Exploiting Behavioral Finance: Portfolio Strategy and Construction

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Research shows that analysts' forecast errors are high. The findings reported here connect this outcome with behavioral tendencies toward extrapolation from the past, reliance on expert opinion and consensus, peer and institutional pressures, and extreme mispricing in the best and worst stocks prior to earnings surprises. Findings on reversion to the mean and behavioral factors may explain several market anomalies and the long-term success of contrarian strategies.

Analysts' estimates of company earnings form one of the cornerstones of all security analysis and are the bedrock of most financial theory. Earnings estimates require a fine precision, one that most practitioners believe can be obtained. Analysts aim to zero in on actual earnings—often, within 1–5 percent of actual earnings. When that goal is not reached, the result is sometimes enormous reaction in the stock price. In 1994, for example, Motorola reported earnings up 50 percent for the second quarter. These actual earnings were slightly less than 1 percent below the average analyst's forecast, however, and the stock dropped 15 percent in the next two to three months.

To the analysts' credit, they face a difficult environment, with thousands of inputs. Many decisions must be made about how to quantify a company's earnings estimates. A company may operate in as many as 50–100 different countries and have dozens of different products. Company managers, in doing their job properly, do not add to the precision. The analysts' job is difficult, and expecting them to estimate earnings on the nail every time is not realistic.

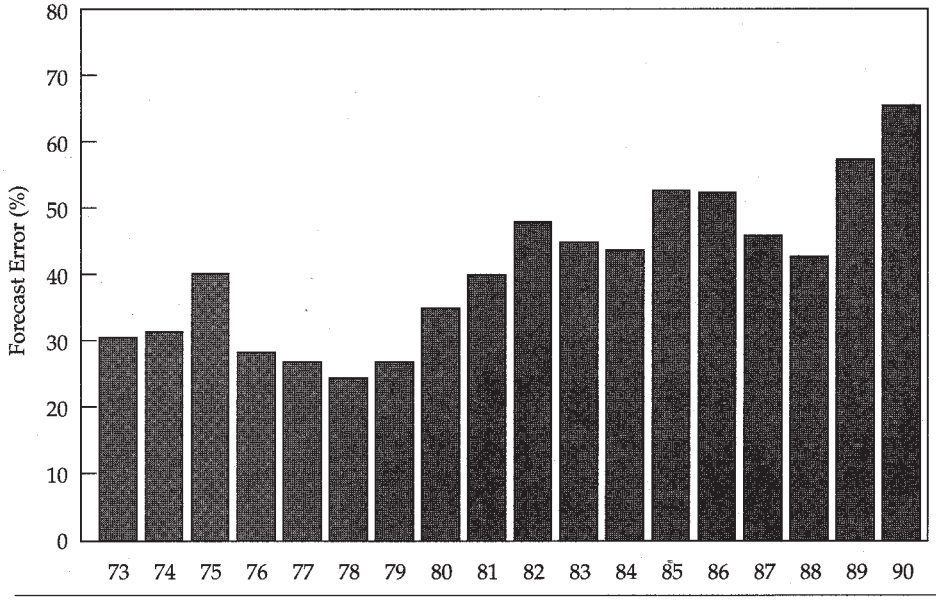
Forecast Error

Analysts today have access to more information on which to base forecasts than ever before. Through First Call, for example, analysts can immediately obtain other people's or other analysts' changes of estimates. They have more online company financial data than ever. Nevertheless, forecast error rates seem to be rising—and rising significantly. **Figure 1** is from a study by Michael Berry and me (1995a) and shows analysts' forecasting errors as a percentage of reported earnings for 1,221 NYSE and Amex companies for all quarters between 1973 and 1990 For this study, we used consensus earnings estimates derived from the Abel Noser data base, the longest data base of quarterly earnings that we are aware of. The data base is composed of more than 1,000 large companies, with nearly complete coverage of the S&P 500 Index. Both current and delisted companies are included. At least six different analysts provided forecasts for each stock each quarter. For a major company, such as Microsoft, we may have had several dozen analysts' forecasts. Forecasts could be made at any time during the quarter, and both positive and negative earnings surprises were included. We had 66,000 consensus forecasts altogether, which would be at least 400,000 estimates.

