

# Coexistence and Dynamics of Overconfidence and Strategic Incentives\*

Katrien Bosquet<sup>†</sup>     Peter de Goeij<sup>‡</sup>     Kristien Smedts<sup>§</sup>

## Abstract

We present a two-stage model for the decision making process of financial analysts when issuing earnings forecasts. In the first stage, financial analysts perform a fundamental analysis in which they are prone to a behavioral bias. In the second stage analysts can adjust their earnings forecast in line with their strategic incentives. The paper analyzes this decision process throughout the forecasting period and explains the underlying drivers. Using quarterly earnings forecasts, we document that financial analysts overweight their private information throughout the entire forecasting period. At the same time, financial analysts behave strategically. They issue initial optimistic forecasts by strategically inflating their forecast. In their last revision, they become pessimistic and strategically deflate their earnings forecast, which creates the possibility of a positive earnings surprise. This analysis of the dynamics of the decision process provides empirical evidence on the coexistence of overconfidence and strategic incentives.

Keywords: Financial analysts, Earnings Forecasts, Overconfidence, Conflicts of interest.

JEL-classifications: G14; G17; G24

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<sup>†</sup>Catholic University of Leuven, AFI, Naamsestraat 69, 3000 Leuven, Belgium. Email: katrien.bosquet@econ.kuleuven.be, tel: (+) 32 (0)16 326675, fax: (+) 32 (0)16 326732.

<sup>‡</sup>CentER, TILEC, Tilburg University, Department of Finance, P.O. Box 90153, 5000LE Tilburg, The Netherlands. Email: p.c.degoeij@tilburguniversity.nl, phone: (+) 31 (0)13 4662083, fax: (+) 31 (0)13 4662875.

<sup>§</sup>Catholic University of Leuven, AFI, Naamsestraat 69, 3000 Leuven, Belgium. Email: kristien.smedts@econ.kuleuven.be, tel: (+) 32 (0)16 326739, fax: (+) 32 (0)16 326732.

# 1 Introduction

Studies of financial markets make assumptions concerning the behavior and decision process of market participants. The efficient market hypothesis (EMH) postulates that all agents are rational and value each security for its fundamental value. To the extent that agents are not rational, the EMH assumes that deviations from rational behavior are random or when they are systematic, they are met in the market by rational arbitrageurs who eliminate any mispricing. More recently, behavioral finance has emerged as an alternative view on financial markets. The behavioral finance theory rests on the argument of limited arbitrage to argue that systematic deviations from efficiency are expected to persist (Shleifer, 2000). This debate between the neoclassical-based and behaviorally based finance theory centers on the assumptions about the judgements, preferences, and decision of participants in financial markets. These assumptions about market participants pertain to, amongst others, the character of earnings forecasts (Shleifer, 2008).

Financial analysts are an important source of information to the stock market in the valuation of firms (Schipper, 1991). These analysts assimilate and process publicly available information, acquire private information and disseminate new information by issuing earnings forecasts and recommendations. It is, however, well documented that financial analysts' earnings forecasts systematically deviate from the rational decision process (De Bondt and Thaler, 1990; Abarbanell, 1991; Brown, 1997; Easterwood and Nutt, 1999) and different explanations are put forward for these forecast inefficiencies. Broadly speaking, these systematic deviations from rationality in the decision making process can be assigned to a behavioral bias or a strategic bias (Friesen and Weller, 2006). This paper focuses on the characteristics of the decision making process of real-world financial analysts in issuing earnings forecasts.

The literature analyzing analysts' decision process is quite elaborate. Nonetheless, Ramnath et al. (2008) conclude that much of the analysts' decision process remains hidden in a black box. Recent studies analyzing the recommendations or earnings forecasts of financial analysts often focus on either the behavioral bias (see e.g. Barber and Odean, 2001 and Hilary and Menzly, 2006) or the strategic bias (see e.g. Dugar

and Nathan, 1995 and Ljungqvist et al., 2007), or put the behavioral opposed to the strategic bias, suggesting that only one of them can be present (see e.g. Chen and Jiang, 2006). However, the question whether both coexist in the analyst's decision process has yet to be answered. Therefore, this paper develops a two stage model for the decision making process of financial analysts allowing for the coexistence of a behavioral bias and a strategic bias. In the first stage of the model, financial analysts perform a fundamental analysis in which they combine public and private information to form their earnings forecast. During this first stage, analysts can be affected by a behavioral bias of which they are unaware. Once the fundamental analysis is complete, a financial analyst can, in the second stage, consciously determine to deflate or inflate his forecast because of strategic reasons. The model provides a clear separation and identification of both biases and allows us to provide empirical evidence that behavioral biases and strategic incentives coexist.

The best known behavioral bias is overconfidence. In the context of the financial market, which is characterized by a high degree of difficulty, low predictability and slow, noisy feedback, this bias is highly relevant (Fischhoff et al., 1977). An overconfident financial analyst believes his personal assessment of the security's value is more accurate than the assessments of others (Barber and Odean, 2001). Additionally, financial analysts are confronted with several conflicts of interest. On the one hand, financial analysts want to provide investors with accurate earnings forecasts. On the other hand, they are persuaded to please the management of the firms they cover and increase their compensation in terms of trading commissions, which can lead them to strategically change their forecast. To increase the revenues of their brokerage house through investment banking business (see e.g. Ljungqvist et al., 2007) or obtain additional information concerning the covered stock (see e.g. Chen and Matsumoto, 2006) financial analysts are inclined to please the management of the firms they cover. Richardson et al (2004) show that management prefers high market expectations after an earnings announcement but beatable targets before in order to sell their own stock on favorable terms. Their findings suggest that, in order to please management, financial analysts should be optimistic just after the earnings announcement, but pessimistic just before the next earnings announcement. To determine whether the strategic behavior of financial ana-

lysts is in line with this management pleasing behavior, this paper performs an analysis of the dynamics of the decision process by investigating the strategic behavior of analysts throughout the forecasting period. To our knowledge, we are the first to pursue an in depth analysis of the decision process over time. We compare the results of our two stage model applied to the first quarterly earnings forecasts as well as to the last quarterly earnings forecast revisions and confirm this pleasing behavior. We provide empirical evidence that financial analysts strategically inflate their initial forecast by about 3%, but deflate their forecast in their final revision by approximately 5%. At the same time financial analysts engage in static overconfidence by overweighting their private information with roughly 3% throughout the entire forecasting period.

The remainder of this paper is organized as follows. Section 2 elaborates on the decision making process. Section 3 presents the empirical model and the selected data. Section 4 discusses some descriptives on the data and section 5 discusses the estimation results. Next, section 6 provides some robustness checks. Finally, section 7 concludes.

## 2 The Two-Stage Model

In this section we introduce a two-stage model for financial analysts' decision making process when making their earnings forecasts. In the first stage, financial analysts perform an initial analysis in which they combine public and private information into an earnings forecast. The assimilation of this public and private information is modelled as a Bayesian expectation formation, similar to the model of Chen and Jiang (2006). Following Gervais and Odean (2001) and Chen and Jiang (2006),  $a$  is defined as the announced earnings of a firm, which follows a diffuse zero-mean normal distribution;  $c$  is defined as a statistic for all *public* information about  $a$ :

$$\begin{aligned}
 c &= a + \varepsilon_c \\
 \varepsilon_c &\sim N\left(0, \frac{1}{p_c}\right)
 \end{aligned}
 \tag{1}$$

with  $p_c$  the precision of the public signal. Next, let  $x$  be the analyst's *private* information about  $a$  :

$$\begin{aligned} x &= a + \varepsilon_x \\ \varepsilon_x &\sim N\left(0, \frac{1}{p_x}\right). \end{aligned} \tag{2}$$

with  $p_x$  the precision of the analyst's private signal and  $\varepsilon_x$  independent from  $\varepsilon_c$ . The analyst's best conditional forecast of the actual earnings ( $a$ ) given his private information ( $x$ ) and his public information ( $c$ ), using Bayes' rule, is as follows:

$$E[a | x, c] = hx + (1 - h)c \tag{3}$$

where  $h \cong \frac{p_x}{p_x + p_c} \in [0, 1]$  is the precision of analyst's private signal relative to public information.

When an analyst interprets and weights publicly available information and private information, he may be unconsciously influenced by a behavioral bias. This could lead him to use a personal weighting scheme, that deviates from the correct rational scheme, and come up with a first stage earnings forecast  $F$ :

$$F = kx + (1 - k)c \tag{4}$$

with  $k \in [0, 1]$  the actual weight the analyst places on his private signal.

In the second stage, after the fundamental assessment of the company's earnings, strategic incentives might induce the analyst to alter his forecast. Conflicts of interest may persuade the analyst to inflate or deflate his first assessment:

$$f = sF = s[kx + (1 - k)c] = skx + (s - sk)c \tag{5}$$

with  $f$  the earnings forecast issued by the financial analyst and observed by the public. The strategic incentives are modeled by introducing a multiplicative factor  $s \in [0, +\infty)$ . As analysts are more likely to provide forecasts for stocks for which their true expectations are favorable and are reluctant to issue unfavorable investment information (McNichols and O'Brian, 1997), it is reasonable to assume that  $s \in [0, +\infty)$ .

