2019

To Rely or Not to Rely? A Study of how Analyst Earnings Forecast Error Changes Leading up to Recessions

Mackenzie Bradford

Claremont McKenna College

To Rely or Not to Rely? A Study of how Analyst Earnings Forecast Error Changes Leading up to Recessions

Submitted to

Professor Matthew Magilke

and

Professor Manfred Keil

By

Mackenzie Bradford

for

Senior Thesis

Fall 2018

December 10, 2018

Acknowledgments

First, I would like to thank Professor Magilke not only for reading my thesis but for providing me with support and structure in his Research Seminar class this fall. Professor Magilke has guided me through this process and I would not have been able to do this without his help. I could never thank him enough. Next, I would like to thank Professor Keil for being my secondary thesis reader and for being there for me throughout my college career. I am so grateful to have a professor in my life that believes in me as much as Professor Keil does. Second, I would like to thank my family. They have always believed in me and supported me throughout my academic career. My mom and stepfather have been there every time I called to offer me endless love and support that has pushed me to do my best throughout my schooling. My dad has always been there to be genuinely interested (or at least pretend to be) in all of my coursework, and even this thesis. My brothers and sisters are my biggest motivators. I would not have had such a fantastic college experience without my sister, Madison being only a short drive away whenever I needed her to add some love and happiness to my life. Lastly, I would like to thank the external support system that I have had the luck of finding throughout my life. My friends have been there for me no matter what and I will always owe them for their endless and unconditional love.

Abstract

There are a large number of investors and companies reliant upon analyst earnings forecasts. Missing analyst forecasts can have a massive impact on share price and investors often look to these values to make decisions regarding future investment decisions. However, there has been a great deal of speculation about these forecasts and especially the error associated with them. With the threat of an impending recession, it is important to know the reliability of forecasts during times leading up to recessions. More specifically, this study aims to see how the level of error associated with analyst earnings forecasts change leading up to recessions and whether or not they should be relied upon as heavily during these times.

Table of Contents

Chapter 1: Introduction

In this study, I will look at the trends in the error of analysts' earnings forecasts leading up to recessions to see if analysts are accurately incorporating declining economic activity into their forecasts. I chose to analyze the past three recessions from 1990 until 2018. The driving idea behind this analysis is that outside factors have too much impact and therefore analysts do not accurately incorporate a potential recession into their forecasts. Therefore, there would be greater error in forecasts and this has implications on all of those who rely on the accuracy of these forecasted earnings values.

I recently performed an in-depth analysis of a few components of the Leading Economic Indicator and thought about what other pieces of financial information the public assumes are "forward-looking" projections. This sparked the idea to look at the trends of analysts' forecasts and the components of the error during economic decline. If analysts are truly forward-looking and have a more complete understanding of the macroeconomic climate as well as financial climates, than the error associated with analyst forecasts should be relatively stagnant leading up to recessions. In other words, analysts would be accurately pricing in declines due to slowed economic activity and therefore their error would not increase in size. However, due to many outside factors that have been previously researched, there is evidence to suggest that analysts would not be accurately pricing in economic downturns and therefore produce less accurate forecasts.

The main finding of this study was that the difference between analyst forecasts and actual values increased greatly before recessions. Further, the overall level of optimism bias did not decrease in the way we would expect it to if analysts were building in the declining economic climate into their forecasts. There are many indicators of

slowed economic growth that we would expect to see analysts take into consideration when calculating their forecasting bias. Even something as simple as quarterly growth in GDP we would expect to have been factored into these forecasts.

This lack of a relationship between optimism bias and recessions opens up room for further discussion surrounding how to improve forecasts by incorporating this type of analysis. This would be very impactful for those who are reliant on the information put forth by analysts to be as accurate as possible. This also could have further implications on the company's overall performance if the estimates are less accurate during this time as their stock price is very likely to be taking a large hit because of the company's earnings are far below forecasted earnings.

Chapter 2: Literature Review

How well analyst forecasts end up matching actual earnings is a heavily researched topic, and almost all reports come to the same conclusion: analysts are upwardly biased. Therefore, there is a lot of speculation regarding the accuracy of analysts' forecasts on a broad scale. A 1995 study entitled "A Theory of Analyst Forecast Bias" looked at the relationship of optimism bias and access to management information. These authors hypothesized that the level of optimism is due to the desire to appease managements to gain access to further information about the company. This study showed statistical evidence that initial forecasts put forth by analysts will consistently contain a relatively high level of optimism bias due to this reason. There is no indication that analysts have changed this behavior and there is still a lot of evidence that analysts have bias built in to all forecasts. (Krishnan and Sivaramakrishnan, 1995)

2.1: Earnings and the Business Cycle

Previous research has indicated that there is a positive correlation between actual firm earnings and earnings growth and the business cycle. The authors defined the business cycle as the rate of overall growth in the economy and the level of economic activity. (Johnson, 1999) The level of reaction depends on the specific industry, business model and other factors of the company itself. However, all firms see some level of interaction with overall economic activity when looking at actual earnings. This indicates that the forecasts of earnings should also be dependent on forecasts of overall economic activity to some extent. Analysts often, roughly, make changes in assumptions for base, bear and bull cases in terms of valuation and then weight these different scenarios in order to come up with one forecasted earning value for the firm. However, if analysts are

truly examining macroeconomic trends and attempting to build this into their valuations they would alter their forecasted earnings based on the status of the overall economy.

