

Financial Analysts' Forecasts

Behavioral Aspects and the Impact of Personal Characteristics

Stæhr, Simone

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COPENHAGEN BUSINESS SCHOOL
SOLBJERG PLADS 3
DK-2000 FREDERIKSBERG
DANMARK

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FINANCIAL ANALYSTS' FORECASTS BEHAVIORAL ASPECTS AND THE IMPACT OF PERSONAL CHARACTERISTICS

PhD Series 23-2017

Simone Stæhr

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CHARACTERISTICS

Doctoral School of Business and Management

PhD Series 23.2017

CBS COPENHAGEN BUSINESS SCHOOL
HANDELSHØJSKOLEN

Financial Analysts' Forecasts

Behavioral Aspects and the Impact of Personal Characteristics

Simone Stæhr

Supervisors:

Thomas Plenborg

Jeppe Christoffersen

Doctoral School of Business and Management

Copenhagen Business School (CBS)

Simone Stæhr
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Simone Stæhr, CBS, Sep. 2016

SUMMARY (English)

This thesis is broadly concentrated on decision making under uncertainty. It seeks to investigate how agents in financial markets make decisions at the individual level and how these decisions can sometimes be affected by personal traits and cognitive biases rather than being perfectly rational. The primary focus is on financial analysts in the task of conducting earnings forecasts while a secondary focus is on investors' abilities to interpret and make use of these forecasts.

Simply put, financial analysts can be seen as information intermediators receiving inputs to their analyses from firm management and providing outputs to the investors. Amongst various outputs from the analysts are forecasts of earnings. According to decision theories mostly from the literature in psychology all humans are affected by cognitive constraints to some degree. These constraints may lead to unintentional biases in the decision making and the magnitude of these constraints does sometimes vary with personal traits. Therefore, to the extent that financial analysts are subjects to behavioral biases their outputs to the investors are likely to be biased by their interpretation of information. Because investors need accuracy in the financial forecasts on which they base investment decisions they may end up losing money as a consequence of biased forecasts. Thus, relying primarily on decision theories such as social comparison theory and theories on confirmation bias this thesis investigates how and why pronounced biases in financial analysts' forecasts documented at the market level by prior literature occur at the individual level and which personal traits interact in this process.

The thesis relies on data from two paper-based experiments executed in-class by a total of 633 graduate students within the areas of accounting and finance. All participated voluntarily and were monetarily incentivized. The experimental method is especially relevant to investigate the variables or behaviors of interest in

an isolated setting where confounding factors can be controlled. Further, by relying on the experimental method, limitations in terms of access to data and individual specific variables are lessened.

The thesis consists of three separate articles (referred to as papers) which are shortly summarized by the abstract of each paper below:

Paper 1 - Individual Risk-Willingness and Herding Behaviors in Financial Forecasts

Literature on financial analysts' forecasts (FAF) documents that financial analysts tend to demonstrate herding behaviors and thus issue forecasts that are in line with consensus estimates which sometimes compromises accuracy. A number of explanations spanning rational economic logic, cognitive biases and social forces have been suggested. Relying on data from a paper-based, in-class experiment completed by 289 graduate students participating in the course Financial Statement Analysis and Valuation I posit and find support for individual risk-willingness (or lack of) as an explanatory variable of herding behavior. Specifically, I predict and find that less risk-willing individual's forecasts with less boldness and instead issue forecasts in line with the consensus forecast. Although perfect distinctions between theories are hard to make, the results are argued to be at least partially a result of cognitive biases and an intuitive reaction to uncertainty. Additionally, I find evidence that the relationship is particularly pronounced when bad news (rather than good news) is received prior to forecast revisions.

Paper 2 - Cognitive Dissonance Reduction and Confirmation Bias in Financial Forecast Revisions

Research has shown that confirmation bias, the tendency to seek for, and rely more heavily on information that is confirmatory to an initial belief as a reaction

to cognitive dissonance, exists for most people in various contexts. From an experimental setting, performed by 289 graduate students in finance and accounting, this paper provides evidence that people with high confidence in their own initial forecast are more hesitant to deem a revision necessary after receiving new information. This is argued to be a result of confirmation bias leading to inertia. This paper also finds that those hesitant to make revisions express increased confidence in their forecast following the new information compared to those revising their forecast. Thus, a non-revised forecast following new information in the market is not necessarily a reflection of that new information already being incorporated in the forecast but might also be a result of cognitively biased decision making. The findings have implications for studies in the context of financial analysts' forecasting behavior and may add to the understanding of why under-reactions to new information in the market are often found.