The error rates are very high; annualizing the quarterly data, the average error was 42–43 percent. To assure that these results did not exaggerate the error rates, we screened out companies with small earnings, less than 40 cents a share annually. By doing so, we took out some of the fastest growing companies, of course, but the error rates were still high, about 22 percent.

Because forecasting must be very precise, the investment industry requires that money managers and analysts be able to fine-tune earnings estimates. We found, however, that 74.4 percent of analysts could not forecast within 5 percent of actual earnings, 57.0 percent could not hit within 10 percent of actual, and 45.3 percent were outside 15 percent of actual, a wide estimate range. Staying within a range of 10

Figure 1. Forecast Error as a Percentage of Reported Earnings, 1973–90



Source: Dreman and Berry (1995a).

percent is a reasonable expectation, and missing it is enough to trigger a stock reaction.

To make sure that the high overall forecast errors were not being caused by high forecast errors in only some industries, we performed the analysis again using 15 major industry categories. **Table 1** shows the error rate based on this analysis by industry groups. We found some volatility; forecast errors were actually much higher than expected in certain industries, especially those that are supposed to be reasonably predictable. For example, communications and consumer goods had 41 percent and 36 percent error rates, respectively. Tobacco was the only industry with fairly good stability. In all, the average error rate was 50 percent, and the median error rate was 43 percent.

Table 1. Analysts Forecast Errors by Industry

Industry	Percentage of Annual Error
Capital goods	55%
Chemicals	28
Communications	41
Consumer goods	36
Entertainment	45
Financial	43
Foods	26
Health care	26
Insurance	33
Metals/mining	71
Oil	70
Publishing	27
Textiles	114
Tobacco	9
Transportation	75

Source: Dreman and Berry (1995a).

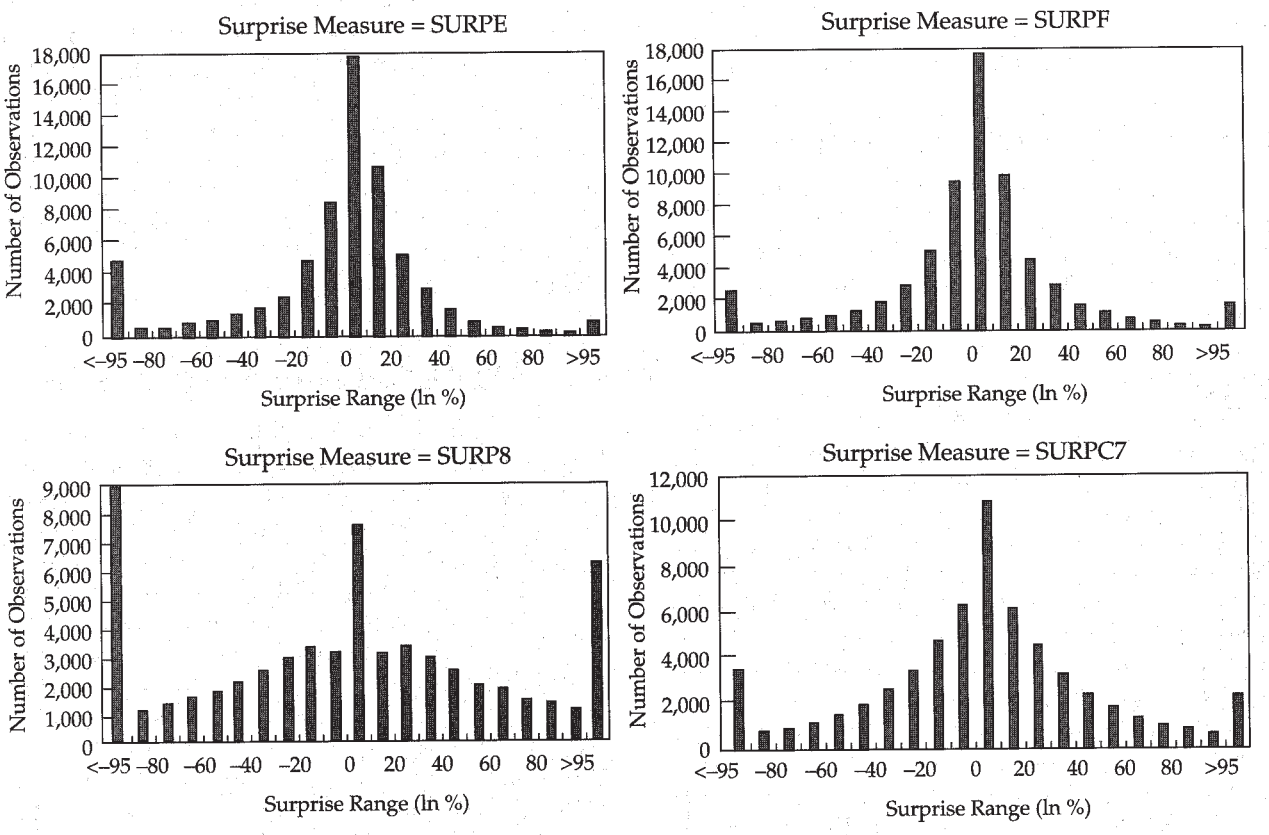
Figure 2 shows the distributions of earnings surprises by four measures:

