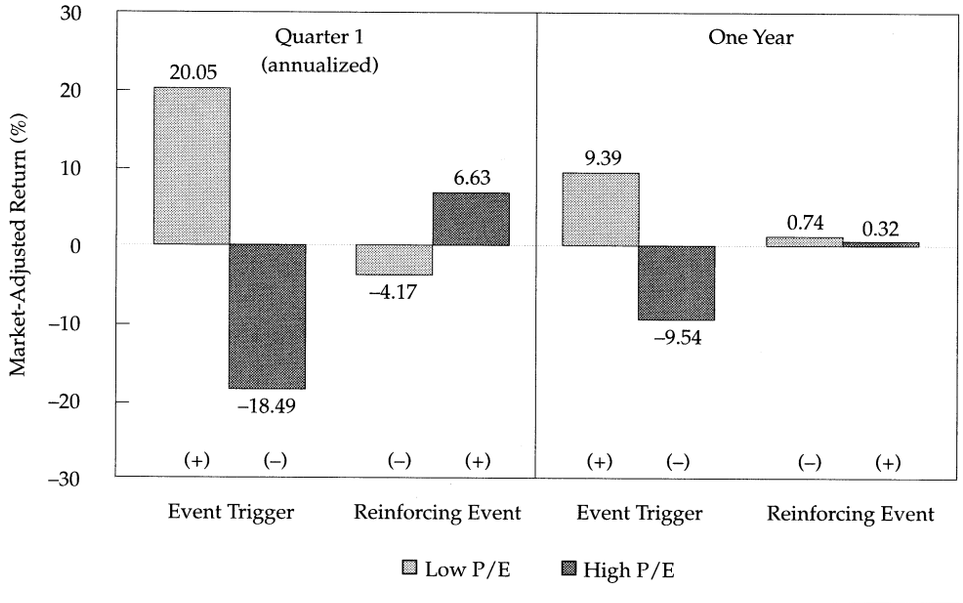
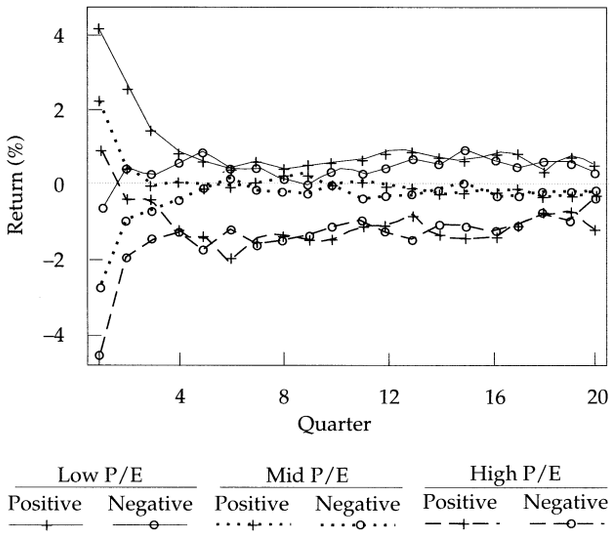


Figure 5. Nonannualized Market-Adjusted Quarterly Returns for Positive and Negative Surprises



adjusted return for the 20-quarter holding period for the four surprise categories. Low-P/E stocks that receive positive surprises return 46.9 percent more than the market (not annualized), and high-P/E negative surprises underperform the market by 51.4 percent. Although event triggers are responsible for the bulk of the return in the year of the surprise, reversion to means accounts for the major part of the total above-market holding period returns for the lowest P/E group and below-market returns for the highest P/E group for the 20-quarter period. For reinforcing events, reversion to the mean occurs in the second quarter and continues in each succeeding quarter. The continuity and duration of the positive returns for the lowest P/E group and the negative returns for the highest are consistent with significant undervaluation of worst stocks and overvaluation of best stocks prior to the commencement of the measurement period.