Paper 3 - Using Feedback to Reduce the Cost of Information Intermediation: Experimental Evidence

Information intermediaries, including financial analysts and financial advisors, face incentives to produce biased recommendations and expend low effort. In an experiment with 344 finance masters students, we investigate the role of incentivized feedback in reducing these costs. Specifically, we have participants play analysts or investors, with the analysts making earnings recommendations for the investors in the presence of biased incentives. In the treatment condition, the investors provide incentivized feedback to the analysts. Consistent with educational learning and psychological theories, we find the presence of feedback reduces bias and increases effort among information intermediaries (financial analysts), while also enhancing information end-users' (investors) critical evaluation of recommendations. Hence the potential welfare gains from incentivized feedback-channels are large. This research is especially timely given

the European Securities and Markets Authority's proposal in 2014 to abolish indirect payments to analysts including the broker votes system, since that system acts as an incentivized feedback-channel from institutional investors to financial analysts.

Whereas the first two papers are solely concerned with the biasing processes within the individual analysts and how these are affected by personal traits and characteristics (risk-willingness and confidence) the third paper expands the perspective to include potential consequences for the users (investors) of this biased information provided by the analysts.

This thesis argues that it is important to consider theories from the psychology literature when investigating observed behavioral biases in financial analysts' forecasts. This should at least be considered as supplementary to the explanations drawing on perfect rationality and strategic incentives which are currently dominating the literature. Thus, this thesis broadly seeks to contribute to the rather narrow stream of literature in behavioral accounting. To the extent that findings from this thesis can be generalized onto the real-world it has implications for regulators by suggesting that biases in financial analysts' forecasts are at least partly a result of unconscious reactions and determined by personal traits and thus broad regulations may not be sufficient. Further, investors that seek to expand their knowledge on potential biases in financial analysts' forecasts should be interested in the findings of this thesis and perhaps it will lead to a greater demand for analyst-specific data in the future. Finally, analysts that are interested in learning how to evade being victims of behavioral biases must first require knowledge about how these biases occur. Findings in this thesis may help them do so. Although findings from this thesis are not necessarily directly generalizable to the biases observed in financial analysts' forecasts on the market level, it still

provides important indications of central tenets and causes of these biases from the individual level. Future research could expand the view.

SUMMARY (Danish)

Denne afhandling er koncentreret indenfor beslutningstagning under usikkerhed. Formålet er at undersøge hvordan aktører i de finansielle markeder tager beslutninger på individniveau, og hvordan disse beslutninger nogle gange kan være influeret af personlige træk og kognitive biases (skævvridninger/systematiske fejl) fremfor at være fuldt rationelle. Det primære fokus ligger på finansielle analytikeres udførelse af estimater (forecasts), mens et sekundært fokus er på investorers evne til at fortolke og anvende disse estimater.

Som en simplificering kan finansielle analytikere anskues som videreformidlere af information; de modtager inputs til deres analyser fra ledelsen i virksomheder og videregiver outputs til investorer. Blandt disse outputs fra analytikerne er estimater af fremtidig indtjening. Ifølge beslutningsteorier, primært inden for psykologilitteraturen, er alle mennesker påvirket af kognitive begrænsninger i en eller anden udstrækning. Disse begrænsninger kan lede til uforståelige biases af beslutningstagningen, og påvirkningen af disse begrænsninger kan variere med personlige træk. Derfor, givet at finansielle analytikere er omfattet af disse adfærdsmæssige biases, vil deres outputs til investorerne højst sandsynligt også være påvirket af deres biased fortolkning af information. Fordi investorerne efterspørger præcision i de finansielle estimater, på hvilke de baserer investeringsbeslutninger, kan biases i estimater ende med at koste dem penge. Derfor, på baggrund af beslutningsteorier såsom 'social comparison theory' og teorier omkring 'confirmation bias', undersøger denne afhandling, hvordan og hvorfor udbredte biases i finansielle analytikeres estimater dokumenteret på markedsniveau af tidligere studier, opstår på individniveau, samt hvilke personlige træk, der interagerer in denne proces.