- SURPE: consensus earnings per share (EPS) surprise as a percentage of absolute value of actual EPS—that is, (Actual EPS – Forecast EPS)/Actual EPS.
- SURPF: consensus EPS surprise as a percentage of absolute value of forecast EPS—that is, (Actual EPS – Forecast EPS)/Forecast EPS.
- SURP8: consensus EPS surprise as a percentage of the past eight-quarter volatility of actual EPS—that is, (Actual EPS – Forecast EPS)/Standard deviation of trailing eight-quarter actual EPS.
- SURPC7: consensus EPS surprise as a percentage of the past seven-quarter volatility of change in actual EPS—that is, (Actual EPS – Forecast EPS)/Standard deviation of trailing seven-quarter change in EPS.

Four different surprise metrics were used because the academic literature lacks consensus as to the most appropriate form of the metric. Each measure has a unique set of statistical and interpretive problems, but our basic results were approximately the same for the four measures and consistent with earlier studies.

Table 2 reports the results of forecasting error studies from the 1960s and 1970s. As shown, analysts are not the only ones who have problems forecasting; corporate managers do also. The first part of Table 2 reports findings on management forecasts, and the second part reports the findings of studies of ana-

Figure 2. Distributions of Earnings Surprise Measures



Note: All quarterly observations from first quarter 1974 through fourth quarter 1991.

Source: Dreman and Berry (1995a).

Table 2. Findings of Forecast Studies: Managers and Analysts

Study	Period Studied	Number of Companies	Mean Error
	Management Forecasts		
Green and Segall (1967)	1963–64	7	14.0%
Copeland and Marioni (1972)	1968	50	20.1
McDonald (1973)	1966–70	151	13.6
Basi, Carey, and Twark (1976)	1970–71	88	10.1
Mean error			14.5%
	Analysts' Estimates		
Stewart (1973)	1960–64	14	10–15%
Barefield and Cominsky (1975)	1967–72	100	16.1
Basi, Carey, and Twark (1976)	1970–71	88	13.8
Richards (1976)	1972	93	8.8
Richards and Fraser (1977)	1973	213	22.7
Richards, Benjamin, and Strawser (1977)	1969–72	50	18.1
Richards, Benjamin, and Strawser (1977)	1972–76	92	24.1
Mean error			16.6%

Note: Forecasts and estimates for one year or less.

Source: David N. Dreman.

lysts' forecast errors. The average error rate of managers forecasting for their own companies, usually in the first quarter, is about 14.5 percent. The analysts' error rate in these studies is about 16.6 percent.

Reasons for High Forecasting Error Rates

The error rates found in our results and the results of some of the later studies are fairly similar, which suggests a number of interesting questions. First, what might be the reason for the high forecasting errors?

Extrapolation

One reason, which has been demonstrated in the literature, is analysts' tendency to extrapolate past trends into the future. In the mid-1960s, Cragg and Malkiel (1968) carried out a study of analysts' estimates at six major buy-side investment organizations and a study of how the analysts carried out their research. They noted that, despite the fact that analysts did intensive and thorough research on companies, their estimates tended to be nothing more than extrapolations of past earnings.