This two stage model identifies the behavioral bias and the strategic bias in two

separate factors. The weighting factor  $\frac{k}{h}$  is the ratio of the personal weight to the rational weight, put on private information. This captures the behavioral bias. If financial analysts are rational agents, the weighting factor  $\frac{k}{h} = 1$ . Any significant deviation of  $\frac{k}{h}$  from 1 is defined as a behavioral bias. In accordance with Daniel et al. (1998), we define an overconfident analyst as one who overestimates the precision of his private information signal. An analyst who overweights his private information is characterized by  $\frac{k}{h} > 1$ . When an analyst engages in herding behavior and underweights his private information,  $\frac{k}{h} < 1$ . Note that we do not make any statements about  $k$  or  $h$  itself. Only the ratio  $\frac{k}{h}$  is identified and for our purposes it is sufficient. The multiplicative factor  $s$  identifies the strategic bias in an analyst's decision making process. An analyst only striving for the most accurate forecast should have  $s = 1$ . A significant deviation of  $s$  from 1 is a result of the analyst acting on a conflict of interest.  $s > 1$  corresponds to an inflation of the earnings forecast while  $s < 1$  implies a deflation of the earnings forecast.

We are interested in estimates of  $\frac{k}{h}$  and  $s$  for drawing conclusions on behavioral biases and strategic incentives, but they can not be directly estimated. Therefore, we use a reduced form estimation equation. With  $f$  the analyst's expectation about the actual earnings, the expected forecast error is defined as:

$$\begin{aligned} E[(f - a) | x, c] &\cong E[FE | x, c] = skx + (s - sk)c - hx - (1 - h)c \\ &= \frac{h}{k}c - \frac{h}{sk}f + (f - c) \end{aligned} \quad (6)$$

Rearranging allows for a clear identification of both behavioral and strategic biases affecting an analyst's forecast and forecast error:

$$E[FE | x, c] = \left(1 - \frac{h}{k}\right)(f - c) + \frac{h}{k} \left(\frac{s - 1}{s}\right) f \quad (7)$$

Applying a first-order Taylor approximation to both coefficients in equation (7) around  $\frac{k}{h} = 1$  and  $s = 1$ , the reduced form estimation equation is transformed into:

$$\begin{aligned} E[FE | x, c] &= \left(\frac{k}{h} - 1\right)(f - c) + (s - 1)f \\ &= \beta(f - c) + \gamma f \end{aligned} \quad (8)$$

allowing a clear separation of the behavioral and strategic bias in  $\beta$  and  $\gamma$  respectively.

Consequently,  $\beta$  and  $\gamma$  can be estimated and used to determine  $\widehat{\frac{k}{h}}$  and  $\widehat{s}$ , as  $\widehat{\frac{k}{h}} = \widehat{\beta} + 1$  and  $\widehat{s} = \widehat{\gamma} + 1$ .

### 3 The Empirical Model

To test the coexistence of a behavioral bias and strategic incentives, the reduced form equation (8) is estimated with following empirical model:

$$FE_{ikt} = \alpha + \beta Dev_{ikt} + \gamma f_{ikt} + \delta_i X_{ikt} + \varepsilon_{ikt} \quad (9)$$

with  $i$  an analyst identifier (who issues the forecast),  $k$  a company identifier (on which company a forecast is issued) and  $t$  a time identifier (to which quarter the forecast pertains).  $FE_{ikt} = f_{ikt} - a_{kt}$  is the forecast error made by the individual analyst  $i$  for quarter  $t$  for company  $k$ , calculated as the difference between the forecasted  $f_{ikt}$  and actual  $a_{kt}$  earnings per share.  $Dev_{ikt} = f_{ikt} - c_{k\tau}$  is the deviation from the consensus and is determined as the difference between the analyst's forecast  $f_{ikt}$  and the consensus forecast  $c_{k\tau}$  concerning the earnings per share. The consensus forecast proxies for available public information up to the point in time an analyst issues his forecast. This consensus forecast at time  $\tau$  (within the quarter) is calculated as the mean of all the analysts' estimates up to  $\tau$ , excluding the estimate of the analyst  $i$ , who makes his estimate for quarter  $t$  (analogous to Chen and Jiang, 2006 and Zitzewitz, 2001). The forecast error, the deviation from consensus as well as the forecast the analyst makes are deflated by the share price. Following Clement (1999), size of the covered firm ( $Size_{kt}$ ), general ( $TotExp_{it}$ ) and firm specific experience ( $FirmExp_{ikt}$ ), two measures of task complexity ( $FirmCompl_{it}$  and  $IndCompl_{it}$ ) and forecast age ( $Age_{ikt}$ ) are added as control variables ( $X_{ikt}$ )<sup>1</sup>. A full description of all variables and their summary statistics can be found in Table 6 in the Appendix. More information on the estimation technique for equation (9) can be found in Section 5.1.

Analysts' quarterly earnings forecasts and stock price data are obtained from the Institutional Broker Estimate System (I/B/E/S) database, part of Thomson Financial. The earnings forecasts cover the period 1996 until 2006. The database is restricted to

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<sup>1</sup>Performing the analysis without any control variables leads to similar empirical results and the same conclusions.

highly covered United States companies with fiscal year end December. High coverage is ensured by demanding a minimum average coverage of three analysts, and deleting firms which have an average market capitalization below \$100 million, an average market price below \$5, or a market price below \$1. Furthermore, the dataset is stripped from errors and potential companies in difficulties. As quarterly filings must be with the SEC within 45 days subsequent to the end of a quarter, observations of companies, reporting later than 45 days after the last day of the end of the quarter, are eliminated. For a uniform interpretation of the strategic factor ( $s$ ) we split up the the data into negative and nonnegative earnings forecasts. To truthfully examine the decisions of analysts, we wish to maintain those forecasts for which analysts have put in all of their effort. Hayes (1998) concludes that the incentive to gather information is most intense for stocks that are anticipated to give strong performance. McNichols and O'Brian (1997) indicate that analysts drop stocks with unfavorable future prospects. Therefore, we drop negative earnings forecasts, ensuring a sample of forecasts with maximum effort and processing of information. Additionally, the behavioral process as well as the incentives can differ for negative and positive forecasts<sup>2</sup>.

Financial analysts issue an earnings forecast for a certain company in a certain quarter, but they can make a revision during this quarter. Pursuing an in depth analysis of the decision process throughout the forecasting period, we compare first forecasts with last revisions. Consequently two data sets are created, one where only the first forecast is kept and one where only the last revision is kept. The First Forecast sample contains 322,123 earnings forecasts, issued by 6,736 analysts on 2,773 companies. The Last Revision sample contains 60,047 earnings forecasts, issued by 4,148 analysts on 747 companies. The presence of forecast revisions provides a measure of how closely analysts follow the stock that they cover (Green et al., 2007). Therefore, the difference in sample size suggests that many analysts focus mainly on a few companies, only issuing revisions for those.

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<sup>2</sup>Deleting negative forecasts implies a reduction of the dataset of 11% from 362,040 to 322,123 quarterly forecasts in the First Forecast sample. Deleting negative forecasts implies a reduction of the dataset of 12% from 68,270 to 60,047 quarterly forecasts in the Last Revision sample. A sample of only positive forecasts still implies a symmetric loss function of forecast errors.

## 4 Data Descriptives

When analyzing the strategic behavior of financial analysts it is imperative to understand what it is that pleases the management of a firm. Richardson et al. (2004) suggest that management wishes to sell stock on favorable terms after an earnings announcement. Since the 1990's firms' management is often compensated by stock options inducing an increased interest in the stock price. In this context, management prefers high market expectations after an earnings announcement but beatable targets before an earnings announcement. The reason is that there is an asymmetric response to earnings surprises. Skinner and Sloan (2002) find that the average response to negative earnings surprises is significantly larger in magnitude than the average response to positive earnings surprises. Bartov et al. (2000) show that firms which manage to beat or meet their earnings expectations enjoy an average quarterly return that is almost 3% higher. These empirical findings suggest that, in order to please management, financial analysts should be optimistic just after the earnings announcement, but be pessimistic just before the next earnings announcement. We evaluate these dynamics of the decision process by investigating the strategic behavior of analysts throughout the forecasting period.

This in depth analysis of the decision process throughout the forecasting period requires the comparison of the first forecasts to the last revisions. In Figure 1 we descriptively make this comparison. Both the first forecast and the last revision are evaluated against the actual reported earnings. This forecast error (FE), the difference between the forecast and the actual earnings, has an intuitive interpretation. A positive forecast error reflects optimistic behavior while a negative forecast error is defined as pessimism. The graph of the FE for the First and Last Revision sample not only allows for a comparison of the two, but at the same time evaluates optimism or pessimism.

The majority of past empirical studies finds systematic analyst optimism (see e.g. O'Brian, 1988 and Abarbanell, 1991). It is only recently that researchers document systematic analyst forecast pessimism (see e.g. Brown, 2001 and Richardson et al., 2004). Brown (2001) shows that the mean earnings surprise, which is the difference between the analyst's forecasted earnings and the actual announced earnings, has shifted

from small positive to small negative during the 16 years of 1984 until 1999.

