PRIOR UNCERTAINTY, ANALYST BIAS, AND SUBSEQUENT ABNORMAL RETURNS

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Abstract

In this paper we examine the relation between analysts' overoptimism and uncertainty as proxied by the standard deviation of earnings forecasts. We find a positive relation between overoptimism and uncertainty, but very little or no optimism when uncertainty is low. If the uncertainty surrounding a firm is high, analysts have fewer reputational concerns when they act on their inclinations to issue optimistic forecasts. Portfolio strategies based on these findings generate abnormal returns. The results suggest that greater prior uncertainty leads to higher analyst optimism, which in turn causes market overvaluation and profitable portfolio strategies.

I. Introduction

We investigate the relation between overoptimism in professional analysts' earnings-per-share forecasts and analysts' uncertainty about the firm, as well as the market response to analysts' overoptimism. Much research examines the properties of earnings-per-share forecasts produced by professional financial analysts. For example, on average, analysts' earnings forecasts contain an upward bias (Ali, Klein, and Rosenfeld (1992), De Bondt and Thaler (1990)). Several studies conclude that analysts often have incentives to issue optimistic forecasts because of the relations among the analyst, brokerage firm, and client firm (Dugar and Nathan (1992), Francis and Philbrick (1993)). In addition, the experimental research of Hand and Maines (1995) suggests that individuals are more optimistic when the variability in the residual of a time-series regression model for earnings

per share is higher. Thus, even in the absence of other incentives, individual optimism increases with increases in earnings forecast error variability.

In this paper we extend prior research by examining the relation between analysts' overoptimism and uncertainty. Overoptimism is defined as the difference between the consensus forecast of annual earnings per share and actual earnings divided by the absolute value of actual earnings. Overoptimism in earnings forecasts is classified by the standard deviation of earnings forecasts, the proxy for uncertainty. For each standard deviation quartile, the median level of overoptimism is calculated. The results suggest a strong positive relation between overoptimism and uncertainty. When much uncertainty surrounds the firm, analysts may be more likely to act on their incentives to release optimistic forecasts. However, when uncertainty is low, little or no optimism exists. We also examine the changing relation between analysts' overoptimism and uncertainty over time. The results indicate that the level of overoptimism consistently declines to zero for all standard deviation quartiles as the forecast horizon declines.

To gain insight into the market reaction to analysts' behavior, we examine whether a portfolio strategy, based on the uncertainty measure, can generate positive risk-adjusted returns. The market may react to analysts' overoptimism for certain firms by elevating their stock prices. Holding-period returns and excess returns are calculated for portfolios of stocks, where portfolio composition is determined by the ex-ante level of uncertainty associated with the stock. The results suggest that low (high) uncertainty firms earn positive (negative) abnormal returns when the standard deviation of earnings forecasts proxies for uncertainty.

Our findings have important implications for understanding the forecasting behavior of professional financial analysts and the market reaction to analysts' behavior. Keynes (1964, p. 158) argues that for investors it is often better to "fail conventionally than to succeed unconventionally." It may be costly for an analyst to report an expectation that deviates from that of other professionals when little dispersion among forecasts exists. However, if greater variation in forecasts exists, analysts may have fewer reputational concerns when they act on their inclinations to issue optimistic forecasts. In fact, our results suggest that analysts are more optimistic on average when greater dispersion in analysts' forecasts exists and that we can construct profitable trading strategies. Thus, greater prior uncertainty leads to increased analyst optimism about the firm. This optimism, in turn, causes overvaluation of the firm by the market, which permits investors to fashion profitable portfolio strategies.