2.2: External Influences on Forecasts

Putting the previous two ideas together, "The Relation Between Analysts' Forecasts of Long-Term Earnings Growth and Stock Price Performance Following Equity Offerings". The authors found that not only were analyst forecasts upwardly biased and overestimated long-run earnings upon equity offerings, but also that there was a positive correlation between fees paid to analysts' employers and level of the same employers analyst forecasts. (DeChow, Hutton and Sloan, 2010) This may indicate that analysts will not be accurately looking at macroeconomic trends and building them into the valuations.

Further, the authors of "Do Managers Always Know Better? The Relative Accuracy of Management and Analyst Forecasts" looked into the difference between manager and analyst forecasts. While the outcome does not specifically apply to this paper, the authors discussed the difference in building analyst and manager forecasts. The authors hypothesized that analysts would have much more macroeconomic data built in to their forecasts, but they failed to find evidence for this. (Hutton and Shu, 2012). All of the literature regarding analyst forecasts generally imply that analysts are not accurately building in macroeconomic trends because they are too reluctant to lower their forecasted values due to outside factors. However, there has been no literature directly addressing if this theory holds leading up to recessions.

Previous research also shows that analysts are typically very hesitant to lower their forecasts and be pessimistic. This is usually due to the overlap of clients within the firms that produce these forecasts. It is very unlikely for analysts to want to release any

negative news for the fear of losing clients. (Nathan, 2010) Further, analysts' forecasts are often used as marketing props by the banks producing them. This is because the banks putting out the forecasts often will benefit greatly from their clients' stock performing well. (Heinzl, 2013) This study aims to prove that due to these reasons, analyst forecasts will become much less accurate during this time and therefore has implications for those reliant on this information, as well as the reaction to companies not meeting these forecasted values.

2.3: Forecasts and the Business Cycle

Another 1995 study titled "Analyst Forecasting Errors and Their Implications for Security Analysis" created distributions for the difference between analyst forecasts and actual earnings for the corresponding period. They ran a regression to estimate the size of forecasting error. They divided their distributions based on business expansion and recessions. They found that there was no significant difference between the mean size of analyst errors in periods of expansion and recession. They concluded that larger forecasting errors "did not emanate from business cycles". (Brown, 2996) This study did look at the difference in the error from expansion to recession but it did not analyze the different points in time leading up to both. This is problematic, as analysts should always be considering macroeconomic factors in order to produce accurate forecasts. I wanted to take this study one step further and look into the size of this error not just compared to an expansion but across the three quarters leading up to recessions. Therefore, we could see if there was a specific point in time in which the size of the error changed.

Overall, the levels of analyst bias has been widely researched and there have been countless attempts at modeling the error associated with analysts' forecasts and these

models are useful to an extent. However, there is a gap in the literature analyzing the way analysts change their forecasts prior to upcoming recessions. I aim to fill a gap in the literature regarding analyst forecast error. While it is very important to try to model this error and gauge how much analysts are incorrect by, it is also important to analyze how this error changes. This will provide insight into what is driving the level of forecasting error, but also the periods when analysts' forecasts should be relied upon by the public and when their data may be less accurate.

Chapter 3: Hypotheses

In my study, I will analyze the average difference between the mean analyst forecast for earnings, scaled by stock price, and the actual value of earnings for the same time period, also scaled by stock price. If the previous literature is true, I hypothesize an increase in this difference. This increase would imply that, on average, analysts forecasts are staying high relative to the falling performance of the company due to the slowing of the economic climate. This will help take a step back from digging into what makes up forecasting error and gain a larger picture of how this error is changing with regard to important economic events, such as recessions.

This leads to the second portion of this study, dissecting the components that construct the analysts' forecasting error to see how those are changing leading up to recessions. Similar to the regression performed in the aforementioned study, I will also run a regression using mean forecasted earnings and actual earnings. I will run the opposite of the regression in the previous study. This is to serve the purpose of providing more insight on how the error is actually changing over time as opposed to just analyzing the level. If analysts are incorporating the fluctuation in economic performance leading up to a recession, I hypothesize that the intercept of this regression would decrease. It would decrease because analysts, on average, would be less likely to overestimate the firm's performance since there is a decline of economic activity built into their projections. The slope of this regression is more indicative of the correlation between forecasted earnings and actual earnings in this time period. If analysts were very good at forecasting earnings, this coefficient would be close to one. If the slope moves further away from one, either greater or less than, the analysts are getting less correlated with the

actual value of earnings. Thus, there is a larger error associated with the forecast with respect to the actual value. Further, this regression yields a standard error that is indicative of how tightly the data fits around the model. In this regression, a high standard error implies that analyst forecasts are not tightly fitted to the model, using actual values as an explanatory variable. I also hypothesize that this would increase if the analysts were getting less accurate leading up to a recession.

Chapter 4: Data and Methodology

I found the data utilized in this study through the Wharton Research Data Services. I searched all companies in the database that had quarterly data back to 1989. The actual data was for each quarter and was gathered by the I/B/E/S database two months after the quarter ended. The mean estimate was for the forecasted period ending on the corresponding quarter to the average price and was collected by I/B/E/S in the same month the quarter ended, before the actual earnings value was released. Each company has actual quarterly earnings per share value and a mean analyst forecast estimate for quarterly earnings for the three quarters leading up to the 1990 recession, 2001 recession and 2008 recession. I scaled each value by the associated closing stock price at the end of the last month of the quarter. I then merged the data within each recessionary period across the four quarters corresponding to each recession I analyzed to ensure that the same companies were used in each quarter leading up to each recession. However, these companies do change across the recessions.