Figure 1 provides an overview of the quarterly and yearly average forecast error over time for the First Forecast sample as well as for the Last Revision sample. The yearly figures show that, in the First Forecast sample, average optimism turns into average pessimism after 2002. Analysts become less optimistic around 1999 and even pessimistic after 2002. This is in line with economic events such as the burst of the dot-com bubble and the introduction of new analyst regulation in 2002 as a reaction to a series of accounting scandals. The Last Revision sample shows that the yearly and quarterly average forecast errors are almost consistently negative, implying that financial analysts are pessimistic when issuing their final revision. These preliminary descriptives are in line with findings of Markov and Tan (2006), who indicate that analysts have incentives to systematically underpredict earnings. Underpredicted earnings set beatable targets for firms' management, allowing for a positive earnings surprise which has been shown to have a positive impact on the market price. More importantly, both the yearly and quarterly averages of the forecast error show that the last revision of financial analysts is always more negative than the first forecast. These descriptives are consistent with Richardson et. al. (2004), who suggest that analysts tend to issue optimistic forecasts early and slightly pessimistic forecasts later in the forecast period.

The descriptives already suggest that financial analysts are, in some periods of time more than others, optimistic in their initial forecast. Their last revision, on the contrary, is systematically pessimistic and additionally consistently more negative than their initial forecast. These preliminary findings are consistent with management pleasing behavior. In the next section, we take a closer look at the decision process and analyze the underlying drivers throughout the forecasting period.

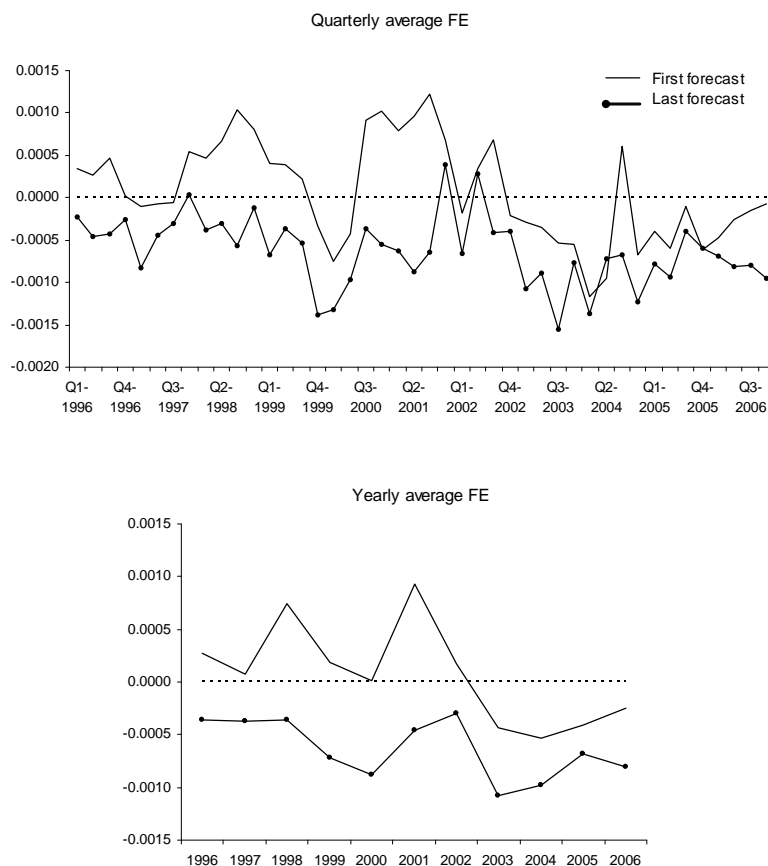
## **5 Empirical Results**

### **5.1 Main Findings**

Both data sets contain financial analysts' earnings forecasts for a particular stock at a certain point in time. This three way panel possibly contains unobserved effects such as analyst, time, firm and industry effects. To control for these unobserved effects,

Figure 1: **Average FE of First Forecast and Last Revision**

The first graph shows the quarterly average FE for the First Forecast and the Last Revision over time. The second graph shows the yearly average FE for the First Forecast and the Last Revision over time. The time period covers 1996 until 2006.



Petersen (2008) argues that OLS with clustered standard errors (if necessary multi-way) is the best estimation method. Comparing clustered standard errors, in each dimension or multiple dimensions, with White standard errors, we conclude that standard errors clustered by business group are sufficient<sup>3</sup>. Moreover a firm fixed effects estimation is used. The reason is not only to allow for a more efficient estimation of parameters but also to control for a possible endogeneity issue. Several studies document the presence of earnings management in firms (see e.g. Healy and Wahlen, 1999 and Matsumoto, 2002). When a forecast ends up below the actual reported earnings this can be attributed to

<sup>3</sup>Using the proprietary classification scheme of Thomson Financial to categorize companies into homogenous groups according to business lines, results into 211 clusters. This group classification allows for a sufficient number of clusters, which is necessary to obtain unbiased standard errors (see Thompson, 2006 and Petersen, 2008).

earnings management by the firm covered or by strategic deflation by the analyst. A firm fixed effects estimation eliminates this endogeneity issue. Consequently, to estimate equation (9) we use firm fixed effects with clustered standard errors by 211 business groups<sup>4</sup>. Table 1 presents estimation results on the weighting factor  $\widehat{\frac{k}{h}}$  and the strategic factor  $\widehat{s}$ . These estimates are obtained from the reduced form estimation equation (9), whose full estimation results can be found in Table 7 in the Appendix.

Table 1: **Estimation Results**

This table presents estimation results for the weighting factor  $\frac{k}{h}$  and the strategic factor  $s$ . These factors are extracted from the reduced form estimation equation (9). The delta method is used to obtain standard errors. For both factors the two sided hypothesis test whether they are significantly different from 1 is performed. \*, \*\*, \*\*\* indicate significance at the 10%, 5% and 1% level, respectively.

	First Forecast				Last Revision			
	Coeff.	SE	t-value		Coeff.	SE	t-value	
$\widehat{\frac{k}{h}}$	1.025	0.0060	4.17	***	1.028	0.0064	4.29	***
$\widehat{s}$	1.029	0.0150	2.13	**	0.952	0.0157	-3.02	***
No. Obs.	322,123				60,047			

Our two stage model identifies a weighting factor  $\frac{k}{h}$  and a strategic factor  $s$ . Formulating estimates and standard errors on the two factors allows us to determine their significance and compare the behavioral and strategic bias in magnitude. The weighting factor  $\widehat{\frac{k}{h}}$  is significantly larger than 1 at the 1% level for both the First Forecast and the Last Revision sample. Following the definition of Daniel et. al. (1998), we interpret this overweighting as overconfidence. Financial analysts overweight the precision of their private information by about 3% throughout the forecasting period. The strategic factor  $\widehat{s}$  is significantly different from 1 in the First Forecast sample and the Last Revision sample. However, for the initial forecast we find an  $\widehat{s}$  larger than 1 while for the last revision this  $\widehat{s}$  is smaller than 1. Financial analysts strategically inflate their initial forecast by roughly 3% while they strategically deflate their final revision by approximately 5%.

We conclude that financial analysts remain overconfident about the precision of their private information throughout the forecasting period. This is in line with the assumption of an unconscious behavioral bias. At the same time analysts behave strategically,

<sup>4</sup> Adding quarter dummies for a possible fixed time effect or adding industry dummies for a possible fixed industry effect leads to similar results. All conclusions remain the same.

in a fashion which is in line with management pleasing. Additionally, the size of the behavioral bias is slightly smaller than the strategic alteration, suggesting that strategic incentives are economically more relevant. To maximize their own compensation, often consisting out of stock options, management of a firm prefers optimistic forecasts after an earnings announcement and beatable targets just before an earnings announcement. Our empirical results confirm that financial analysts deliberately inflate their initial forecast while they consciously deflate their last revision. An initially inflated optimistic forecast stimulates buying behavior among investors, possibly pushing up the stock price and potentially making it an ideal moment for the management to sell their stock. A deflated forecast just before the announcement date creates beatable targets for management which can enjoy a higher return on their stock due to a favorable market reaction to the positive earnings surprise.

Financial analysts thus engage in management pleasing behavior for strategic purposes. Pleasing management leads to more investment banking business and additional stock information. Several studies document how analysts alter their forecast in order to please management. The majority of existing empirical studies has found systematic analyst optimism relative to actual earnings outcomes (see for example O'Brian, 1988 and Abarbanell, 1991). In line with optimism, many studies find a strategic inflation of the forecast to please management. Chen and Matsumoto (2006) find that managers provide more information to analysts with more favorable stock recommendations and Francis and Philbrick (1993) confirm that financial analysts report more optimistic earnings forecasts to please the management of the firms they cover. Dugar and Nathan (1995) show that financial analysts of brokerage firms, that provide investment banking services to a company, are optimistic, relative to other analysts, in their earnings forecasts and investment recommendations. It is only recently that researchers document systematic analyst forecast pessimism relative to actual quarterly earnings (see e.g. Brown, 2001 and Richardson et al., 2004). Consequently, several explanations in terms of strategic deflation of earnings forecasts have been put forward. Malmendier and Shanthikumar (2007) find that analysts with conflicting interests may distort recommendations upwards to trigger small-investor purchases and to please management, while they may distort earnings forecasts downwards shortly before the announcement,

to allow management to beat the forecast. Markov and Tan (2006) also indicate that analysts have incentives to systematically underpredict earnings. When the expected earnings are at a lower level, they are kept beatable and they ensure a positive earnings surprise when the actual earnings are reported. Recent research by Richardson et al. (2004) shows that management prefers optimistic earnings after an earnings announcement but beatable targets just before the next earnings announcement. Both investment banking business as well as analysts' dependence on management for future information, can be used to pressure analysts to engage in this pleasing behavior. Our empirical results of an initial inflated forecast and a deflated revision is in line with Richardson et al. (2004).