Afhandlingen bygger på data fra to papirbaseret eksperimenter, der blev gennemført i klasselokalet af i alt 633 kandidatstuderende inden for områderne

regnskab og finansiering. Alle blev givet et økonomisk incitament og deltog frivilligt. Den eksperimentelle metode er særlig relevant til at undersøge variable eller adfærd af interesse i isolerede omgivelser, hvor forstyrrende faktorer kan kontrolleres. Desuden mindskes potentielle begrænsninger i form af datatilgængelighed ved at anvende denne metode.

Afhandlingen består af tre separate artikler (benævnt papirer), der kort er opsummeret gennem hver deres 'abstract' nedenfor (løst oversat fra originalerne på engelsk):

Papir 1 – Individuel risikovillighed og imiterende adfærd i finansielle estimater

Litteraturen inden for finansielle analytikerers estimaters dokumenterer, at finansielle analytikere har en tendens til at udvise en imiterende adfærd og dermed udsende ens estimater (i overensstemmelse med konsensus), hvilket indimellem hindrer præcision. Forklaringer spænder fra økonomisk rationalitet til kognitive biases og sociale påvirkninger. På baggrund af data fra et papirbaseret eksperiment, som blev udført i klasselokalet under kurset regnskabsanalyse og værdiansættelse på 289 kandidatstuderende, finder jeg belæg for hypotesen om, at individuel risikovillighed (eller mangel på samme) er forklarende variabel for imiterende adfærd. Mere præcist foreslår jeg og finder belæg for, at mindre risikovillige individer udarbejder estimater, der er mindre dristige og i stedet mere i overensstemmelse med konsensus. Selvom det er svært at sondre mellem teorier, argumenteres der for, at resultaterne primært er afledt af kognitive biases og en intuitiv reaktion på usikkerhed. Derudover finder jeg beviser på, at denne sammenhæng er mere udtalt, når der modtages dårlige nyheder (i modsætning til gode nyheder) forud for revideringer af estimater.

Paper 2 – Reduktion i kognitiv dissonans og 'confirmation bias' i revidering af finansielle estimater

Forskning har vist, at 'confirmation bias', tendensen til at søge efter og stole mere på information, der bekræfter ens oprindelige opfattelse, eksisterer for de fleste mennesker i mange forskellige kontekster. Ved hjælp af et eksperiment udført af 289 kandidatstuderende dokumenterer dette papir, at mennesker med stor tillid til deres egne estimater er mere tilbageholdende med at revidere disse estimater, når ny information bliver tilgængelig. Dette anses for at være et resultat af 'confirmation bias', som leder til passivitet. Desuden finder dette papir, at mennesker som er mere tilbageholdende med at udføre revideringer, udtrykker en øget tillid til deres egne estimater efter at have modtaget ny information, sammenlignet med dem som reviderer deres estimater. Dermed er et ikke-reviderede estimat efter ny information i markedet ikke nødvendigvis en refleksion af, at denne information allerede er inkorporeret i estimatet, men kan også være et resultat af beslutningstagning under kognitiv bias. Resultaterne har betydning for studier, der er interesseret i adfærdsmæssige mønstre i sammenhæng med finansielle analytikeres estimater samt kan bidrage til en øget forståelse af, hvorfor man ofte finder underreaktioner på ny information i markedet.

Paper 3 – Anvendelse af feedback til at reducere omkostningerne af videreformidling af information: Eksperimentelle beviser

Videreformidlere af information, herunder finansielle analytikere og finansielle rådgivere, har incitamenter til at producere biased anbefalinger og yde en begrænset indsats. Gennem et eksperiment med 344 kandidatstuderende inden for regnskab og finansiering undersøger vi, hvorvidt tilskyndelsen af feedback kan reducere disse omkostninger. Deltagerne agerer enten analytikere eller investorer, hvor analytikerne producerer anbefalinger til investorerne under biasing incitamenter. I det ene af to stadier giver investorerne feedback til analytikerne. I

tråd med lærings- og psykologiske teorier finder vi, at tilstedeværelsen af feedback reducerer bias og øger indsatsen hos videregiverne af information (finansielle analytikere), samtidig med at den kritiske evaluering af anbefalingerne øges hos slutbrugerne af informationen (investorerne). Dermed er der stort potentiale for en velfærdsgevinst ved incitamentsbaseret feedback. Denne forskning er særlig relevant givet et nyligt forslag fra European Securities and Markets Authority's i 2014 om at forbyde indirekte betalinger til analytikere, herunder det såkaldte 'broker vote'-system, fordi dette system netop fungerer som en incitamentsbaseret feedback-kanal fra investorer til finansielle analytikere.