Another interesting and relevant study, by Little and Raynor (1966), showed that no correlation exists between past earnings growth and future earnings growth for any three- or five-year period. Earnings follow a random walk. These results were disputed at the time, so Little redid the study—and came out with the same information. Later, Brealey studied 711 U.S. companies between 1945 and 1964. He also found that earnings tend to follow a random walk.

If earnings follow a random walk but analysts tend to extrapolate past earnings, the result should be fairly large forecast errors, which is precisely what the studies show.

Behavioral Influences

Although earnings are almost impossible to fine-tune, most analysts and money managers place a great deal of emphasis on fine-tuned earnings estimates. In the first edition of *Security Analysis*, published in 1933, Graham and Dodd noted that the thorough analyst will go through hundreds and hundreds of factors—fundamental factors in a company and its industry, monetary conditions, and so forth—but in the end, the analyst will place the greatest emphasis on the short-term earnings forecast. Nothing much has changed since that study.

The behavioral questions are: Given the strong evidence that people cannot forecast in a precise manner, why is Wall Street so dependent on forecasting? Why is the Street so tremendously disappointed when earnings estimates are not met?

In 1984, Tversky and Kahneman published an excellent piece about how humans process information. They warned that cognitive biases affect the human processes of digesting and simplifying large amounts of complex information and that these biases can have major effects on decision making. Other cognitive researchers have aired similar findings. In 1982, Fischhoff warned that even when people are aware of their cognitive biases, they are not able to adjust for them. From a behavioral point of view, modification of analytical and decision-making methods is very difficult.

Earnings Surprises and Investor Overreaction

The next issue is what actually happens when analysts' forecasts miss the mark. As mentioned in other presentations, investors appear to extrapolate exciting or unexciting prospects for stocks well into the future. The market has high expectations for the best stocks and very low expectations for stocks that are out of favor. Companies with the best prospects, fastest growth, and most exciting concepts normally have higher P/Es, higher ratios of price to book value and price to cash flow, and so forth. Sometimes, the disparity between valuations is enormous. Last year, for example, investors valued each dollar earned by General DataComm and Viacom at about ten times a dollar earned by Barnett Banks and the Federal National Mortgage Association, although Fannie Mae is probably growing at a 12 percent rate and has been for quite some time.

We have constructed and studied an investor overreaction hypothesis (IOH) to explain this phenomenon. The IOH posits that there is systematic mispricing of "best" and "worst" asset classes; that is, investors fairly consistently overvalue best stocks and undervalue worst stocks.

"Surprise" in these studies, which used the Abel Noser data base, was simply the analysts' forecast errors. A positive surprise was defined as any error above zero; any error below zero was a negative surprise. We made this simple rule rather than try to cut surprises arbitrarily at 10 percent, 15 percent, 20 percent, and so on. The best stocks in our classification were companies with the highest 20 percent of P/E ratios; the worst were companies in the lowest 20 percent.

The study of the IOH produced a number of findings:

- The study demonstrated an asymmetrical price reaction to earnings surprises for "best" and "worst" stocks. This hypothesis could apply to other contrarian valuation measures, such as price to book (P/B) or price to cash flow (P/CF).
- Favorable surprises for worst stocks raise

prices significantly over time, whereas prices for best stocks move down.

- Conversely, unfavorable surprises after the event quarter result in consistent above-average market performance for worst stocks and below-market returns for best stocks.
- The study also demonstrated postsurprise reversion toward the mean. Best stocks underperform and worst stocks outperform the market over five-year holding periods.
- Finally, positive and negative surprises have had little effect on the 60 percent of stocks grouped in the middle quintiles.

Types of Earnings Surprises

In our study, Berry and I posited that the overreaction occurs before the actual earnings surprise, and we demonstrated that there are two types of earnings surprises: event triggers and reinforcing events. The event triggers and the reinforcing events result in stocks regressing toward the mean.

Event triggers cause changes in investor perceptions of best and worst stocks and result in large price movements. A positive surprise for an out-of-favor stock would be an event trigger; investors do not expect major good surprises for out-of-favor stocks. Similarly, for a stock very much in favor, a negative surprise would be an event trigger.