I also created a condensed data set to analyze for increased power. This condensed set combined the data based on how many quarters prior to the recession it occurs. I analyzed the condensed data set the same way the individual quarterly data was analyzed. Appendix A contains the summary statistics for all of the quarterly data as well as the condensed data.

4.1 Average Difference:

First, each quarter was analyzed based on the difference between the mean analyst estimate and the actual value that was calculated for each company. I then produced summary statistics for each of these differences that also appears in Appendix A. I then performed difference in means testing across each of the quarters to see in what way the analyst forecast error was changing. The purpose of running this test was to ensure that analyst error is not stagnant, as in there is a change in the error from quarter to quarter. It was also used to analyze in what direction the difference was moving to see if there were any trends leading up to a recession. This is for further testing purposes, as if the betas are not changing then there will be no trends to analyze leading up to recession.

$$t = \frac{Avg\ Diff_{t-1} - Avg\ Diff_t}{\sqrt{s.e._{Avg\ Diff_{t-1}} + s.e._{Avg\ Diff_t}}}$$

$Avg\ Diff$	The average difference defined as the mean estimate less the actual value for the company. The subscript *t* indicates the current quarter or the quarter before.
$s.e._{Avg\ Diff}$	The standard error of the difference in mean estimate less the actual value for each company. Calculated by taking the variance divided by the number of observations.

The equation above was used to calculate the t-statistic for each change in the average difference of analyst error. If the t-statistic is greater than 1.96, we can say with 95% confidence that the average difference did change from quarter to quarter. The sign on this t-statistic is also indicative of the direction in which the average difference

changed. If the sign is negative, then the average difference decreased from quarter to quarter.

4.2 Mean Earnings Estimate and Actual Earnings Regression:

The next step of my analysis was to break down the difference between mean forecasted earnings and the actual value by running a regression utilizing this data. I ran a regression for each of the twelve quarters I have data for using the equation below.

$$Actual = \beta_0 + \beta_1 MeanEst + \in_i$$

$MeanEst$	The mean estimate of analyst forecasts of quarterly earnings per share for each company, collected one month prior to the end of the quarter.
$Actual$	The actual value of each company's quarterly earnings per share collected two months after the end of the quarter.

I did not use any control variables because of the way I collected my data. The analysts were polled by I/B/E/S the month before the end of the quarter and this was the mean estimate value used. This would control for nearly all external variables, such a press releases, as analysts had almost full information regarding the company's presence and performance a month before the companies released their actual earnings. Therefore, the same external effects would have the same impact on actual and estimated and would be controlled for inherently in the data.

In this regression, the interpretation of the coefficients gives us relevant insight regarding overall bias in analyst forecasts. The intercept, β_0, represents the overall bias direction that is typically referred to as optimism bias. A positive intercept would indicate

that the consensus by analysts was generally optimistic, while a negative intercept would indicate pessimistic bias in an analyst forecast. This intercept represents the average of all forecasted values; therefore, this positive intercept indicates that on average analysts would be slightly more on the optimistic side. The units of this bias is in percentage of stock price.

The slope coefficient, β_1, is representative of the correlation between the actual value of earnings and the estimated value with respect to the variance of the actual values. If $\beta_1$was equal to one, then the covariance of mean estimates and actual values would exactly equal the variance of the actual values. All of the observed β_1 values are less than one. This tells us that for every one-unit increase in actual earnings, the forecasted earnings would move less than one full unit. This implies that shifts in actual values are not represented fully in the forecasted values. However, it is important to remember that the data used was scaled by stock price. This has large implicated on the level of β_1, as a linear transformation does not alter covariance and variance in the same way. The level of this beta does not have much significance; however, the trends in it will provide some insight to how large the discrepancy between forecasted and actual values are. The farther away from one β_1, the large this discrepancy is.

The residual, $\in_i$ is forecasting error. This comes as a result the variation in the data not being fully explained by the model. (Hughson, 2018). A key statistic regarding analyst error is the standard error of the regression. Stata outputs this value as the Root MSE. A small standard error of the regression indicates that the data is very tightly fitted around the model. In other words, the overall error is small. However, a large standard error indicates that the data is more spread out in regards to the model.

The purpose of running these regressions is to dissect the composition of analyst forecasting error. I will have values for the directional bias as well as the correlation and the standard error of the regression and be able to see if the changes from quarter to quarter are statistically significant. One would expect directional bias to trend downward leading up to a recession as this represents overall analyst bias in this time period. It also will allow for the analysis of trends in these changes leading up to recessions that may be indicative of a recession approaching.

Across each quarter, I performed a difference in beta test to ensure that both slope and intercept were changing from quarter to quarter. This was performed very similarly to the prior difference in means testing. However, the equation below was what was used for testing the change in beta. Again, we will do the same analysis as we did on the difference in means testing to see if there are any trends leading up to recessions in these changes. The t-score that was yielded was compared to a critical value of 1.96, for 95% confidence.

$$t = \frac{\beta_{t-1} - \beta_t}{\sqrt{s.e._{\beta_{t-1}} + s.e._{\beta_t}}}$$

I also performed this test on the regressions yielded from running the condensed data that is explained above.