II. Hypothesis Development

The types of services their firms provide differentiate financial analysts. Buy-side analysts are typically money managers, whereas sell-side analysts are typically investment dealers or multiservice securities firms. Firms that employ

sell-side analysts produce most earnings forecasts, and firms that employ buy-side analysts often buy these forecasts. Sell-side analysts face incentives that encourage overoptimism in their earnings forecasts. Sell-side analysts and their research departments do not directly contribute to the revenue base of the securities firm. These analysts are often pressured to be optimistic to increase brokerage commissions and maintain good relations with the management of client firms. Analysts' forecast optimism and incentives to portray client firms favorably receive coverage in the popular press.[1] Empirical evidence suggests that analysts are more optimistic for certain stocks when trying to maintain good relations with management (Francis and Philbrick (1993)) and when forecasting earnings for investment banking clients (Dugar and Nathan (1992)). In addition, experimental research suggests that higher variance in the residual of a time-series regression model for earnings per share induces optimism (Hand and Maines (1995)).

Although analysts are overly optimistic, on average, their expectations may be unbiased for firms with a more certain information environment. When uncertainty is low, little dispersion is likely among analysts' forecasts. In such a situation, analysts may be more concerned with forecast accuracy and their reputations. Analysts may have incentives to avoid standing out from the crowd. Scharfstein and Stein (1990) show that in some circumstances managers ignore their private information and mimic the behavior of others rather than take a "contrarian" position. Analysts may also attempt to avoid issuing forecasts that are contrarian, particularly when relatively low uncertainty surrounds the firm. However, when uncertainty is greater, analysts may be more willing to report forecasts that deviate from the forecasts of other professionals. In this case, analysts may take a contrarian position without hurting their credibility. Thus, an analyst may be more likely to succumb to pressure to issue optimistic forecasts. As the forecast horizon declines, the level of overoptimism should decline toward zero, regardless of the level of uncertainty. Analysts' tendency to revise forecasts downward is recognized in the literature (Ackert and Hunter (1994), Brown, Foster, and Noreen (1985)). This leads to our first null hypothesis:

H_{01}: No relation exists between analyst forecast bias and ex-ante uncertainty, as measured by the dispersion in analysts' forecasts.

If much uncertainty surrounds a firm, analysts are likely to issue forecasts that are too optimistic.

To test our first hypothesis, we use the standard deviation of analysts' earnings forecasts to proxy for uncertainty, though we do not assert that this standard deviation is part of analysts' information sets when they construct their forecasts. Clearly, analysts cannot observe the full distribution of forecasts issued

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[1] Koretz, G., 1992, Analysts and brokers: Too close for comfort?, *Business Week* (July 20), 20, and Siconolfi, M., 1992, At Morgan Stanley, analysts were urged to soften harsh views, *Wall Street Journal* (July 14), A1, A6.

simultaneously by other analysts. Rather, we use the standard deviation of earnings forecasts, measured ex-post, as a proxy for the level of uncertainty associated with the information and environment in which the firm operates.

III. Sample Selection

Empirical tests employ a sample of monthly consensus forecasts of annual earnings per share obtained from the Institutional Brokers Estimate System (IBES).[2] The median forecast is the measure of the consensus forecast. The sample includes estimates of annual earnings per share for each year from 1980 through 1991, subject to the following criteria:

1. At least three forecasts determine the median forecast.
2. The IBES database includes consensus forecasts for at least nine years starting in 1980 and for twenty consecutive months starting in June of the year before the forecast year and ending in January of the subsequent year.
3. The company's fiscal year ends in December.

The initial sample contains 50,120 consensus forecasts.

Our measure of overoptimism is:

$$OOPT_{i,T-t} = (FEPS_{i,T-t} - EPS_{i,T})/ \,|\, EPS_{i,T} \,|$$

where $FEPS_{i,T-t}$ is the consensus forecast at time $T-t$ of time T earnings per share for firm i and $EPS_{i,T}$ is the actual earnings level for firm i at time T.[3] Because the measure is undefined when actual earnings are zero and small earnings levels result in extreme values that might dominate the results, we exclude observations when the absolute value of actual earnings is less than 20¢. Our measure of overoptimism is an ex-post measure that defines overoptimism relative to actual earnings that are unobservable when analysts form their expectations. However, we must define overoptimism in terms of some benchmark. The observed

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[2]Mendenhall (1991) points out that serially correlated forecast errors can result from including out-of-date forecasts in the consensus measure. Out-of-date forecasts do not appear to be a problem because our focus is on the overall level of optimism and our results are strong.