This change we find in strategic behavior from inflation to deflation can be attributed to two main possible underlying causes. On the one hand financial analysts bow to management pressure and therefore alter their forecast. On the other hand, management of covered firms engage in earnings guidance, releasing specific amounts and content of information and consequently guide financial analysts to the desired earnings level.

While analysts are overconfident throughout the forecasting period, our empirical results show that the strategic behavior of analysts changes significantly throughout the forecasting period. In the literature of financial analysts, researchers use the first (see e.g. Francis and Philbrick, 1993) or the last (see e.g. Byard and Shaw, 2003) quarterly or annual earnings forecast, often on a non-motivated basis. Our empirical findings indicate that analysts' decision making differs in the first forecast or the last. The choice of the first or last forecast is therefore not innocent. Depending on the purpose of a study the first or last forecast might be more appropriate (or both as a robustness).

## **5.2 Closely Monitored Stocks**

The First Forecast sample contains 322,123 observations while the Last Revision sample only has 60,047 observations. The First Forecast sample contains all initial forecasts. The Last Revision sample then excludes analysts who issue a single forecast in a given quarter on a particular company, and only contains the revisions of analysts who update

their initial forecasts within that quarter<sup>5</sup>. Examining both samples more closely, it becomes clear that the difference in size is due to a significantly smaller amount of companies being followed in the Last Revision sample. In the First Forecast sample analysts cover 2,773 companies while in the Last Revision sample analysts only cover 747 companies. These differences indicate that the majority of analysts follows a limited number of stocks closely, while they keep track of other companies in a more superficial manner. These closely monitored companies get initial forecasts and revisions while the other companies only get one forecast.

The presence of forecast revisions provides a measure of how closely analysts follow the stock that they cover (Green et al., 2007). One can argue that the behavior towards stocks which are closely monitored is different from the behavior towards stocks which are followed only in a superficial manner. Therefore, it is useful to compare the decision making process of superficially covered stocks to the decision making process of highly monitored stocks. Additionally, studying the dynamics within the forecasting period implies a comparison of first forecasts with last revisions. Until now this analysis implied a comparison between two data samples that differ in size. Comparing the first forecasts to the last revisions of closely monitored stocks allows for a comparison between samples with similar size.

To determine which stocks are closely monitored by an analyst we use the presence of a revision as a selection criterion. The First Forecast sample is segmented into a Single Issue sample and a First of Revision sample. The Single Issue sample contains the forecasts of analysts who issue just one forecast and make no revisions during the quarter. The First of Revision sample contains the first forecast of analysts who issue a revision on the stock during the quarter.

Table 2 shows the estimates of  $\frac{k}{h}$  and  $s$  for the Single Issue sample and the First of Revision sample. These factors are extracted from the reduced form estimation equation (9), whose full estimation results can be found in Table 8 in the Appendix. The results for the Single Issue and First of Revision subsamples allow for a comparison of the decision process with regard to superficially monitored stocks to the decision process of

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<sup>5</sup>I/B/E/S calls up the majority of the analysts asking whether they want to update their forecast. An analyst without a revision has consciously chosen to issue and stick to his first forecast.

closely monitored stocks. For the Single Issue sample, we find that the behavioral bias  $\widehat{\frac{k}{h}}$  is significantly larger than 1 but that the strategic bias  $\widehat{s}$  is not significantly different from 1. When analysts track a firm in a superficial manner and issue only one forecast, they are overconfident but not strategic. Possibly these analysts do not expect to reap any benefits from behaving strategically, and are therefore only behaviorally biased. For the First of Revision sample, both  $\widehat{\frac{k}{h}}$  and  $\widehat{s}$  are significantly larger than 1. The few companies, which are closely monitored by financial analysts, are the companies for which financial analysts engage in strategic behavior, with an inflation of the forecast up to almost 8%. These findings also confirm the model assumptions of an unconscious behavioral bias and a conscious strategic bias.

Table 2: **Subsamples: Single Issue and First of Revision**

This table presents estimation results for the weighting factor  $\frac{k}{h}$  and the strategic factor  $s$ . These factors are extracted from the reduced form estimation equation (9). The delta method is used to obtain standard errors. For both factors the two sided hypothesis test of whether they are significantly different from 1 is performed. \*, \*\*, \*\*\* indicate significance at the 10%, 5% and 1% level, respectively.

	Weighting and Strategic Factor											
	Single Issue				First of Revision			Last Revision				
	Coeff.	SE	t-value		Coeff.	SE	t-value	Coeff.	SE	t-value		
$\widehat{\frac{k}{h}}$	1.026	0.0061	4.30	***	1.024	0.0108	2.20	**	1.028	0.0064	4.29	***
$\widehat{s}$	1.021	0.0152	1.38		1.079	0.0192	4.14	***	0.952	0.0157	-3.02	***
No. Obs.	268,842				53,279			60,047				

Table 2 also shows estimation results of  $\frac{k}{h}$  and  $s$  for the Last Revision sample, which are already mentioned in Table 1. Including the First of Revision sample and the Last Revision sample allows for a comparison between first forecasts and last revisions under similar sample size conditions. The conclusions with respect to the coexistence and dynamics of overconfidence and strategic incentives remain. However, we are aware that the First of Revision sample could be subject to a selection bias. This sample is constructed based on a post-factum event: a revision at the end of the quarter is used as a criterion to select analysts at the beginning of the quarter. Our main goal, however, is to provide sufficient empirical evidence on the coexistence of overconfidence and strategic incentives. Therefore we wish to compare the first forecasts to the last revisions under similar sample size conditions. To address the problem of different sample sizes, without possible selection bias issues, we draw a random sample of 60,047 observations from the First Forecast sample. The results again remain consistent with

previous findings. Estimation results can be found in Table 12 in the Appendix.

### 5.3 The Extended Model

To further investigate the coexistence and dynamics of overconfidence and strategic behavior and the validity of the two-stage model, we investigate the underlying drivers of overweighting ( $\frac{k}{h}$ ) and conflicts of interest ( $s$ ). So far, we illustrate that financial analysts strategically inflate their first forecasts, but deflate their last revisions. Earlier research (see e.g. Dugar and Nathan, 1995 and Ljungqvist, 2007) shows that affiliated analysts engage more in management pleasing. Therefore we add investment banking business (IB) as an underlying driver of  $s$ . We expect affiliated analysts to inflate their initial forecast more severely and deflate their last revision more explicitly. A financial analyst is perceived as affiliated when the brokerage house, he or she works for, assisted as underwriter in a public offering of the company, for which the analyst is following the stock. The window of affiliation is five years (following Chen and Jiang, 2006), centered around the moment the public offering is registered with the SEC. To determine the affiliation of financial analysts, all public offerings done by US companies with a registration date between July 1996 and December 2007 are taken into account. The data related to these offerings are obtained from Westlaw Business, part of Thomson Financial.

Additionally, a financial analyst's compensation is often tied to the trading commissions earned for their brokerage house (see e.g. Groysberg et al., 2008). Therefore, financial analysts are willing to adjust their forecast to raise commission fees and consequently their compensation. Studies such as Chen and Jiang (2006) and Groysberg et al. (2008) suggest that analysts exaggerate information to increase trading volume. The increased volume renders higher trading commissions for the analysts. This exaggeration of information can be translated into both inflation or deflation of the earnings forecast. However, Hong, Lim, and Stein (2000) show that positive news spurs more trading than negative news due to restrictions of short-selling. Therefore we expect a positive relation between trading volume and the strategic component  $s$ . Trading volume is the average daily number of shares traded in the previous quarter multiplied by the average daily price of the previous quarter, and is used to proxy for the commission

incentive. Trading volume data is acquired from CRSP and is expressed in millions of dollars.