β	Represents either the intercept or slope estimate from the regression for each time period analyzed. The subscript *t* indicates the current quarter or the quarter before.
$s.e._{\beta}$	The standard error of the estimate for slope or intercept calculated by the regression.

Chapter 5: Results

5.1: Analysis of Average Difference

Appendix C contains all of the results for both the quarterly differences as well as the difference in the condensed data. When analyzing the change in the quarterly difference across the three recessions, there are few statistically significant changes. There is an increase from the second quarter of 2000 to the third quarter of 2000, as well as the third quarter to the fourth quarter of the same year. There also is a statistically significant increase in from the third to fourth quarter of 2007. While the statistically significant changes across these quarters do not seem to be the same across all of the quarters, solely analyzing the directional change does yield some interesting results.

Across all three of the recessions, we see that in the quarter leading up to the recession, the difference increases. This means that on average, the mean estimate and actual value are farther away in the times leading up to the recession. This follows what I hypothesized regarding this data and the previous research. The main conclusion is that, while it is not always statistically significant, the difference between the forecasted value and the average value is higher leading up to a recession.

This theory holds when looking at the condensed data as well. There are no statistically significant changes in the average difference from any of the three quarters prior to recessions. It is important to note, however, that the mean difference did grow leading up to recessions prior to all three recessions. This would suggest that on average, the mean estimate is higher than the actual value and that gap widens leading up to recessions. This provides some evidence that analysts forecasts are indeed less accurate in the times leading up to the recessions and further is in line with my hypothesis. A

deeper look in to this difference is necessary because of the fact the changes are not significant. By breaking down the levels that are playing a factor into this difference, we hope to statistically prove the hypotheses set forth in the beginning of this study. Further, just analyzing the difference in means is not entirely informative about the breakdown of this difference. Thus, it is important to dive deeper and utilize the regressions coefficients and standard error to look further into this data.

5.2: Analysis of the Intercept Coefficients

After running the regression of forecasted values on the actual values The change in the intercept coefficient yielded far more statistically significant changes than the average difference. This intercept provides information regarding the average outlook of an analyst in this time period. If the intercept is positive, it is indicative of a more positive outlook on the economic climate. As discussed in the literature review, previous research has indicated that analysts always tend to have a more optimistic outlook. However, if analysts were factoring in the potential of a recession occurring into their forecasts, we would see a decrease in the intercept coefficient in the quarters leading up to a recession and especially in the quarter that the recession actually occurs.

When analyzing the data across all three recessions, the only time that we see a statistically significant drop is from the third to the fourth quarter of 1989 and from the last quarter of 2000 to the first quarter of 2001. However, the growth in GDP plummeted, and even went negative, in the same time periods that I am analyzing. This would suggest a much larger drop in the overall optimism of the economic climate. However, we do not see as large of a drop as we would have expected. The 2001 recession began in the first quarter, so it is fitting with my hypothesis regarding analyst forecasts that there would be

a drop occurring in this quarter. The main issue presented in the 1989 data point is that it is followed by two statistically significant increases in this intercept. This means that even though there was a drop, the analysts corrected that and ended up at roughly the same level when the recession begins as they were three quarter prior. The quarters leading up to the 2008 recession are even more against my hypothesis as they see statistically significant increases from the first to second quarter of 2007 and the third to the fourth quarter of 2007. The recession occurred in the final quarter of 2007 and therefore I would have expected to see a fall in the intercept in this quarter.

Across all three recessions, there was an increase in the intercept in each quarter prior to the three recessions. This is interesting as it would imply that analysts are increasing their general outlook, on average, in the quarter leading up to a recession. Not all of these increases were statistically significant, but it still would imply that on average there was an increase.

Even though the quarterly data is a bit sporadic, the condensed data provided a clearer picture. There is more power associated with this data as it is far more data points for each segment than just looking at the quarterly data. Each change between periods was statistically significant. We did see the increase occurring in the quarter prior to the recessions start. However with this data, we did see a statistically significant fall in from the third to the second quarter prior to the recession and from the quarter prior to the recessions start. The falls are in-line with my proposed hypothesis that analysts would be shifting slightly downward leading up to a recession. However, since this increase does occur the level of the intercept for the quarter containing the beginning of a recession ends up almost exactly equal to the intercept relating to two quarters prior to the

recession. This is indicative that while there are some shifts downward, it does not trend downward leading up to a recession, and actually sees and increase in the average outlook right before the recession. This is an area for potential further research as to why this shift upward occurs in every quarter right before the recession begins.

5.3: Analysis of the Slope Coefficient

When analyzing the changes in the slope coefficient, I observed a statistically significant change in each quarter. All of the slopes that were observed were less than one. This would imply that all of the actual values would have to be scaled down by the factor of the slope and then added to the level of optimism, represented by the slope, to obtain the forecasted value. A slope coefficient closer to one would indicate a more closely correlated data set. However, we do not observe this to be the case. In fact, in the quarter before the 1990 and 2001 recessions occurred we see a drop in the slope farther away from one. This implies that the value of actual to mean were farther away from each other, on average, than in the quarter before. The changes in the slope are sporadic but it is important to note that each quarter did observe a statistically significant change in the slope coefficient. This would imply that, to some extent, the level of error associated with analyst forecasts is shifting over time.

When we look to the condensed data for results with more power, we observe that the value of the slope fell to 0.108, much farther from one than the 0.557 observed in the data that was two quarters prior to the start of the recession. This would follow the trend of the 1990 and 2001 recession that the slope coefficient in getting farther away from one in the quarter prior to a recession beginning. It does increase from this quarter to the quarter that the recession begins, however not in as large of a movement. The movement

leaves you at a level much farther away from one than the value observed two quarters prior to the recession starting.