[3]To examine the sensitivity of the results to the choice of deflator, we also define the denominator of the overoptimism measure as lagged actual earnings per share and stock price. Inferences are not affected. Often, the standard deviation of analysts' forecasts ($\sigma(FEPS)$) is used as a deflator; however, given that this variable is our proxy for uncertainty, the approach would not be appropriate.

TABLE 1. Descriptive Statistics.

Variable[a]	Mean	Median	Std Dev
$FEPS_{i,T-t}$	2.66	2.22	2.25
$\sigma(FEPS)$	.23	.13	.33
$EPS_{i,T}$	2.48	2.15	2.61

[a]$FEPS_{i,T-t}$ denotes the consensus forecast, $\sigma(FEPS)$ denotes the standard deviation of the individual forecasts used to construct the consensus, and $EPS_{i,T}$ denotes the actual earnings per share.

earnings level is the natural choice because earnings prediction is the analyst's objective.

After adjustments for missing information, the final sample contains 34,876 observations for 167 firms representing 29 industries as classified by the two-digit Standard Industrial Classification (SIC) code. The number of forecasts is approximately evenly distributed across sample firms with 180 to 220 observations per firm. Forecasts are for as early as June of the year preceding the forecast year and as late as January of the following year.

In Table 1 we provide descriptive statistics for the sample of IBES forecasts and associated actual earnings along with sample firm information. The mean of the consensus forecast ($FEPS_{i,T-t}$) exceeds the mean of actual earnings ($EPS_{i,T}$), suggesting analysts were too optimistic in their earnings predictions for the overall sample. This mean difference is statistically significant at the 1 percent level ($t = 9.755$) and is consistent with the upward bias in forecasts reported in other studies. The mean forecast exceeds the median, indicating the distribution of forecasts is positively skewed. Also, the distribution of actual earnings is skewed to the right. Finally, Table 1 reports the mean, median, and standard deviation of the standard deviation of the individual analysts' forecasts used to construct the consensus forecast ($\sigma(FEPS)$).

IV. Methodology and Empirical Results

Optimism and Uncertainty

We calculate the median level of overoptimism ($OOPT_{i,T-t}$) for each firm and forecast month where $OOPT_{i,T-t}$ is the difference between the consensus forecast of annual earnings per share and actual earnings divided by the absolute value of actual earnings, as defined earlier. We classify $OOPT_{i,T-t}$ by forecast horizon (t) and the standard deviation of the forecasts used to construct the consensus measure ($\sigma(FEPS)$). We use a median test to examine whether quartiles exhibit differences. Although F-tests of equality in means are often used in other

contexts (Bhardwaj and Brooks (1992)), these tests are inappropriate when the populations are non-normal. Because the distribution of our measure of overoptimism is skewed, we use a nonparametric Brown-Mood (median) test, which provides an approximate χ^2-test. This test does not rely on normality. The only assumptions are that the samples are independent and the population distributions have similar shape.

We classify $OOPT_{i,T-t}$ by forecast horizon to examine how the level of overoptimism changes over time. The first forecast month is June of the year before the earnings forecast year, giving a forecast horizon of nineteen months. The final forecast month is January of the year after the earnings forecast year. Table 2 reports the median level of $OOPT_{i,T-t}$ for the overall sample for each of the twenty horizons. $OOPT_{i,T-t}$ monotonically declines to zero at the end of the earnings forecast period. The differences in medians across horizons are statistically significant with a χ^2-statistic of 887.75.