Daniel et. al. (1998) show that all agents view themselves as more able to value securities than they actually are. Each analyst is overconfident in the sense that if he receives a signal, he overestimates its precision. Not only this static overconfidence has been investigated but also the dynamics of overconfidence has been studied. Gervais and Odean (2001) illustrate how analysts overestimate their ability after a series of successful forecasts because of a biased learning process. Hilary and Menzly (2006) confirm the dynamics of overconfidence by pointing out that a previous thriving track record leads to more bold forecasts and consequently to more forecast errors. In an attempt to not only provide evidence for the static overconfidence but also for the dynamics, we add a track record variable (TR), defined similarly to the track record variable from Chen and Jiang (2006), as an underlying driver of  $\frac{k}{h}$ .  $TR_{ikt}$  measures the frequency of the analysts' earnings forecast being more accurate than the consensus forecast up until time  $t$  for firm  $k$ .

$$TR_{ikt} = \frac{1}{N_{ikt}} \sum_{j=1}^{N_{ikt}} \text{sign}(|FE\_Cons_{ikj}| - |FE_{ikj}|) \quad (10)$$

where  $N_{ikt}$  is the number of forecasts made by analyst  $i$  on firm  $k$  up to time  $t$  and  $FE\_Cons_{ikj}$  is the forecast error of the consensus, where  $\text{sign}(\cdot)$  is the sign function defined as:

$$\text{sign}(\cdot) = \begin{cases} 1 & \text{if } |FE\_Cons_{ikj}| - |FE_{ikj}| > 0 \\ 0 & \text{if } |FE\_Cons_{ikj}| - |FE_{ikj}| = 0 \\ -1 & \text{if } |FE\_Cons_{ikj}| - |FE_{ikj}| < 0 \end{cases}$$

Based on previous empirical results (see e.g. Hilary and Menzly, 2006), we expect a positive relation between the past track record of an analyst and overconfidence ( $\frac{k}{h} > 1$ ).

Zitzewitz (2001) and Chen and Jiang (2006) provide empirical evidence of a mimicking hypothesis which suggests that low ability analysts exaggerate their private information because of reputation concerns. This incentive exists because the market uses information in forecast deviations to form beliefs about an analyst's ability. On average, high ability analysts have viewpoints that are more different from the consensus. In an attempt to mimic these high ability analysts, low ability analysts overweight the preci-

sion of their private information. The exaggeration of the news content of their private information leads to larger forecast deviations, a pattern typical of high ability analysts. Since investors form perceptions about an analyst's ability from his track record (Chen, Francis and Jiang, 2005), the mimicking hypothesis also predicts a positive relation between overweighting and track records. The overconfidence and mimicking hypothesis differ in their prediction about the relation between ability and overweighting. The overconfidence hypothesis predicts no relation, after controlling for track record, while the mimicking hypothesis predicts a negative relation once track record is controlled for. To further analyze the overweighting behavior, we add an ability measure as an underlying driver of  $\frac{k}{h}$ . According to the mimicking hypothesis the less able analysts mimic the high ability analysts to increase perceived reputation. Michaely and Womack (1999) argue that the analyst's perceived external reputation is one of the major factors determining an analyst's compensation and Stickel (1992) shows that the annual Institutional Investor All-America Research Teams poll is perhaps the most significant external influence driving analyst compensation. Therefore, we use the Institutional Investor All-America Research Team poll as an ability or perceived external reputation measure. We define a Star dummy based on this yearly prestigious ranking, published in the October edition of Institutional Investor (see also Hong and Kubick, 2003 and Sorescu and Subrahmanyam, 2006). Financial analysts identified as Star analysts are assumed to be high ability analysts. The Star dummy equals 1 when the analyst is elected a star past October and zero otherwise<sup>6</sup>. The summary statistics and a description of all added variables can be found in Table 9 in the Appendix.

The weighting factor and strategic factor are now defined as a function of their underlying drivers:

$$\begin{aligned}\frac{k}{h} &= f(TR, Star) \\ s &= f(IB, TVol)\end{aligned}$$

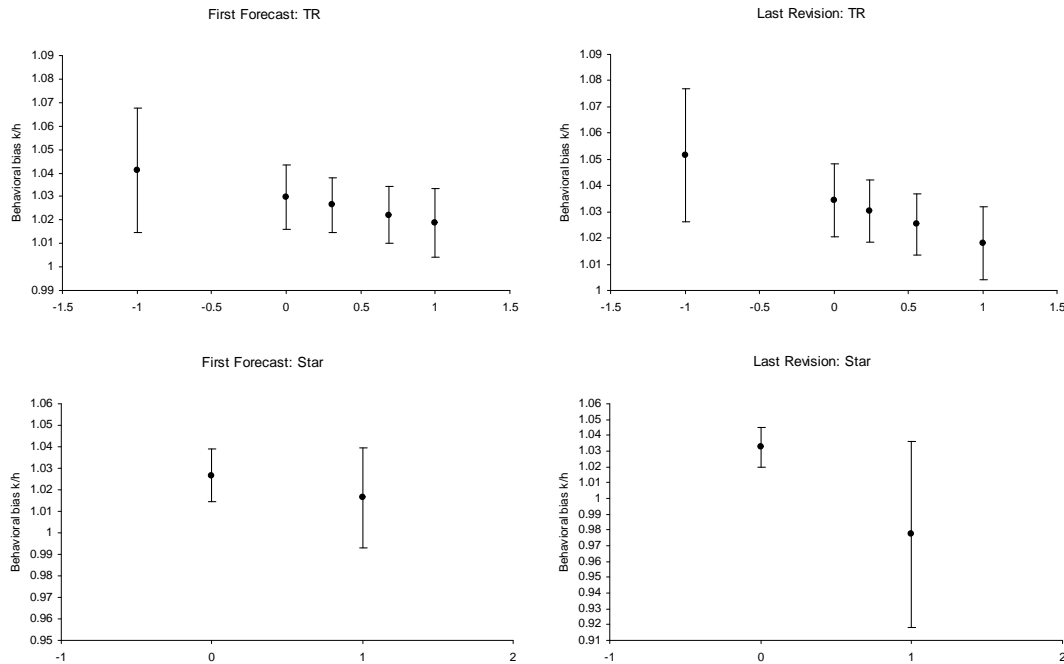
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<sup>6</sup>Stickel (1992) shows that financial analysts, who are elected a star or who will become a star, perform better than other financial analysts, who have never been elected or will never become a star. The star status is awarded in October based on the performance of the previous year. One could argue to use the year previous to the awarded star status as the ability measure. Changing the definition of Star does not impact our empirical findings.

To map the relation between the  $\frac{k}{h}$  and  $s$  and their underlying factors, we make use of the reduced form estimation equation (9). Equation (8) shows that  $\beta$  and  $\gamma$  from the reduced form estimation equation (9) are directly and linearly related to  $\frac{k}{h}$  and  $s$ , respectively. Therefore, in equation (9)  $\beta$  is made conditional on  $TR$  and  $Star$  and  $\gamma$  is made conditional on  $IB$  and  $TVol$ . This extended reduced form estimation equation and its estimation results can be found in Table 10 in the Appendix. To determine how the weighting factor and the strategic factor evolve for changes in their underlying drivers, we extract  $\widehat{\frac{k}{h}}$  and  $\widehat{s}$  from the reduced form estimation results, but at different values for their underlying drivers. The relation between these underlying drivers and their respective factor are illustrated in Figure 2 and Figure 3.

Figure 2: **Weighting factor**

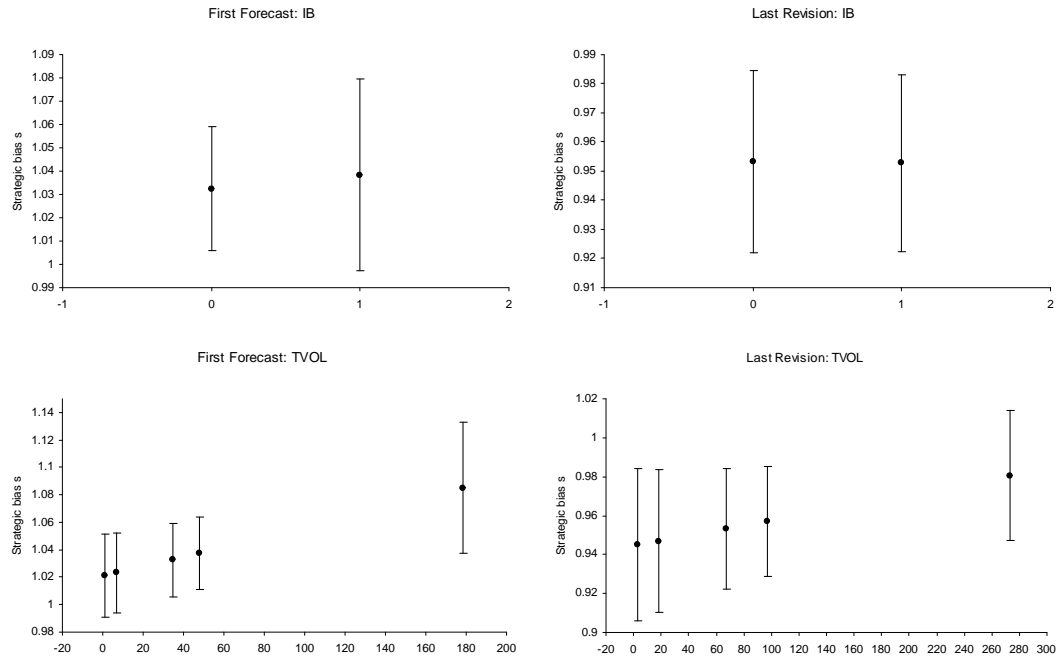
This figure shows the changes in the weighting factor ( $\frac{k}{h}$ ) for specific values of  $TR$  and  $Star$ .  $Star$  is evaluated at the values 0 and 1 because it is a dummy variable.  $TR$  is evaluated at the minimum, 1st quantile, mean, 3rd quantile and the maximum. When one covariate changes value, the others are kept at their mean value.