The analysis of the slope coefficient also shows that there is a spike in value from three quarters prior to two quarter prior, when looking at the condensed data. This same change only occurred leading up to the 1990 recession. In truth, the slope coefficient moves around quite a lot and the main take-away is that there seems to be a fall in the coefficient from three quarters prior to two quarters prior to a recession beginning.

5.4: Analysis of the Standard Error of the Regression

Similar to the idea of testing the difference in means, looking at the standard error of the regression gives us insight into how large the general mismatch between forecasted values and actual values are in the time period analyzed. This standard error is an indicator of how closely the data is fit around the model. Therefore, if the forecasted valued given by the model for a given actual value is very different then the observed forecast value, this number will be very high. On a quarterly basis, we see a fairly substantial increase in this value from the quarter prior to the recession to the quarter the recession begins. This is the same trend as seen in the condensed data.

While there doesn't seem to be a clear trend in the quarterly data, the condensed data follows the same pattern as the difference in means. The largest change occurs from three quarters prior to the recession occurring to two quarter prior. This is also when the largest change in the difference in means occurs. Therefore, this is further evidence that forecasted values are farther away from actual values in the quarter right before the recession in comparison to the quarters prior to that.

Also similar to the difference in means observations, there is another jump in standard error of the regression in the condensed data from the quarter prior to the recession to the quarter in which the recession occurs itself. This, coupled with the quarterly data and all data for the difference in means, would give us a clear indication that analysts are getting less accurate in the quarter leading up to a recession. There are multiple reasons why this is the case and this has large implications for those who rely on this data.

Chapter 6: Conclusion

Overall, there is no indication that analysts biases have gone away or analysts have gotten more accurate in the recent years. There is plenty of evidence that suggests that analysts are consistently optimistically biased, even in times of recessions. So much so, that they are not altering this optimism bias even though the economy is slowing down. Quarterly growth in GDP even plummeted to -1.1% in the first quarter of 2001, when we would also expect to see a shift downward in optimism bias as well. However this is not the case, and it holds true across all of the recessions that I analyzed. This leads to less accurate forecasted results. This is a crucial finding for those who are reliant on analyst forecasts. This heightened error means that not only are those who invest based on projections going to be effected, but the stock price of companies who are not hitting these forecasts will drop more than necessary. If analysts were accurately reducing their optimism during these times, then the difference between the forecasted earnings value and the actual value of earnings would be smaller than it is currently, on average. This could imply that company's stock prices are taking a larger hit then they should due to analyst error.

6.1: Shortcomings

There were a number of shortcomings associated with running this study. The time constraint made it difficult to look at any other periods except for the one analyzed. There are a number of different analyses that could be run looking at longer-term forecasts or forecasts put out and different times than right before the end of the quarter. There could be a difference in these results if the time horizon for the forecast was longer. There also is a potential to analyze the trends across a longer period of time. For

example if we looked at the forecasts two years prior to the recessions compared to the year leading up to the recession, we would control for some effects that were not controlled for in this study and gain more insight to how the forecasts were changing over time.

It is important to note that in the time period analyzed, this larger error may not be entirely due to the optimism bias of analysts. While the analysis of the intercepts does give us an indication that they are not shifting the overall levels of optimism down enough, managers may be manipulating their earnings during this time as well. This could also lead to larger forecasting error as analysts would not know in what way managers are altering earnings until after the actual value is released. In a study published in 2002, researchers utilized the 1990 recession as a case study to see if managers were in fact manipulating earnings differently in times during a business cycle. They found that GDP growth can fairly accurately predict the direction in which earnings are being manipulated. In periods of moderate GDP growth, which typically occur right before and right after a recession, mean discretionary accruals were positive. This would indicate that earnings were being manipulated upward during these times. (Shih, Lin and Zhi Xing, 2002). If this is true across recessionary periods, then this upward earnings management would close the gap between optimistic analyst forecasts and actual values if analysts were staying at the same level across periods. However, this is not what was observed. Therefore, analysts are not staying at the same level and the error is increasing due to the fact analysts are not adjusting their levels of bias based on slowed economic activity.

6.2: Further Study

The findings of this research open the doors to further investigation regarding this topic. Primarily, there is room for further analysis regarding the time horizon the forecasts are projected across. It would be interesting to run this analysis for more than just quarterly forecasts. We could run the same analysis yearly forecasts or forecasts done earlier to the month ending the quarter. This could provide more insight as to whether analysts every shift their level of optimism down before a recession. There also is room to compare those forecasts to times of business expansions and the corresponding recessions. That way we could see if the same analysts were changing their levels of optimism in correspondence with those economic trends.

Another area to explore is the change in earning management and how this factors into the level of error leading up to recessions. As previously mentioned this is a limitation on my study and would be very beneficial to analyze. Other factors such as timing of press releases and other news that can affect earnings would also be interesting to introduce into my study. Even moreso, other factors that could be analyzed are the components of the leading economic indicators. How these indicators are reacting and the response in the breakdown of analyst forecasts would be an interesting study to run.

Works Cited

Brown, Lawrence D. "Analyst Forecasting Errors and Their Implications for Security Analysis: An Alternative Perspective." The Mutual Dependency of Force and Law in American Foreign Policy on JSTOR. January 01, 1996. Accessed December 09, 2018. https://www.jstor.org/stable/4479844?seq=9#metadata_info_tab_contents.