Table 4. Market-Adjusted Holding Period Returns for Low- and High- P/E Surprises (percentages)

Portfolio	Surprise Quarter	20-Quarter Holding Period
Low P/E (+)	4.10	46.90
Low P/E (−)	−0.60	23.59
High P/E (+)	1.09	−40.48
High P/E (−)	−4.68	−51.43

Figure 5 also demonstrates a finding that may be explained by the work of Abarbanell and Bernard, who showed that analysts appear to underreact to recent earnings reports. Their evidence consisted of positive autocorrelation in quarterly earnings surprises extending over three or four lags. Stocks experiencing positive surprises in Quarter 1 showed more than an average number of positive surprises for approximately three quarters thereafter, and stocks incurring negative surprises received more negative surprises. As shown previously, positive-surprise stocks outperformed negative-surprise stocks in the surprise quarter for each P/E grouping. We may infer from Abarbanell and Bernard's results, then, that this outperformance will continue into the second, third, and possibly fourth quarters after the initial surprise. In fact, our findings indicate that for the three quarters following a surprise, the returns on stocks with positive surprises exceed those of stocks with negative surprises within the high-, low-, and middle-P/E groupings.[17] The difference in returns for stocks with positive and negative surprises in Quarters 2 through 4 can thus be interpreted as being the result of analyst underreaction. After about one year, the autocorrelation dies away and the returns from stocks experiencing negative and positive surprises coincide.

Even though the lowest P/E groups provide a significantly above-market return for the 20-quarter holding period, the average P/E multiple of 10.7 for the sample is still well below that of the market (13.4) after five years. Conversely, although high-P/E stocks experiencing negative surprises decline more than 51 percent, their average P/E at the end of the five-year holding period is 16.7. (These figures are significant at the 0.1 percent level.) The fact that the P/E multiples of worst stocks are still below market after the significant outperformance for the 20-quarter holding period and that the best stocks are still above market after the major underperformance provides support for the case of prior overreaction.

Fuller, Huberts, and Levinson showed that the lowest (highest) P/E quintile does experience the lowest (highest) earnings growth for periods in excess of five years.[18] Moreover, analysts correctly predict this growth behavior on average over time. Long-term difference in performance that occurs despite a continuation of the low growth rates for low-P/E and high growth rates for high-P/E stocks also suggests prior mispricing.

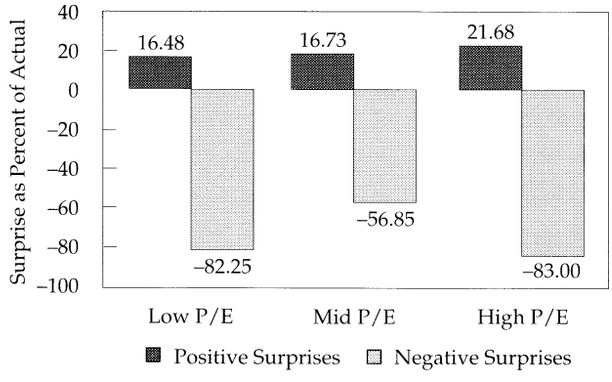
OTHER POTENTIAL CAUSES OF THE LOW-P/E EFFECT

Several factors unrelated to how investors perceive surprise could explain the existence of the low-P/E effect. Two such factors are the size and frequency distributions of surprises. For the case of size of surprise, we examined the distribution across quintiles for the metric

$$\frac{\text{Actual EPS} - \text{Forecast EPS}}{|\text{Actual EPS}|}.$$

According to LLSV's expectational errors hypothesis, the contrarian effect results from either significantly larger size or frequency of positive surprises for worst stocks. Figure 6 shows the size of positive surprise is greater for high-P/E stocks than for low-P/E stocks, but the difference between low and high P/Es for negative surprises is insignificant.