We divide the firms into quartiles determined by the standard deviation of the individual analysts' earnings estimates (σ(FEPS)) as of June of the year before the earnings forecast. This standard deviation is our measure of analysts' uncertainty about the firm.[4,5] We rank the firms in ascending order according to σ(FEPS) and then divide the sample into four quartiles of equal size. The first quartile (Q1) contains the firms with the lowest standard deviation and the fourth (Q4) contains those with the highest standard deviation. We partition into quartiles using the standard deviation for June of the year before the forecast year rather than the standard deviation over the entire sample period. As a result, a firm's membership in a quartile could vary from forecast year to year as its standard deviation changes over time. For each standard deviation quartile, Table 2 reports the median value of $OOPT_{i,T-t}$ over all forecast horizons, as well as for each individual forecast horizon. $OOPT_{i,T-t}$ increases monotonically from Q1 to Q4, and the differences in medians across quartiles are statistically significant with a χ^2-statistic of 1,776.90. Sign tests indicate that for each quartile, except the lowest standard deviation quartile (Q1), the number of firms for which analysts are optimistic exceeds the number for which they are pessimistic. For Q1, the frequency of analyst pessimism exceeds the frequency of analyst optimism. In addition, paired quartile comparisons using median tests indicate differences between all quartile pairs at the 1 percent level. Furthermore, χ^2-tests reported in Table 2 indicate that quartile medians differ across the four quartiles for every forecast horizon at the 1 percent level. These results suggest a strong positive

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[4]Our measure of uncertainty may also proxy for firm size because large firms have greater earnings and may have greater earnings forecast dispersion. We examined the distribution of earnings for each standard deviation quartile and the relation between uncertainty and overoptimism for market value quartiles. Our examinations suggest that size and level of earnings do not drive the results.

[5]We also classify $OOPT_{i,T-t}$ by σ(FEPS) divided by stock price. Our inferences are unaffected.

TABLE 2. Analyst Optimism and Uncertainty as Measured by the Standard Deviation of Earnings Forecasts.

Forecast Horizon	Standard Deviation Quartile[a]				Overall	χ^2-statistic[b]
	Q1 (Low)	Q2	Q3	Q4 (High)		
June(T-1)	.0180	.0160	.0711	.3426	.0784	150.27***
July(T-1)	.0133	.0105	.0772	.3156	.0756	145.70***
August(T-1)	.0156	.0175	.0785	.3033	.0696	148.19***
September(T-1)	.0102	.0185	.0738	.3168	.0616	138.41***
October(T-1)	.0123	.0153	.0672	.3456	.0573	129.20***
November(T-1)	.0000	.0236	.0599	.2869	.0491	112.04***
December(T-1)	.0090	.0251	.0625	.2641	.0464	90.91***
January(T)	.0099	.0112	.0573	.2698	.0428	98.29***
February(T)	.0079	.0177	.0608	.2467	.0398	93.63***
March(T)	.0075	.0146	.0488	.2195	.0323	87.47***
April(T)	.0053	.0089	.0556	.2234	.0255	86.16***
May(T)	.0000	.0090	.0581	.2189	.0249	94.20***
June(T)	.0000	.0093	.0391	.1941	.0217	74.38***
July(T)	.0044	.0050	.0381	.1655	.0188	71.84***
August(T)	.0000	.0073	.0260	.1306	.0172	57.59***
September(T)	.0000	.0041	.0290	.1111	.0147	52.00***
October(T)	.0000	.0000	.0242	.0938	.0089	36.13***
November(T)	.0000	.0028	.0120	.0461	.0028	28.14***
December(T)	.0000	.0000	.0075	.0152	.0000	14.38***
January(T+1)	.0000	.0000	.0066	.0000	.0000	15.89***
Overall	.0000	.0087	.0417	.2091	.0235	1776.90***
χ^2-statistic[c]	53.83***	42.38***	117.22***	230.11***	887.75***	

[a]The table reports the median level of overoptimism for quartiles determined by the standard deviation of analysts' earnings forecasts. We define overoptimism as the difference between the consensus forecast and actual earnings divided by the absolute value of actual earnings. We also classify overoptimism by forecast month.
[b]The test statistic is a χ^2-test of the null hypothesis of no variation in overoptimism across the quartiles for each month.
[c]The test statistic is a χ^2-test of the null hypothesis of no difference in overoptimism across the twenty months within each standard deviation quartile.