DECHOW, PATRICIA M., AMY P. HUTTON, and RICHARD G. SLOAN. "The Relation between Analysts' Forecasts of Long-Term Earnings Growth and Stock Price Performance Following Equity Offerings*." The Canadian Journal of Chemical Engineering. April 27, 2010. Accessed December 09, 2018. https://onlinelibrary.wiley.com/doi/full/10.1111/j.1911-3846.2000.tb00908.x.

Heinzl, John. "Stock Price Targets: What Analysts Won't Tell You." The Globe and Mail. October 25, 2013. Accessed December 08, 2018. https://www.theglobeandmail.com/globe-investor/investor-education/the-hit-and-miss-world-of-price-targets/article15093603/.

Hughson, Eric. *Fin340: Investments*.

HUTTON, AMY P., and SUSAN Z. SHU. "Do Managers Always Know Better? The Relative Accuracy of Management and Analyst Forecasts." The Canadian Journal of Chemical Engineering. June 06, 2012. Accessed December 09, 2018. https://onlinelibrary.wiley.com/doi/full/10.1111/j.1475-679X.2012.00461.x.

Johnson, Marilyn F. "Business Cycles and the Relation between Security Returns and Earnings." SpringerLink. June 1999. Accessed December 09, 2018. https://link.springer.com/article/10.1023/A:1009649018325.

Krishnan, Murugappa, and K. Sivaramakrishnan. *A Theory of Analyst Forecast Bias*. Http://citeseerx.ist.psu.edu. July 1995. http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.48.2391&rep=rep1&type=pdf.

Nathan, Siva, and AMITABH DUGAR. "The Effect of Investment Banking Relationships on Financial Analysts' Earnings Forecasts and Investment Recommendations*." The Canadian Journal of Chemical Engineering. April 20, 2010. Accessed December 09, 2018. https://onlinelibrary.wiley.com/doi/abs/10.1111/j.1911-3846.1995.tb00484.x.

Shih, Michael S. H.Lin, and Zhi-Xing. "Earnings Management in Economic Downturns and Adjacent Periods: Evidence from the 1990-1991 Recession." By Lawrence J. Trautman :: SSRN. November 11, 2002. Accessed December 09, 2018. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=331400

Appendix A: Summary Statistics

Summary Statistics for Adjusted Mean Estimate and Adjusted Actual Values:

Summary Statistics	Mean	Std. Deviation	First Quartile	Median	Third Quartile
1989 Q3 Adjusted Mean Estimate	2.15%	0.017	0.014	0.021	0.029
1989Q3 Adjusted Actual	0.01	0.112	0.011	0.018	0.026
1989Q4 Adjusted Mean Estimate	0.02	0.030	0.014	0.020	0.030
1989Q4 Adjusted Actual	0.01	0.071	0.012	0.018	0.027
1990Q1 Adjusted Mean Estimate	0.02	0.030	0.012	0.018	0.028
1990Q1 Adjusted Actual	0.00	0.370	0.010	0.016	0.025
1990Q2 Adjusted Mean Estimate	0.02	0.038	0.015	0.021	0.031
1990Q2 Adjusted Actual	-0.01	0.283	0.012	0.019	0.029
2000 Q2 Adjusted Mean Estimate	0.01	0.029	0.004	0.013	0.022
2000 Q2 Adjusted Actual	0.01	0.029	0.004	0.013	0.022
2000 Q3 Adjusted Mean Estimate	0.01	0.045	0.004	0.013	0.023
2000 Q3 Adjusted Actual	0.01	0.047	0.004	0.013	0.022
2000 Q4 Adjusted Mean Estimate	0.00	0.063	0.005	0.013	0.020
2000 Q4 Adjusted Actual	0.00	0.078	0.004	0.012	0.019
2001 Q1 Adjusted Mean Estimate	-0.01	0.099	0.003	0.010	0.017
2001 Q1 Adjusted Actual	-0.01	0.105	0.001	0.010	0.017
2007 Q1 Adjusted Mean Estimate	0.01	0.015	0.007	0.011	0.016
2007 Q1 Adjusted Actual	0.01	0.016	0.007	0.012	0.016
2007 Q2 Adjusted Mean Estimate	0.01	0.018	0.009	0.014	0.019
2007 Q2 Adjusted Actual	0.01	0.022	0.009	0.014	0.019
2007 Q3 Adjusted Mean Estimate	0.01	0.028	0.008	0.014	0.019
2007 Q3 Adjusted Actual	0.01	0.042	0.008	0.014	0.019
2007 Q4 Adjusted Mean Estimate	0.01	0.038	0.009	0.015	0.020
2007 Q4 Adjusted Actual	0.01	0.071	0.008	0.014	0.019

Condensed Summary Statistics for Adjusted Mean Estimate and Adjusted Actual Values:

Summary Statistics	Mean	Std. Deviation	First Quartile	Median	Third Quartile
3 Quarters Prior Mean Estimate	0.012	0.023	0.007	0.014	0.021
3 Quarters Prior Actual	0.010	0.057	0.006	0.013	0.020
2 Quarters Prior Mean Estimate	0.012	0.034	0.008	0.015	0.023
2 Quarters Prior Actual	0.010	0.047	0.007	0.015	0.022
1 Quarter Prior Mean Estimate	0.009	0.046	0.008	0.014	0.021
1 Quarter Prior Actual	0.003	0.186	0.007	0.014	0.020
Recession in this Quarter Mean Estimate	0.006	0.069	0.008	0.015	0.021
Recession in this Quarter Actual	-0.004	0.157	0.006	0.014	0.020