Figures 2 and 3 depict the impact of  $TR$  and  $Star$  on the weighting factor and the impact of  $IB$  and  $TVol$  on the strategic factor, ceteris paribus. The values of  $\widehat{\frac{k}{h}}$  and  $\widehat{s}$  for each value of the underlying driver can be found in Table 11 in the Appendix. With respect to the strategic incentives, the relations of  $IB$  and  $TVol$  with  $\widehat{s}$  are as predicted by

Figure 3: **Strategic factor**

This figure shows the changes in the strategic factor ( $s$ ) for specific values of  $IB$  and  $TVol$ .  $IB$  is evaluated at the values 0 and 1 because it is a dummy variable.  $TVol$  is evaluated at the minimum, 1st quantile, mean, 3rd quantile and the maximum. When one covariate changes value, the others are kept at their mean value.



the literature. Affiliated analysts are more optimistic in their first forecast and slightly more pessimistic in their last revision, however not significantly. When trading volume increases and the possibility for a higher commission fee increases, financial analysts become more optimistic, though not statistically significant. The results for the drivers of the overweighting behavior,  $TR$  and  $Star$ , are inconclusive. We find no significant relation between an analyst's track record and overweighting behavior, nor between an analyst's ability and his overweighting behavior. In addition, the analysis shows a negative relation between previous track record and overweighting while the dynamic overconfidence hypothesis and the mimicking hypothesis both suggest a positive relation. While we do find a negative relation between ability and overweighting as suggested by the mimicking hypothesis, it is not significant. Therefore, we do not confirm the mimicking hypothesis but neither do we confirm the presence of dynamic overconfidence. We only confirm a static overconfidence: an analyst overweights each signal he receives regardless of past performance.

## 6 Robustness Checks

### 6.1 Alternative Consensus Measure

When testing the reduced form equation (8), the public information ( $c$ ) is proxied by a consensus measure. In previous results this consensus is calculated as the mean of the earnings forecasts, for a particular quarter, previous to the analysts' own forecast. As a robustness check we also calculate the median consensus and we obtain similar results. Estimation results are reported in Table 13 in the Appendix.

### 6.2 Regulatory Impact: 2002

The yearly average forecast errors in Figure 1 reveal that analysts become pessimistic in their first forecast, after 2002. Even though the last revision is still more negative than the first forecast, the difference between them appears to be much smaller. In 2002, after the dot-com bubble burst, it was clear that financial analysts were not free from conflicts of interest and that their recommendations and earnings forecasts were biased. On May 10, 2002 the SEC approved the NYSE Rules 351 and 472 and the NASD Rule 2711 which implemented basic reforms to pursue the objectivity of the financial analyst's research. This regulatory change could be a trigger for a change in behavior. Consequently, we analyze the decision process for two separate time periods: the pre 2002 and the post 2002 period. The cutoff point is the second quarter of the year 2002 because this contains the month of May. The pre period runs from January 1996 until April 2002 and the post period runs from April 2002 until December 2006.

Table 3 shows the estimation results for the weighting factor  $\frac{k}{h}$  and the strategic factor  $s$  for both the First Forecast sample and the Last Revision sample, for both time periods. Full estimation results of equation (9) can be found in Table 14 in the Appendix. The empirical results confirm what is to be expected. Before the new regulation is enforced, analysts strategically inflate their first forecast and deflate their last revision, which is in line with management pleasing behavior. After the 2002 regulation, which tackles conflicts of interest, strategic behavior becomes insignificant. Overconfidence remains in both the pre and post time periods for both samples. This is additional empirical evidence that confirms the model assumption of an unconscious behavioral

Table 3: **Evaluation Pre and Post 2002**

This table presents estimates for the weighting factor  $\frac{k}{h}$  and the strategic factor  $s$  for two periods of time: pre 2002 and post 2002. The results are presented for both the First Forecast sample and the Last Revision sample. These factors are extracted from the reduced form estimation equation (9). The delta method is used to obtain standard errors. For both factors the two sided hypothesis test whether they are significantly different from 1 is performed. \*,\*\*,\*\*\* indicate significance at the 10%, 5% and 1% level, respectively.

		Weighting and Strategic Factor							
		First Forecast				Last Revision			
		Coeff.	SE	t-value		Coeff.	SE	t-value	
<b>PRE 2002</b>	$\widehat{\frac{k}{h}}$	1.034	0.0106	3.18	***	1.032	0.0070	4.60	***
	$\widehat{s}$	1.052	0.0189	2.73	***	0.947	0.0142	-3.72	***
	No. Obs.	154,210				26,607			
		Coeff.	SE	t-value		Coeff.	SE	t-value	
<b>POST 2002</b>	$\widehat{\frac{k}{h}}$	1.024	0.0085	2.90	***	1.028	0.0081	3.47	***
	$\widehat{s}$	1.017	0.0236	0.74		0.955	0.0296	-1.51	
	No. Obs.	167,913				33,440			

bias.

## 7 Conclusion

This paper contributes to the literature in three ways. First, a two-stage model is developed where behavioral and strategic biases can coexist. Secondly, the model is tested on a large dataset of quarterly earnings forecasts and the empirical results confirm the coexistence of overconfidence and strategic incentives. Thirdly, this paper is the first, as we know of, to empirically investigate the difference in the decision making process between the first earnings forecast and the last earnings revision of financial analysts. Descriptive statistics as well as regression results suggest that financial analysts issue initial optimistic (less pessimistic) earnings forecasts and pessimistic (more pessimistic) last earnings revisions.

Our empirical findings, on these dynamics of the decision process, show a consistent overweighting of private information throughout the forecasting period. A static overconfidence is present in the first forecast as well as in the last revision. At the same time, our results show a strategic inflation of the first earnings forecast after an earnings announcement followed by a strategic deflation of the last forecast revision before the next earnings announcement. Both the initial inflation and the final deflation are consistent with management pleasing theories. An initially inflated optimistic forecast stimulates

buying behavior among investors, possibly pushing up the stock price and potentially making it an ideal moment for the management to sell their stock. A deflated forecast revision before the announcement date creates beatable targets for management which can enjoy a higher return on their stock due to a favorable market reaction to the positive earnings surprise.

We conclude that overconfidence and strategic incentives coexist in financial analysts' earnings forecasts where the size of the behavioral bias is slightly smaller than the strategic alteration. This suggests that strategic incentives are economically more relevant. The conflicts of interest that financial analysts are confronted with, are often believed to imply a trade off between management pleasing and investor pleasing through forecast accuracy. As financial analysts engage in management pleasing, clearly the benefits outweigh the costs of a less accurate forecast. However, earnings forecasts formed under the earnings guidance of the management are shown to be more accurate (Hutton, 2005). Consequently the financial analyst seems to please all parties, investors and management, involved.

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## Appendix

Table 4: **Correlation Matrix First Forecast sample**

This table presents the correlation between the variables from equation (9) for the First Forecast sample. The forecast error, the deviation from consensus and the earnings forecast are deflated by the share price.

	FE	Dev	f	Age	Size	FirmExp	TotExp	FirmCompl	IndCompl
FE	1.00	0.05	0.04	0.02	-0.05	0.00	-0.01	-0.01	-0.01
Dev		1.00	0.41	0.34	-0.06	0.01	0.03	0.00	0.04
f			1.00	-0.02	0.03	0.08	0.06	0.11	-0.03
Age				1.00	-0.04	-0.01	0.03	-0.08	0.07
Size					1.00	0.21	0.09	0.12	-0.10
FirmExp						1.00	0.60	0.17	0.02
TotExp							1.00	0.21	0.12
FirmCompl								1.00	0.12
IndCompl									1.00

Table 5: **Correlation Matrix Last Revision sample**

This table presents the correlation between the variables from equation (9) for the Last Revision sample. The forecast error, the deviation from consensus and the earnings forecast are deflated by the share price.

	FE	Dev	f	Age	Size	FirmExp	TotExp	FirmCompl	IndCompl
FE	1.00	0.02	-0.12	0.02	0.00	-0.01	-0.01	-0.03	-0.01
Dev		1.00	0.25	0.34	-0.07	0.00	0.01	-0.10	0.02
f			1.00	-0.05	-0.01	0.04	0.05	0.19	0.04
Age				1.00	-0.03	0.00	0.01	-0.10	0.00
Size					1.00	0.17	0.08	-0.01	-0.07
FirmExp						1.00	0.67	0.10	-0.05
TotExp							1.00	0.11	-0.01
FirmCompl								1.00	0.19
IndCompl									1.00

Table 6: Summary Statistics

This table presents the summary statistics of the forecast error, the deviation from consensus, the earnings forecast (deflated) and the control variables used in equation (9). Panel A shows the summary statistics of the First Forecast sample. Panel B shows the summary statistics of the Last Revision sample. Outliers are removed by deleting the top and bottom 0.1% for the variables forecast error, deviation and earnings forecast. The earnings forecast data is obtained from I/B/E/S.