***Significant at the 1 percent level.

relation between analysts' optimism and uncertainty as proxied by the standard deviation of earnings forecasts. This leads us to reject our first hypothesis.[6] The results support the notion that analysts have fewer reputational concerns and are inclined to issue overoptimistic forecasts when greater dispersion exists among analysts' earnings expectations. In addition, although other studies document that,

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[6]To investigate the consistency of the results over time, we split the sample into two subperiods and examined the relation between overoptimism and uncertainty for each sample. The results are similar to those reported for the overall sample.

on average, analysts' forecasts exceed actual earnings per share, we do not observe this bias when the level of dispersion across forecasts is low.

Returns and Excess Returns for Uncertainty Portfolios

The results discussed above suggest a positive relation between analyst optimism and firm uncertainty, as proxied by the standard deviation of earnings forecasts. We next investigate whether abnormal returns can be generated using a portfolio strategy based on these observations, where ex-ante information determines portfolio membership. If analysts are too optimistic in their earnings forecasts for some firms, the market may react by elevating stock prices. As the earnings release date approaches and forecasts are revised downward (see Table 2), the market may respond by adjusting prices. Similarly, pessimistic forecasts may lead to low stock prices that are later adjusted upward as forecasts are revised upward. Previous research suggests that earnings forecasts have information content (Brown, Foster, and Noreen (1985)) and that stock prices react to forecast revisions (Stickel (1991)). If analysts' overoptimism (or pessimism) is related to uncertainty and if mispricing in the market results from analysts' behavior, an ex-ante measure of uncertainty may be used to generate positive risk-adjusted returns. This leads to our second null hypothesis:

H_{02}: No relation exists between ex-ante uncertainty, as measured by the dispersion in analysts' forecasts, and subsequent abnormal returns.

We classify firms by our proxy for uncertainty each year and assign them to quartiles based on the uncertainty in June of the year before the earnings forecast year (June($T-1$)). This information about forecast dispersion is available to investors at the beginning of the holding period. In addition, because of the lag in analysts' reports of forecast revisions to IBES (Brown, Foster, and Noreen (1985)), our measure of uncertainty is likely available to investors well before implementing the strategy. We compute monthly returns for the subsequent twenty months for each firm in each quartile, and we then average within quartiles to determine the average monthly quartile return. The firms included in each quartile remain the same for each twenty-month period. However, we rebalance the quartiles annually. We compute monthly returns by compounding the daily returns for each firm using holding-period (R^{HP}) returns and two excess return series. We obtain beta excess returns (ε^{β}) and standard deviation excess

TABLE 3. Returns for Portfolios Based on the Standard Deviation of Earnings Forecasts.

Return[a]	Standard Deviation Quartile[b]				
	Q1 (Low)	Q2	Q3	Q4 (High)	*F*-statistic[c]
R^{HP}	.0186	.0155	.0129	.0097	18.22
	(.01)	(.01)	(.01)	(.01)	(.01)
ε^{β}	.0038	.0008	-.0017	-.0043	21.16
	(.01)	(.27)	(.03)	(.01)	(.01)
ε^{SDR}	.0045	.0017	-.0002	-.0031	20.28
	(.01)	(.01)	(.81)	(.01)	(.01)

[a]R^{HP} is the raw holding-period return, ε^{β} is the excess return when we determine benchmark portfolios by beta, and ε^{SDR} is the excess return when we determine benchmark portfolios by the standard deviation of holding-period returns.
[b]The table reports mean monthly returns and excess returns for portfolios selected on the basis of the standard deviation of analysts' earnings forecasts for 1980–91. Below each mean are *p*-values for a test of the null hypothesis that the mean return is zero.
[c]The test statistic is an *F*-test of the null hypothesis of no difference in returns across the quartiles; *p*-values are reported below.

returns (ε^{SDR}) from the CRSP database.[7] This yearly buy-and-hold strategy follows from Bhardwaj and Brooks (1992).