Summary Statistics for Quarterly Difference between Adjusted Mean Estimate and Adjusted Actual Value:

Summary Statistics For Difference	Mean	Std. Deviation	First Quartile	Median	Third Quartile
1989 Q3	1.167%	0.108	-0.074%	0.090%	0.525
1989 Q4	0.777	0.049	-0.118	0.066	0.594
1990 Q1	1.653	0.351	-0.099	0.063	0.471
1990 Q2	2.729	0.275	-0.100	0.071	0.484
2000 Q2	0.008	0.012	-0.146	-0.034	0.037
2000 Q3	0.195	0.021	-0.127	-0.022	0.090
2000 Q4	0.433	0.038	-0.093	0.000	0.118
2001 Q1	0.373	0.039	-0.104	0.000	0.193
2007 Q1	0.027	0.006	-0.140	-0.022	0.109
2007 Q2	-0.021	0.006	-0.140	-0.022	0.109
2007 Q3	0.207	0.024	-0.160	-0.034	0.091
2007 Q4	0.558	0.053	-0.159	-0.015	0.200

Summary Statistics for Condensed Difference between Adjusted Mean Estimate and Adjusted Actual Value:

Summary Statistics	Mean	Std. Deviation	First Quartile	Median	Third Quartile
3 Quarters Prior Difference	0.281%	0.053	-0.001	0.000	0.001
2 Quarters Prior Difference	0.246	0.030	-0.001	0.000	0.002
1 Quarter Prior Difference	0.627	0.171	-0.001	0.000	0.002
Recession in this Quarter Difference	0.985	0.138	-0.001	0.000	0.003

Note: Mean, Median and Quartiles are shown as percentage of stock price
Note: Highlighted Rows indicate Start of recession

Appendix B: Regression Results

Quarterly Regressions:

Dependant Variable	Independent Variable	Intercept	Slope	ROOT MSE	R-Squared
Quarter 3 1989 Mean Estimate	Quarter 3 1989 Actual	0.021	0.042	0.016	8%
		(0.01)	*(0.01)*		
Quarter 4 1989 Mean Estimate	Quarter 4 1989 Actual	0.017	0.346	0.017	69%
		(0.00)	*(0.01)*		
Quarter 1 1990 Mean Estimate	Quarter 1 1990 Actual	0.019	0.052	0.023	42%
		(0.00)	*(0.00)*		
Quarter 2 1990 Mean Estimate	Quarter 2 1990 Actual	0.022	0.035	0.037	7%
		(0.00)	*(0.00)*		
Quarter 2 2000 Mean Estimate	Quarter 2 2000 Actual	0.001	0.925	0.012	83%
		(0.00)	*(0.01)*		
Quarter 3 2000 Mean Estimate	Quarter 3 2000 Actual	0.003	0.706	0.02	80%
		(0.00)	*(0.01)*		
Quarter 4 2000 Mean Estimate	Quarter 4 2000 Actual	0.003	0.706	0.03	77%
		(0.00)	*(0.01)*		
Quarter 1 2001 Mean Estimate	Quarter 1 2001 Actual	0.001	0.925	0.037	86%
		(0.00)	*(0.01)*		
Quarter 1 2007 Mean Estimate	Quarter 1 2007 Actual	0.001	0.899	0.006	84%
		(0.00)	*(0.01)*		
Quarter 2 2007 Mean Estimate	Quarter 2 2007 Actual	0.006	0.511	0.014	39%
		(0.00)	*(0.02)*		
Quarter 3 2007 Mean Estimate	Quarter 3 2007 Actual	0.006	0.556	0.015	72%
		(0.00)	*(0.01)*		
Quarter 4 2007 Mean Estimate	Quarter 4 2007 Actual	0.009	0.357	0.028	45%
		(0.00)	*(0.01)*		

Condensed Regressions:

Dependant Variable	Independent Variable	Intercept	Slope	ROOT MSE	R-Squared
3 Quarters Prior Mean Estimate	**3 Quarters Prior Actual**	0.011	0.155	0.021	15%
		(0.00)	*(0.01)*		
2 Quarters Prior Mean Estimate	**2 Quarters Prior Actual**	0.007	0.557	0.021	61%
		(0.00)	*(0.01)*		
1 Quarter Prior Mean Estimate	**1 Quarters Prior Actual**	0.009	0.108	0.041	19%
		(0.00)	*(0.00)*		
Recession in this Quarter Mean Estimate	**Recession in this Quarter Actual**	0.007	0.209	0.061	22%
		(0.00)	*(0.01)*		

Appendix C: Difference in Means Testing

Difference in Means Each Quarter:

Difference In Means Testing	Average Difference	Difference In Means	Combined Standard	Predicted Sign	T-Statistic
1989 Q3	0.012				
1989 Q4	0.008	-0.004	0.012	n/a	-0.34
1990 Q1	0.017	0.009	0.015	n/a	0.60
1990 Q2	0.027	0.011	0.009	-	1.20
2000 Q2	8.207E-05				
2000 Q3	0.002	0.002	0.001	n/a	**1.71**
2000 Q4	0.004	0.002	0.001	n/a	**1.73**
2001 Q1	0.004	-0.001	0.001	-	-0.61
2007 Q1	2.653E-04				
2007 Q2	-2.101E-04	0.000	0.001	n/a	-0.63
2007 Q3	0.002	0.002	0.001	n/a	1.55
2007 Q4	0.006	0.004	0.001	-	**2.60***