The other type of "surprise" is called a reinforcing event. Reinforcing events cause smaller market movements than triggers because they fit investors' current perceptions. An example would be positive news from a high-P/E or highly valued stock. People have favorable expectations for the best stocks—improved earnings and other positive events. Similarly, negative news for out-of-favor stocks should have little effect on stock price. If a company is trading at a very low P/E, P/B, or P/CF and is believed to have a mediocre outlook, a negative event is not likely to have a major effect.

Apple Computer's performance last year is an example of an event trigger—a positive surprise in an out-of-favor stock. Apple's Newton line of computers had been a failure, and many analysts thought Apple was losing market share in the personal computer business. When Apple introduced the PowerMac, revenues and earnings rose dramatically. The price of an Apple share more than doubled, from $22 to about $45.

The second type of event trigger is a negative surprise for a market favorite. For example, at the beginning of 1994, Biogen was at a very high P/E multiple, but after a number of disappointing quarters and other negative surprises, the stock dropped almost 50 percent.

Examples of two types of reinforcing events are Banc One and Duracell. Banc One, a low-P/E stock, had a minor problem in the fourth quarter of last year because of a write-off caused by derivatives losses in its portfolio. The stock dropped some, but within two or three months, it was higher than prior to the negative surprise. Duracell is a high-P/E stock and a major institutional favorite. Although earnings were above forecast in at least two quarters last year, the earnings surprises had very little impact on the stock price.

To summarize, according to our IOH, the net effect of surprises is positive for the lowest P/E quintile, but negative for the highest P/E quintile. The net effect is neutral for the middle quintiles.

Impact of Earnings Surprises

The annualized impact of all earnings surprises for the entire period of our study is shown in **Table 3**. We used zero as the market or the sample average. The combination of all surprises, positive and negative, resulted in the low-P/E, most out-of-favor stocks having a 6.4 percent outperformance of the sample in the initial quarter in which the surprise occurred. The most in-favor stocks had a return of –5.0 percent in the initial quarter. Therefore, the difference between best and worst stocks, with all surprises, was roughly 1,100 basis points (bps). For the full year in which the surprise occurred in the first quarter, the out-of-favor stocks still had a 400 bp above-average market performance, an 800 bp difference in performance between best and worst stocks. By the end of the full year, the result was virtually no effect for the 60 percent of stocks in the middle quintiles.

Table 3. Impact of Earnings Surprises on Performance: Annualized, 1973–90

Quintile	Quarter One	Year One
All earnings surprises		
Lowest P/E	6.42%	4.13%
Middle P/E	–0.66	–0.19
Highest P/E	–5.01	–4.21
Positive surprises		
Lowest P/E	17.32	8.03
Middle P/E	10.98	3.77
Highest P/E	7.04	0.35
Negative surprises		
Lowest P/E	–4.43	–0.88
Middle P/E	–11.79	–4.94
Highest P/E	–18.40	–9.55

Source: Dreman and Berry (1995b).

Table 3 also shows the impact of all positive surprises annualized. Positive surprises have an

enormous above-market effect in the first quarter for the low-P/E stocks and much less effect on the best stocks. The annualized difference in the quarter is 1,000 bps, which holds up at 800 bps through the year.

The impact of negative surprises, the last set shown in Table 3, also indicates how dramatically different the effect of surprise is for best and worst stocks. The difference in reaction to surprise between worst stocks and best stocks in the first quarter is 1,400 bps. Even in a full year, the difference is enormous, almost 900 bps. Worst stocks totally absorb the surprise, and by the end of the full year, there is no impact on their stock prices.

Table 4 shows the difference between impacts of the event triggers and reinforcing events. As expected, event triggers (the positive surprises for the low-P/E stock and the negative surprises for the high-P/E stock) have an enormous impact on prices.