Table 3 contains portfolio returns and excess returns for the four portfolios determined by the standard deviation of analysts' earnings forecasts. The table reports the average monthly return over the twenty months with *p*-values reported below each average. All four portfolios generate positive R^{HP}'s that differ from zero at the 1 percent level. The difference in monthly returns across the first and fourth quartiles translates into an annually compounded difference of 11.35 percent. The low standard deviation portfolios generate higher returns. Furthermore, the lowest standard deviation quartile generates significantly positive excess returns. The highest standard deviation portfolio generates negative excess returns that differ from zero at the 1 percent level. *F*-tests suggest that the means of ε^{β} and ε^{SDR} differ across quartiles at the 1 percent level. Across the first and fourth quartiles, the monthly abnormal returns imply an annually compounded difference of 10.16 percent for ε^{β} and 9.51 percent for ε^{SDR}. The results indicate that as analysts are more overly optimistic for high uncertainty firms, the market reacts to analysts' optimism, resulting in elevated

[7]The CRSP daily excess return is the excess of the daily return above the return on a portfolio of stocks with similar risk. Benchmark portfolios are defined using two risk measures. First, portfolio rankings are determined by beta values (beta excess return). Recent evidence supports using beta as a risk measure (Pettengill, Sundaram, and Mathur (1995)). A second excess returns series uses the standard deviation of holding-period returns (standard deviation excess return) to form benchmark portfolios.

stock prices. Analysts are not overoptimistic, on average, when little dispersion exists among analysts' forecasts. In fact, sign tests indicate that analysts' forecasts are more frequently pessimistic for the low standard deviation quartile. The market reacts in this case by underpricing. On average, the low uncertainty firms' stocks generate significantly positive abnormal returns, as forecasts are revised upward near the earnings release date.

CRSP beta excess returns (ε^β) and standard deviation excess returns (ε^{SDR}) may not fully control for risk and our proxy for uncertainty may proxy for the risk priced by the market. Although we cannot be positive that we have controlled for all sources of risk, the results are consistent with the relations among prior uncertainty, analyst bias, market overvaluation, and returns. Furthermore, the results are similar across firm sizes (see note 4) and periods (see note 6), suggesting unobserved risk is not a factor.

The results suggest we can construct profitable portfolio strategies. This leads us to reject our second hypothesis. We can implement one such strategy by buying stock in firms included in the low uncertainty quartile based on the standard deviation of analysts' forecasts, as reported by IBES in June of each year. At the same time, take an equivalent and offsetting (short) position in the benchmark portfolio and simultaneously sell the stock of the firms included in the high uncertainty quartile, while taking an offsetting (long) position in the benchmark portfolio. Over the sample period this strategy would have resulted in positive risk-adjusted returns before transactions costs. Given the complexity of this strategy, however, it is unclear that excess returns would be generated after transactions costs. A simpler strategy with lower transactions costs involves buying stock in firms included in the low uncertainty quartile. In addition, investment in firms included in the high standard deviation quartile would not be advisable, given that such a strategy generates negative excess returns, on average.

V. Summary and Conclusion

We find that analysts are too optimistic, on average, and their overoptimism declines as the earnings release date approaches. However, analysts are not overoptimistic for firms with low uncertainty, as proxied by the standard deviation of analysts' earnings forecasts. In addition, a strong positive relation exists between overoptimism and uncertainty.

Our results lend insight into the behavior of professional financial analysts and the functioning of financial markets. Analysts' expectations are accurate, overall, for firms with low uncertainty. Analysts may hesitate to act on their inclinations to issue overoptimistic forecasts because of reputational concerns when little uncertainty surrounds the firm. Analysts' optimism increases when uncertainty, as proxied by the standard deviation of earnings forecasts, increases.

With greater dispersion among forecasts, analysts may have fewer reputational concerns when issuing a forecast that deviates from the forecasts of others. However, as the earnings forecast horizon diminishes, analysts' reputational concerns may become more prominent. In addition, our results suggest that analysts' overoptimism leads to mispricing in the market. An ex-ante portfolio strategy of buying the stock of firms in the low standard deviation quartile and avoiding the stock of firms in the high standard deviation quartile would have resulted in positive risk-adjusted returns before transactions costs over the sample period. Even though analysts are too optimistic, on average, market participants do not appear to discount the overly optimistic forecasts by analysts. Thus, market prices do not always reflect all available information.

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