Condensed:

Difference In Mean Testing	Average Difference	Difference In Means	Combined Standard	Predicted Sign	T-Statistic	Variance
3 Quarters Prior	0.003					0.003
2 Quarters Prior	0.002	0.000	0.001	n/a	-0.37	0.001
1 Quarter Prior	0.006	0.004	0.003	n/a	1.41	0.029
Recession in this Quarter	0.010	0.004	0.003	-	1.04	0.019

Note: Highlighted rows indicate the start of a recession
Note: Bolded t-statistics are significant at 10% level, "*" indicates that it is significant at the 5%.

Appendix D: Difference in Beta Testing

Intercept:

Difference In Intercept	Intercept	Intercept Std. Error	Difference In Intercept	Combined Standard	Predicted Sign	T-Statistic
1989 Q3	0.021	5.369E-04				
1989 Q4	0.017	5.521E-04	-0.004	0.001	n/a	**-5.69**
1990 Q1	0.019	7.488E-04	0.002	0.001	n/a	**2.24**
1990 Q2	0.022	1.209E-03	0.003	0.001	-	**2.10**
2000 Q2	0.001	3.213E-04				
2000 Q3	0.003	5.057E-04	0.002	0.001	n/a	**3.38**
2000 Q4	0.003	7.617E-04	0.001	0.001	n/a	0.58
2001 Q1	0.002	9.304E-04	-0.001	0.001	-	-1.07
2007 Q1	0.001	1.816E-04				
2007 Q2	0.006	4.124E-04	0.004	4.506E-04	n/a	**9.96**
2007 Q3	0.006	3.780E-04	3.499E-04	0.001	n/a	0.63
2007 Q4	0.009	7.097E-04	0.003	0.001	-	**3.49**

Condensed:

Difference In Intercept	Intercept	Intercept Std. Error	Difference In Intercept	Combined Standard	Predicted Sign	T-Statistic
3 Quarters Prior	0.011	3.346E-04				
2 Quarters Prior	0.007	3.384E-04	-0.004	0.000	n/a	**-8.56**
1 Quarter Prior	0.009	6.434E-04	0.002	0.001	n/a	**2.51**
Recession in this Quarter	0.007	9.564E-04	-0.002	0.001	-	**-1.87**

Note: Highlighted rows indicate the start of a recession
Note: Bolded t-statistics are significant at 10% level, "*" indicates that it is significant at the 5%.

Slope:

Difference In Slope	Slope	Slope Std. Error	Difference in Slope	Combined Standard Error	Predicted Sign	T-Statistic
1989 Q3	0.042	4.786E-03				
1989 Q4	0.346	7.625E-03	0.304	0.009	n/a	**33.74**
1990 Q1	0.052	2.024E-03	-0.294	0.008	n/a	**-37.21**
1990 Q2	0.035	4.280E-03	-0.017	0.005	-	**-3.66**
2000 Q2	0.925	1.050E-02				
2000 Q3	0.845	1.064E-02	-0.080	0.015	n/a	**-5.37**
2000 Q4	0.706	9.705E-03	-0.139	0.014	n/a	-9.65
2001 Q1	0.868	8.763E-03	0.163	0.013	-	12.44
2007 Q1	0.899	1.005E-02				
2007 Q2	0.511	1.628E-02	-0.388	1.913E-02	n/a	**-20.26**
2007 Q3	0.556	8.821E-03	4.440E-02	0.019	n/a	2.40
2007 Q4	0.357	1.001E-02	-0.199	0.013	-	**-14.91**

Condensed:

Difference In Slope	Slope	Slope Std. Error	Difference in Slope	Combined Standard Error	Predicted Sign	T-Statistic
3 Quarters Prior	0.155	5.742E-03				
2 Quarters Prior	0.557	7.005E-03	0.402	0.009	n/a	**44.39**
1 Quarter Prior	0.108	3.461E-03	-0.449	0.008	-	**-57.51**
Recession in this Quarter	0.209	6.090E-03	0.101	0.007	-	**14.40**

Note: Highlighted rows indicate the start of a recession
Note: Bolded t-statistics are significant at 10% level, "*" indicates that it is significant at the 5%.

Appendix E: Analyzing Trends in Standard Error of Regressions

All Quarterly Changes:

Time Period	Regression Std. Error	Predicted Sign	Percentage Change
1989 Q3	0.016		
1989 Q4	0.017	n/a	0.014
1990 Q1	0.023	+	0.381
1990 Q2	0.037	+	0.615
2000 Q2	0.012		
2000 Q3	0.020	n/a	0.650
2000 Q4	0.030	+	0.517
2001 Q1	0.037	+	0.214
2007 Q1	0.006		
2007 Q2	0.014	n/a	1.318
2007 Q3	0.015	+	1.949E-02
2007 Q4	0.028	+	0.914

Condensed Changes:

Time Period	Regression Std. Error	Predicted Sign	Percentage Change
3 Quarters Prior	0.021		
2 Quarters Prior	0.021	n/a	0.003
1 Quarter Prior	0.041	+	0.943
Recession in this Quarter	0.061	+	0.486