Table 4. Impact of Positive and Negative Event Triggers and Reinforcing Events

	Quarter One Annualized		Year One	
Surprise	Low P/E	High P/E	Low P/E	High P/E
Event trigger	17.32	–18.40	8.03	–9.55
Reinforcing event	–4.43	7.04	–0.88	0.36

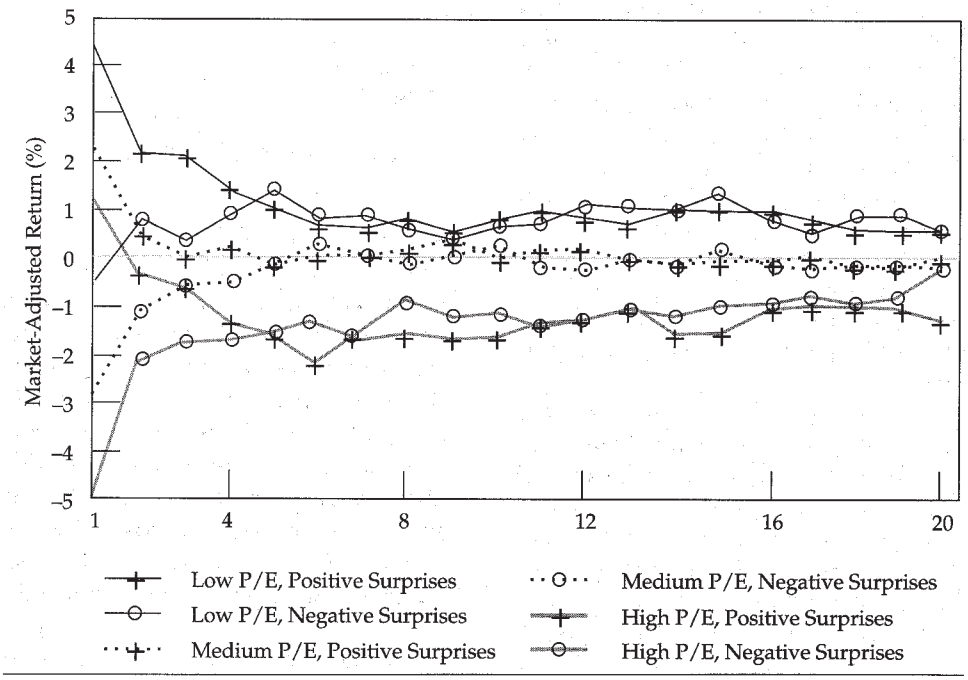
Source: Dreman and Berry (1995b).

With the event trigger, the overall impact (total of absolute surprises) annualized for the quarter is almost 36 percent, and for the full year, the difference is about 17.6 percent. The reinforcing events (negative surprises for the low-P/E stocks and positive surprises for the high-P/E stocks) have much less impact. In the quarter, the total of absolute surprises is about 11.5 percent; for the year, 1.2 percent. All of these differences are statistically significant, and for some, the *t*-test would result in 1 in 10,000, 1 in 100,000, or higher.

Figure 3 demonstrates the reversion to the mean for a 20-quarter period. Surprise has a major effect in the first quarter. The low-P/E stocks with positive surprises outperform the market in all 20 quarters. Moreover, the low-P/E stocks with negative surprises underperform only in the quarter of the surprise; then they outperform the market for the next 19 quarters. High-P/E reactions are exactly the opposite.

A summary of the return data is dramatic. For the low-P/E stocks that had a positive surprise, the absolute return in the quarter of the surprise was 4.29 percent above market and the overall five-year performance was 53.69 percent above market. The low-P/E stocks with negative surprises suffered a –0.49 percent effect in the quarter but outperformed the market for the full five years by 34.13 percent. High-P/E stocks with negative surprises underperformed the market by 4.98 percent on an absolute basis in the quarter and by a dramatic 56.04 percent for the five-

Figure 3. Quarterly Returns for Positive and Negative Surprises



Source: Dreman and Berry (1995b).

year period. High-P/E stocks with positive surprises enjoyed only a 1.14 percent positive effect within the quarter, and for the holding period, they underperformed the market by 48.37 percent.

We believe this reversion to the mean results partly from the change in investor perceptions and partly because the surprise quarter is very likely followed by negative news for best stocks and by positive news for worst stocks. Note that surprise does not have much effect on the stocks in the middle; after the fourth quarter, they track the market.