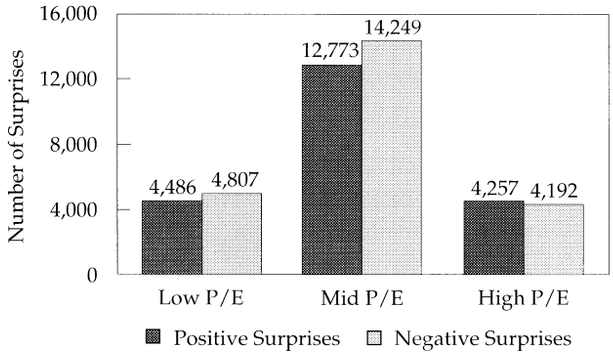
Figure 6. Size of Earnings Surprises, 1973–93



Because many more positive than negative surprises might occur in one particular quintile, we also examined the number of surprises by P/E quintile. As Figure 7 shows, the positive and negative surprises were fairly equally distributed: 4,486 positive surprises for the lowest P/E group and 4,257 for the highest P/E group. Low-P/E stocks have more negative surprises than high-P/E stocks (4,807 versus 4,192). The difference in number of positive and negative surprises in the lowest P/E quintile is not statistically significant, nor is that for the highest P/E quintile, which favors positive surprises by a small amount.

We therefore find no evidence for the observed performance differential being attributable to analysts' tendencies systematically to misforecast earnings on one class of stocks versus another, contrary to the LLSV hypothesis.

Figure 7. Number of Earnings Surprises, 1973–93



In addition, we studied the relationships between earnings-related variables (e.g., P/E multiple, EPS, and share price) in an attempt to find patterns that might explain the observed distributions. None of these results shows any correlation with the asset groupings that can offer an alternative explanation for the excess returns.[19]

WHY ARE BEST AND WORST STOCKS MISPRICED?

Although extrapolation is a simple term, its behavioral roots are more complex. Dreman has discussed the difficulties of information processing in a complex decision-making environment under conditions of risk and uncertainty.[20] Many factors, all of which may interact, may be involved in the extrapolation of past performance into the future. These factors include the attractiveness of the best and the unattractiveness of the worst stocks; the belief that their favorable or unfavorable prospects will continue for an extended period; and the reinforcement of this opinion by expert and peer group consensus, as well as by the price action of the stock itself. Kahneman and Lavallo demonstrated that decision makers are over confident in predicting potential outcomes in complex situations, resulting in high error rates.[21] Some of the initial mispricing of best and worst stocks may be caused by such overconfidence.

Psychological research also suggests the accuracy of judgmental forecasts is influenced by cognitive biases. Heuristic biases such as representativeness, which maintains that recent and salient events cause decision makers to place too much weight on short-term returns and not enough on long-term probabilities, may also be a cause of the extrapolation of current expectations of best and worst stocks well into the future. Such biases arise

when complex information processing is simplified (Kahneman and Tversky 1984[22]).

Although previous studies have examined topics such as best and worst stocks, visibility, and the extrapolation of the past into the future, none to date has shown a definite behavioral link among these factors or to expert error. We believe this paper is the first to incorporate these variables into a testable hypothesis. The outcomes as demonstrated are both systematic and predictable.

Our findings suggest that investors are not always rational according to the classical economic definition.[23] The MCH predicts that the rationality of investors often is suboptimal because of the strong influences of behavioral phenomena in a high-risk and uncertain environment in which information processing is complex.

The hypothesis may also explain a number of the anomalies found in the finance literature today such as the superior returns of value stocks reported by LSV and other contrarian strategies, as well as the low-P/E effect.

CONCLUSION

This study demonstrates that, as The MCH predicts, future returns of best and worst stocks are asymmetric. It also shows a diametrically opposite response of prices in the extreme asset categories to positive and negative surprises. Surprises have little net impact on the 60 percent of stocks in the middle groupings.

Event triggers (good news on worst stocks and bad news on best) result in a much larger impact on absolute prices than reinforcing events (good news on best stocks and bad news on worst stocks). This response is greatest in the surprise quarter, but it persists throughout a one-year holding period.