Panel A	First Forecast Sample			
	Mean	Stdev.	Min.	Max.
FE	0.30E <sup>-5</sup>	0.006	-0.254	0.682
Dev	0.005	0.009	-0.112	0.532
f	0.014	0.009	0.000	0.532
Age	73.874	26.127	1.000	143.000
Size	7.930	1.324	-5.319	12.344
FirmExp	11.461	10.363	1.000	59.000
TotExp	20.721	13.390	1.000	59.000
FirmCompl	9.223	5.889	1.000	67.000
IndCompl	1.716	0.937	1.000	9.000
Panel B	Last Revision Sample			
	Mean	Stdev.	Min.	Max.
FE	-0.001	0.004	-0.101	0.383
Dev	0.004	0.008	-0.050	0.109
f	0.015	0.010	0.000	0.191
Age	29.299	19.836	1.000	128.000
Size	8.679	1.282	-3.744	12.431
FirmExp	13.086	11.321	1.000	59.000
TotExp	21.086	13.496	1.000	59.000
FirmCompl	4.642	4.157	1.000	32.000
IndCompl	1.175	0.441	1.000	5.000

**FE** is the difference between the earnings forecast and the actual, deflated by the share price. **Dev** is the difference between the earnings forecast and the consensus forecast, deflated by the share price. **f** is the analyst's earnings forecast, deflated by the share price. **Age** is the number of days between the issue of the analyst's earnings forecast and the reporting date of the actual earnings. **Size** is the logarithm of the market capitalization, calculated in the month prior to the forecast. **FirmExp** is the number of quarters an analyst has followed a certain stock. **TotExp** is the number of quarters the analyst is present in the data set. For both ability variables data starting from 1992 is used to prevent all analysts from starting with the same experience in 1996. **FirmCompl** is the number of companies an analyst follows during a quarter. **IndCompl** is the number of sectors an analyst follows during a quarter. I/B/E/S identifies 11 sectors using a proprietary classification scheme for companies with similar business lines.

Table 7: **Estimation Results**

This table presents estimation results for the reduced form estimation equation (9). The second and third column show the coefficient estimates and t-values, respectively, using analysts' first earnings forecast. The third and fourth column represent the coefficient estimates and t-values, respectively, using analysts' last earnings review. For both regressions firm fixed effects is used with clustered standard errors by business group. These clustered standard errors are White (1984) standard errors adjusted to account for possible correlation within a cluster, i.e. business group. The earnings forecast data is obtained from I/B/E/S. \*, \*\*, \*\*\* indicate significance at the 10%, 5% and 1% level, respectively.

Explanatory Variables	First Forecast		Last Revision	
	Coeff.	t-value	Coeff.	t-value
Dev ( $\hat{\beta}$ )	24.86E <sup>-3</sup>	4.17 ***	27.51E <sup>-3</sup>	4.29 ***
f ( $\hat{\gamma}$ )	29.34E <sup>-3</sup>	2.13 **	-47.50E <sup>-3</sup>	-3.02 ***
Age	49.00E <sup>-7</sup>	3.05 ***	-7.00E <sup>-7</sup>	-0.28
Size	-19.95E <sup>-5</sup>	-1.83 *	20.00E <sup>-5</sup>	1.55
FirmExp	-18.00E <sup>-7</sup>	-0.96	-27.00E <sup>-7</sup>	-1.70 *
TotExp	8.00E <sup>-7</sup>	0.66	-5.00E <sup>-7</sup>	-0.45
FirmCompl	-7.00E <sup>-7</sup>	-0.48	-3.00E <sup>-7</sup>	-0.09
IndCompl	-7.00E <sup>-7</sup>	-0.08	-72.00E <sup>-7</sup>	-0.36
Adj. R <sup>2</sup>	0.47%		0.93%	
No. Obs.	322,123		60,047	

Table 8: **Estimation Results for Single Issue and First of Revision**

This table presents estimation results for the reduced form estimation equation (9) on two specific samples. The second and third column show the coefficient estimates and t-values, respectively, for the Single Issue sample. The third and fourth column represent the coefficient estimates and t-values, respectively, for the First of Revision sample. For both regressions firm fixed effects is used with clustered standard errors by business group. These clustered standard errors are White (1984) standard errors adjusted to account for possible correlation within a cluster, i.e. business group. The earnings forecast data is obtained from I/B/E/S. \*, \*\*, \*\*\* indicate significance at the 10%, 5% and 1% level, respectively.

Explanatory Variables	Theoretical Model			
	Single Issue		First of Revision	
	Coeff.	t-value	Coeff.	t-value
Dev ( $\hat{\beta}$ )	26.42E <sup>-3</sup>	4.30 ***	23.70E <sup>-3</sup>	2.20 **
f ( $\hat{\gamma}$ )	20.86E <sup>-3</sup>	1.38	79.31E <sup>-3</sup>	4.14 ***
Age	56.00E <sup>-7</sup>	4.13 ***	-85.00E <sup>-7</sup>	-1.71 *
Size	-21.78E <sup>-5</sup>	-2.03 **	-26.00E <sup>-7</sup>	-0.01
FirmExp	1.00E <sup>-7</sup>	0.05	-97.00E <sup>-7</sup>	-3.97 ***
TotExp	-2.00E <sup>-7</sup>	-0.17	52.00E <sup>-7</sup>	2.46 **
FirmCompl	-0.01E <sup>-7</sup>	-0.02	-49.00E <sup>-7</sup>	-1.29
IndCompl	78.00E <sup>-7</sup>	0.87	-53.50E <sup>-6</sup>	-1.74 *
No. Obs.	268,842		53,279	

Table 9: **Summary Statistics of the First Forecast and Last Revision Samples: Extended model**

This table presents the summary statistics of the variables Track Record, Star, Investment banking business and Trading volume, used in the extended analysis. Panel A shows the summary statistics of the First Forecast sample. Panel B shows the summary statistics of the Last Revision sample. Trading volume outliers are removed. The earnings forecast data is obtained from I/B/E/S. The security offerings data is retrieved from Westlaw Business, while the trading volume data was obtained from CRSP.

Panel A	First Forecast Sample			
	Min.	Mean	Max.	Stdev.
TR	-1.000	0.312	1.000	0.531
Star	0.000	0.031	1.000	0.174
IB	0.000	0.066	1.000	0.249
TVol	0.974	34.685	178.243	39.249
Panel B	Last Revision Sample			
	Min.	Mean	Max.	Stdev.
TR	-1.000	0.238	1.000	0.502
Star	0.000	0.036	1.000	0.186
IB	0.000	0.057	1.000	0.232
TVol	2.995	67.537	273.304	64.885

**TR** measures the frequency of the analysts' earnings forecast being more accurate than the consensus forecast up until time  $t$  for firm  $k$ . **Star** is a dummy variable which equals one when an analyst has been elected by the Institutional Investor all-American research Teams poll. **IB** is a dummy variable which equals one when an analyst is employed by a brokerage house which has assisted as underwriter in a public offering of the company, for which the analyst is following the stock. The window of affiliation is five years, centered around the moment of the registration with the SEC of the public offering. **TVol** is the average daily number of shares traded the previous quarter multiplied by the average daily price of the previous quarter.

**Table 10: Estimation Results Extended Model**

This table presents estimation results for the extended reduced form estimation equation:

$$FE_{ikt} = \alpha + \beta_0 Dev_{ikt} + \beta_1(Dev_{ikt} \times TR_{ikt}) + \beta_2(Dev_{ikt} \times Star_{it}) + \gamma_0 f_{ikt} + \gamma_1(f_{ikt} \times IB_{ikt}) + \gamma_3(f_{ikt} \times TVol_{kt}) + \delta_i X_{ikt} + \varepsilon_{ikt} \quad (11)$$

The second and third column show the coefficient estimates and t-values, respectively, using analysts' first earnings forecast. The third and fourth column represent the coefficient estimates and t-values, respectively, using analysts' last earnings review. For both regressions firm fixed effects is used with clustered standard errors by business group. These clustered standard errors are White (1984) standard errors adjusted to account for possible correlation within a cluster, i.e. business group. The earnings forecast data is obtained from I/B/E/S. \*,\*\*,\*\*\* indicate significance at the 10%, 5% and 1% level, respectively.