Some research has shown that the growth rates of best and worst stocks—high- and low-P/E stocks—tend not to change much over some extended time period (Fuller, Huberts, and Levinson 1993). We found the difference in the price performance of the two groups, however, to be enormous. Even after 53 percent above-market return over five years, low-P/E stocks still had below-market multiples: The average for the quintile was 9.5 compared with roughly 12.5 for the market.

High-P/E stocks had above-market multiples—an average at the end of five years, even after their sharp underperformance, of about 15. These results support the part of the IOH that posits enormous mispricing of best/worst stocks prior to earnings surprises.

Size and Frequency of Earnings Surprises

Finally, we wanted to make sure no other factors could have explained the results, so we examined two factors we thought were the most likely possible biases—size of earnings surprises and frequency of earnings surprises. Some researchers have recently proposed that high-P/E stocks have more negative surprises than low-P/E stocks. They also theorize that the sizes of negative earnings surprises are much larger for high- than for low-P/E stocks. We did not find either proposition to be true. **Table 5** contains the results for the size factor. With positive surprises,

Table 5. Sizes of Earnings Surprises, 1973–90

Quintile	All Positive Surprises	All Negative Surprises
Lowest P/E	17.45%	–79.46%
Middle P/E	16.74	–56.25
Highest P/E	22.08	–81.25

Note: Percentage of actual.

Source: Dreman and Berry (1995b).

low-P/E stocks actually had an average surprise of about 17.5 percent, versus about 22.1 percent for the high-P/E group. High-P/E stocks had somewhat larger positive surprises and somewhat lower negative surprises, but results were not statistically significant.

Finally, we investigated whether a case could be made for the frequency of negative and positive surprises; for example, are negative surprises much more numerous for the best stocks than for the worst stocks. **Table 6** shows that the answer to this question is no. The differences are not statistically significant.

Table 6. Number of Surprises, 1973–90

Quintile	All Positive Surprises	All Negative Surprises
Lowest P/E	4,267	4,300
Middle P/E	12,046	12,924
Highest P/E	3,946	3,749

Source: Dreman and Berry (1995b).

We have checked other statistical factors but have found nothing that pointed to any factors other than simple stock mispricing prior to the measurement period to account for the effect of surprises.

Conclusion

From the overall results, we have concluded that the returns from surprise are asymmetrical for best/worst stocks and that this effect is a result of extreme mispricing of the best/worst stocks prior to the occurrence of surprises. Surprises have little effect on the 60 percent of stocks in the middle. Event triggers—good news for the worst stocks and bad news for the best stocks—have much larger impacts on absolute prices than do reinforcing events—good news for the best stocks and bad news for the worst stocks. We have also shown that reversion to the mean begins in the first quarter following surprise and continues for each quarter throughout a five-year holding period.

We believe the explanation for these results is rooted in human behavior. As Amos Tversky discussed, the inability of money managers and analysts to estimate with precision is related to a natural tendency toward overconfidence.[1] Such overconfidence affects not only earnings estimates; it also affects judgments about which companies have excellent futures and which have very poor futures. We think a combination and interaction of factors are involved in the overconfidence—the reliance on expert opinion and consensus, for example, and peer and institutional pressures in the environment that push people toward favorite stocks and away from unfavored ones.

The reasons contrarian strategies work so well over time probably lie in behavioral factors. Contrarian strategies have been discussed for decades and

[1]See Professor Tversky's presentation, pp. 2–5.

have become even more appealing recently following the publication of Lakonishok's (1994) findings. Contrarian strategies are well documented and are not limited to pursuing low-P/E, low-P/B, or low-P/CF stocks. The average investor has difficulty sticking with a contrarian strategy. Researchers have the statistical results but have not pinpointed the behavior behind the statistics. Financial professionals are taught security analysis and the financial part of the equation, but the behavioral part is new territory.

We think the investor overreaction hypothesis probably applies to many other areas currently considered anomalies. Initial public offerings are a good example. Why do people consistently go into new issues when research shows that five-year returns on IPOs are slight to negative (Ritter 1991). Behavioral factors may also help explain returns on closed-end funds, junk bonds, and also the superior returns from financially distressed companies.