Reversion toward the mean, which begins in the quarter following the surprise, continues for each quarter throughout a five-year holding period for both best and worst stocks regardless of the type of the initial surprise. This effect does not occur in the middle quintiles.

The price reversals of the extreme quintiles indicate that overreaction does not take place at the time of the announcement of the earnings surprise but is present in the pricing of the best and worst asset classes at the beginning of the measurement period and is corrected thereafter.[24]

FOOTNOTES

1. Benjamin Graham and David Dodd, *Security Analysis: Principles And Techniques* (New York: McGraw Hill, 1934).
2. See J.D. McWilliams, "Prices and Price/Earnings Ratios," *Financial Analysts Journal*, vol. 22, no. 3 (May/June 1966): 137–42; P.F. Miller and E.R. Widmann, "Price Performance Outlook for High and Low P/E Stocks," 1966 Stock and Bond Issue, Commercial & Financial Chronicle (September 29, 1966):26–28; Francis Nicholson, "Price–Earnings Ratios in Relation to Investment Results," *Financial Analysts Journal*, vol. 24, no. 4 (July/August 1968):105–109; David Dreman, *Psychology and the Stock Market: Investment Strategy Beyond Random Walk* (New York: Amacom, 1977); S. Basu, "Investment Performance of Common Stocks in Relation to Their Price–Earnings Ratios: A Test of the Efficient Markets Hypothesis," *The Journal of Finance*, vol. 32, no. 3 (June 1977):663–82; S. Basu, "The Effect of Earnings Yield on Assessments of the Association Between Annual Accounting Income Numbers and Security Prices," *The Accounting Review*, vol. 53, no. 3 (July 1978):599–625; David Dreman, *Contrarian Investment Strategy* (New York: Random House, 1979), and references therein; and S. Basu, "The Relationship Between Earnings' Yield, Market Value and Return For NYSE Common Stocks: Further Evidence," *Journal of Financial Economics*, vol. 12, no. 1 (June 1983):129–56.
3. Dreman, *Contrarian Investment Strategy*.
4. See Marc R. Reinganum, "Misspecification of Capital Asset Pricing: Empirical Anomalies Based on Earnings Yields and Market Values," *Journal of Financial Economics*, vol. 9, no. 1 (March 1981):19–46; R.W. Banz and W. Breen, "Sample Dependent Results Using Accounting and Market Data: Some Evidence," *The Journal of Finance*, vol. 41, no. 4 (September 1986):779–94; and E. Fama and K. French, "Size and Book-to-Market Factors in Earnings and Returns," *The Journal of Finance*, vol. 50, no. 1 (March 1995):131–55.
5. Jennifer Conrad and Gautam Kaul, "Long-Term Overreaction or Biases in Computed Returns?" *The Journal of Finance*, vol. 48, no. 1 (March 1993):39–63. The bias arises from pricing errors in the bid–ask spread and is greatest for illiquid stocks and when returns are cumulated many times (e.g., daily).
6. J. Lakonishok, Andrei Shleifer, and Robert Vishny, "Contrarian Investment, Extrapolations, and Risk," *The Journal of Finance*, vol. 49, no. 5, (December 1994):1541–78. See also N. Chopra, Josef Lakonishok, and Jay Ritter, "Measuring Abnormal Performance: Do Stocks Overreact?" *Journal of Financial Economics*, vol. 31, no. 2 (April 1992):235–68; and E. Fama and K. French, "The Cross-Section of Expected Stock Returns," *The Journal of Finance*, vol. 46, no. 2 (June 1992):427–65; Fama and French found that differential returns to P/E strategies are captured by a combination of firm size and book-to-market ratio. The latter also constitutes a contrarian strategy.
7. See V. Bernard and J.K. Thomas, "Evidence That Stock Prices Do Not Fully Reflect the Implications of Current

Earnings for Future Earnings," *Journal of Accounting and Economics*, vol. 13 (1990):305–40; and R. La Porta, Josef Lakonishok, Andrei Shleifer, and Robert Vishny, "Good News for Value Stocks: Further Evidence on Market Efficiency," paper presented to the National Bureau of Economic Research, February 1995.