Explanatory Variables	Extended Model					
	First Forecast			Last Revision		
	Coeff.	t-value		Coeff.	t-value	
Dev	29.24E <sup>-3</sup>	4.08	***	35.22E <sup>-3</sup>	4.78	***
Dev×TR	-10.54E <sup>-3</sup>	-1.27		-15.67E <sup>-3</sup>	-2.04	**
Dev×Star	-9.88E <sup>-3</sup>	-0.75		-54.57E <sup>-3</sup>	-1.74	*
f	19.53E <sup>-3</sup>	1.28		-56.89E <sup>-3</sup>	-2.83	***
f×IB	5.46E <sup>-3</sup>	0.36		-42.23E <sup>-5</sup>	-0.10	
f×TVol	31.68E <sup>-5</sup>	2.05	**	13.78E <sup>-5</sup>	1.46	
Age	47.00E <sup>-7</sup>	2.98	***	-8.00E <sup>-7</sup>	-0.33	
Size	-32.39E <sup>-5</sup>	-2.88	***	8.52E <sup>-5</sup>	0.48	
FirmExp	-20.00E <sup>-7</sup>	-1.06		-24.00E <sup>-7</sup>	-1.52	*
TotExp	5.00E <sup>-7</sup>	0.48		-5.00E <sup>-7</sup>	-0.54	
FirmCompl	1.00E <sup>-7</sup>	0.09		5.00E <sup>-7</sup>	0.12	
IndCompl	27.00E <sup>-7</sup>	0.30		-24.00E <sup>-7</sup>	-0.12	
Adj. R <sup>2</sup>	0.52%			1.09%		
No. Obs.	322,123			60,047		

Table 11: **Weighting and Strategic Factors for the Extended Model**

This table presents the weighting and strategic factors for specific values of the underlying factors TR, Star, IB and TVol. This analysis is performed ceteris paribus: when for example *Star* changes from 0 to 1, the other covariates are kept at their mean value. The estimates of  $\frac{k}{h}$  and  $s$  are obtained using following equations, derived from the extended reduced form estimation equation (11):

$$\begin{aligned} \left(\frac{\widehat{k}}{\widehat{h}}\right)_t &= \left(\widehat{\beta}_0 + \widehat{\beta}_1 TR_{ikt} + \widehat{\beta}_2 Star_{ikt}\right) + 1 \\ \widehat{s}_t &= \left(\widehat{\gamma}_0 + \widehat{\gamma}_1 IB_{ikt} + \widehat{\gamma}_2 TVol_{ikt}\right) + 1 \end{aligned} \tag{12}$$

The delta method is used to obtain standard errors. For all factors the two sided hypothesis test whether they are significantly different from 1 is performed. \*, \*\*, \*\*\* indicate significance at the 10%, 5% and 1% level, respectively.

Weighting Factor										
Covariates	First Forecast					Last Revision				
	values	$\widehat{\frac{k}{h}}$	$SE\left(\widehat{\frac{k}{h}}\right)$	t-value		values	$\widehat{\frac{k}{h}}$	$SE\left(\widehat{\frac{k}{h}}\right)$	t-value	
<i>TR</i>	-1	1.0411	0.0134	2.94	***	-1	1.049	0.0130	3.78	***
	0	1.0298	0.0070	4.13	***	0	1.033	0.0070	4.73	***
	0.31	1.0263	0.0060	4.25	***	0.24	1.030	0.0061	4.87	***
	0.69	1.0222	0.0062	3.48	***	0.56	1.025	0.0059	4.15	***
	1	1.0187	0.0075	2.46	**	1	1.018	0.0071	2.49	**
<i>Star</i>	0	1.0266	0.0062	4.18	***	0	1.031	0.0065	4.87	***
	1	1.0163	0.0118	1.36		1	0.977	0.0301	-0.77	
Strategic Factor										
Covariates	First Forecast					Last Revision				
	values	$\widehat{s}$	$SE(\widehat{s})$	t-value		values	$\widehat{s}$	$SE(\widehat{s})$	t-value	
<i>IB</i>	0	1.031	0.0136	2.25	***	0	0.952	0.0159	-2.99	***
	1	1.036	0.0211	1.71	*	1	0.952	0.0155	-3.10	***
<i>TVol</i>	0.97	1.020	0.0153	1.32		2.99	0.945	0.0199	-2.77	***
	6.77	1.022	0.0149	1.48		18.62	0.946	0.0188	-2.89	***
	34.69	1.031	0.0137	2.26	**	67.54	0.952	0.0158	-3.00	***
	48.03	1.035	0.0135	2.60	***	97.09	0.956	0.0145	-3.00	***
	178.24	1.076	0.0243	3.14	***	273.30	0.981	0.0170	-1.13	

Table 12: **Random Draw from First Forecast Sample**

This table presents estimation results for the reduced form estimation equation (9). The second and third column show the coefficient estimates and t-values, respectively, using analysts' first earnings forecast. The sample used contains 60,047 observations, randomly drawn from the First Forecast sample of 322,123 observations. Firm fixed effects is used with clustered standard errors by business group. These clustered standard errors are White (1984) standard errors adjusted to account for possible correlation within a cluster, i.e. business group. The earnings forecast data is obtained from I/B/E/S. \*, \*\*, \*\*\* indicate significance at the 10%, 5% and 1% level, respectively.

The last two rows of this Table presents estimation results for the weighting factor  $\frac{k}{h}$  and the strategic factor  $s$ . These factors are extracted from the reduced form estimation equation (9). The delta method is used to obtain standard errors. For both factors the two sided hypothesis test whether they are significantly different from 1 is performed. \*, \*\*, \*\*\* indicate significance at the 10%, 5% and 1% level, respectively.

Explanatory Variables	Random Draw		
	Coeff.	t-value	
Dev ( $\hat{\beta}$ )	26.84E <sup>-3</sup>	2.61	***
f ( $\hat{\gamma}$ )	30.32E <sup>-3</sup>	2.07	**
Age	19.00E <sup>-7</sup>	0.90	
Size	-76.20E <sup>-6</sup>	-0.63	
FirmExp	-33.00E <sup>-7</sup>	-1.17	
TotExp	-15.00E <sup>-7</sup>	-0.99	
FirmCompl	8.00E <sup>-7</sup>	0.27	
IndCompl	85.00E <sup>-7</sup>	0.54	
No. Obs.	60,047		
	Coeff.	SE	t-value
$\hat{\frac{k}{h}}$	1.027	0.0103	2.61 ***
$\hat{s}$	1.030	0.0146	2.07 **

Table 13: **Estimation Results with Median Consensus**

This table presents estimation results for the reduced form estimation equation (9). Public information is proxied by the median consensus. The second and third column show the coefficient estimates and t-values, respectively, using analysts' first earnings forecast. The third and fourth column represent the coefficient estimates and t-values, respectively, using analysts' last earnings review. For both regressions firm fixed effects is used with clustered standard errors by business group. These clustered standard errors are White (1984) standard errors adjusted to account for possible correlation within a cluster, i.e. business group. The earnings forecast data is obtained from I/B/E/S. \*, \*\*, \*\*\* indicate significance at the 10%, 5% and 1% level, respectively.

The last two rows of this Table presents estimation results for the weighting factor  $\frac{k}{h}$  and the strategic factor  $s$ . These factors are extracted from the reduced form estimation equation (9). The delta method is used to obtain standard errors. For both factors the two sided hypothesis test whether they are significantly different from 1 is performed. \*, \*\*, \*\*\* indicate significance at the 10%, 5% and 1% level, respectively.

Explanatory Variables	Theoretical Model							
	First Forecast				Last Revision			
	Coeff.	t-value			Coeff.	t-value		
Dev ( $\hat{\beta}$ )	23.72E <sup>-3</sup>	3.99	***		28.11E <sup>-3</sup>	4.35	***	
f ( $\hat{\gamma}$ )	29.93E <sup>-3</sup>	2.18	**		-47.57E <sup>-3</sup>	-3.03	***	
Age	50.00E <sup>-7</sup>	3.07	***		-8.00E <sup>-7</sup>	-0.31		
Size	-19.97E <sup>-5</sup>	-1.83	*		20.12E <sup>-5</sup>	1.56		
FirmExp	-17.00E <sup>-7</sup>	-0.95			-27.00E <sup>-7</sup>	-1.69	*	
TotExp	8.00E <sup>-7</sup>	0.66			-5.00E <sup>-7</sup>	-0.46		
FirmCompl	-8.00E <sup>-7</sup>	-0.49			-3.00E <sup>-7</sup>	-0.08		
IndCompl	-6.00E <sup>-7</sup>	-0.07			-72.00E <sup>-7</sup>	-0.36		
No. Obs.	322,121				60,046			
	Coeff.	SE	t-value		Coeff.	SE	t-value	
$\frac{k}{h}$	1.024	0.0060	3.99	***	1.028	0.0065	4.35	***
$\frac{s}{s}$	1.030	0.0137	2.18	**	0.952	0.0157	-3.03	***

Table 14: **Estimation Results Pre and Post 2002**

This table presents the estimated coefficients of Dev and f from the reduced form estimation equation (9). Estimation results are shown for both the First Forecast sample and the Last Revision sample. Results are presented separately for two periods of time. The pre 2002 and the post 2002 period. The cut off point is the second quarter of the year 2002. The pre period runs from January 1996 until April 2002 and the post period runs from April 2002 until December 2006. For all four regressions firm fixed effects is used with clustered standard errors by business group. These clustered standard errors are White (1984) standard errors adjusted to account for possible correlation within a cluster, i.e. business group. The earnings forecast data is obtained from I/B/E/S. \*, \*\*, \*\*\* indicate significance at the 10%, 5% and 1% level, respectively. Control variables are not reported to facilitate readability.

Explanatory Variables	First Forecast				Last Revision			
	Coeff.	t-value			Coeff.	t-value		
<b>PRE 2002</b>	Dev	33.89E <sup>-3</sup>	3.18	***	32.26E <sup>-3</sup>	4.60	***	
	f	51.64E <sup>-3</sup>	2.73	***	-52.95E <sup>-3</sup>	-3.72	***	
	ControlVar.	<i>not reported</i>				<i>not reported</i>		
<b>POST 2002</b>	Dev	24.50E <sup>-3</sup>	2.90	***	27.95E <sup>-3</sup>	3.47	***	
	f	17.35E <sup>-3</sup>	0.74		44.65E <sup>-3</sup>	-1.51		
	ControlVar.	<i>not reported</i>				<i>not reported</i>		