8. Basu, "Effects of Earnings Yield." Because analysts' forecast data bases were not as yet available, Basu examined actual annual earnings changes as compared with the market average, measuring the effect of above- or below-market earnings changes on high- and low-P/E groups. He concluded that above-average earnings changes affect low-P/E stocks positively and below-average earnings changes affect high-P/E stocks negatively. Although he noted an effect similar to the one we document for these categories, his work could not assess the response to true earnings surprises nor could it separate out the effects of forecast revision during the fiscal year. The analyst forecast data bases also allow us to measure precisely the effect of positive or negative surprises on all P/E groupings.
9. Werner F.M. De Bondt and Richard H. Thaler, "Does the Stock Market Overreact?" *The Journal of Finance*, vol. 40, no. 3 (July 1985):793–805; and Werner F.M. De Bondt and Richard H. Thaler, "Further Evidence on Investor Overreaction and Stock Market Seasonality," *The Journal of Finance*, vol. 42, no. 3 (July 1987):557–80. See also Keith C. Brown and W.V. Harlow, "Market Overreaction: Magnitude and Intensity," *The Journal of Portfolio Management*, vol. 14, no. 2 (Winter 1988):78–85.
10. V. Bernard and J.K. Thomas, "Evidence That Stock Prices Do Not Fully Reflect the Implications of Current Earnings for Future Earnings."
11. Jeffrey S. Abarbanell and Victor Bernard, "Tests of Analysts' Overreaction/Underreaction to Earnings Information as an Explanation for Anomalous Stock Price Behavior," *The Journal of Finance*, vol. 47, no. 3 (July 1992):1181–1208. See also R. Mendenhall, "Evidence of Possible Underweighting of Earnings-Related Information," *Journal of Accounting Research*, vol. 29 (1991):170–80.
12. La Porta et al., "Good News for Value Stocks."
13. Although he did not label them as such, Basu, in "The Effects of Earnings Yield," focused on the movement of event triggers.
14. See Lakonishok, Shleifer, and Vishny, "Contrarian Investment, Extrapolations, and Risk."
15. For more information on the Abel Noser data base, see David N. Dreman and Michael A. Berry, "Analyst Forecasting Errors and Their Implications for Security Analysis," *Financial Analysts Journal*, vol. 51, no. 3 (May/June 1995):30–41.
16. See Conrad and Kaul, "Long-Term Overreaction."
17. The separation in returns between positive and negative surprises is significant at the 0.1 percent level through Quarter 3 for each P/E grouping.
18. Russell Fuller, Lex Huberts, and Michael Levinson, "Returns to E/P Strategies, Higgledy-Piggledy Growth, Analysts' Forecast Errors, and Omitted Risk Factors," *The Journal of Portfolio Management*, vol. 19, no. 2 (Winter 1993): 13–24.
19. The results of these tests are available to readers upon request.
20. Dreman, *Psychology and the Stock Market* and *Contrarian Investment Strategy*.
21. D. Kahnemann and D. Lavallo, "Timid Choices and Bold Forecasts: A Cognitive Perspective on Risk Taking," *Management Science*, vol. 39, no. 1 (January 1993):17–31.
22. D.J. Kahneman and A. Tversky, "Choices, Values, and Frames," *American Psychologist*, vol. 39, no. 4 (April 1984): 341–50.
23. The classical definition of investor rationality imposes five axioms of rational choice under uncertainty. This concept was first developed by John von Neumann and Oskar Morgenstern in *Theory of Games and Economic Behavior* (Princeton: Princeton University Press, 1947). In addition to these axioms, rational investors are presumed to prefer more to less and exhibit risk aversion in maximizing their expected utility of wealth.
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