Hvor de første to papirer udelukkende er koncentrerede omkring de biased processer, som opstår hos den individuelle analytiker, samt hvordan disse er påvirket af personlige træk og karakteristika (risikovillighed og selvtilid), bredes perspektivet ud i det tredje papir til også at inkludere potentielle konsekvenser for brugerne (investorerne) af den biased information leveret af analytikerne.

Denne afhandling argumenterer for vigtigheden af at inddrageteorier fra eksempelvis den psykologiske litteratur, når forskere undersøger adfærdsmæssige biases i finansielle analytikers estimer. Som minimum bør disse indgå som et supplement til de forklaringer, der trækker på perfekt rationalitet og strategiske incitamenter, som er dominerende i litteraturen på nuværende tidspunkt. Dermed stræber denne afhandling efter at bidrage til den forholdsvis snævre strøm af litteratur inden for 'behavioral accounting'. I det omfang resultaterne fra denne afhandling kan generaliseres til den virkelige verden, har den betydning for regulatorer ved at foreslå, at biases i finansielle analytikers estimer kan være et resultat af uforsætlige reaktioner og bestemt af personlige træk, hvorfor generelle reguleringer sandsynligvis ikke er tilstrækkelige. Yderligere kan investorer, som er interesserede i at udvide deres kendskab til potentielle adfærdsmæssige biases i finansielle analytikers estimer, hente inspiration i resultaterne fra denne

afhandling, hvilket måske vil føre til en øget efterspørgsel efter analytikerspecifikke data i fremtiden. Endelig vil analytikere, som er interesserede i at lære, hvordan man undgår adfærdsmæssige biases, kunne hente inspiration i denne afhandling. Selvom resultaterne fra de tre studier ikke nødvendigvis kan generaliseres direkte til de biases i finansielle analytikers estimer, der er observeret på markedsniveau, giver de alligevel vigtige indikationer på grundlæggende årsager til disse biases på individniveau. Fremtidig forskning vil med fordel kunne fokusere yderligere på årsager til biases på individniveau.

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1. MOTIVATION AND OBJECTIVE

The overall motivation to write this thesis comes from a genuine curiosity and interest in how humans make choices and why these choices are sometimes systematically contrary to predictions from economic models based on perfect rationality.

The simplest way of describing the viewpoint of this thesis is by a quote (-unknown): *“The same boiling water that softens the potato hardens the egg. It is about what you are made of, not (only) the circumstances”*.

For example studies document that most individuals are right-orientated and consequently the lines to the right, e.g. at bathrooms or at check-ins in airports, are on average longer than the lines to the left. Other studies have found that we tend to convince ourselves to always trust our first intuition although various evidence, e.g. from exam situations where students are allowed to change their answers, goes against this as the best choice. And at auctions people generally bid more money on a good in order to win it than they have assessed it to be worth before the bidding. Whereas the first example arises largely as a consequence of inherited cognitive brain-mechanisms the second more likely occurs as a result of mental short-cuts while the latter is probably more associated with social influences or emotions. However, all the examples are driven by processes and mechanisms in the brain that we to a large extent are unaware of when they induce a reaction (in line with how intuition works). Thus, avoiding them is hard but in some cases it is possible to work our way around them if we get to know more about them. For instance, always choosing a line to the left will give an advantage to the extent that the others are unaware of this right-oriented bias and therefore do not change behavior.

The general objective for this thesis has been to study and understand behavioral biases in a broader context, typically by looking into research in psychology and educational learnings literature, in order to mirror these tendencies onto accounting-specific contexts. While the behavioral research stream for long has shown its worth in economics and gradually also in finance, behavioral accounting research seems to be forthcoming but still more modestly represented. However, various aspects in the field of accounting rely on individual judgements in uncertain situations. E.g. firm management need to predict benefits of a new investment, financial analysts need to forecast future market developments and auditors must assess whether financial statements correctly reflect the situation in a firm. By focusing on financial analysts' decision process when making forecasts the main objective of this thesis is not to observe behavioral biases on the market level, but rather to provide insights to when and why these biases may occur at the individual level.

A secondary motivation and objective for this thesis has been to learn the experimental method. As a university student the tools and learning insights for data collection, e.g. to larger assignments, are usually concentrated more on surveys, interviews and increasingly on archival data compared to experiments. At least this has been the case in the areas of my studies. Although there may be several good reasons for this focus in the class-rooms, the experimental method in the context of academic research is more prioritized.

2. BACKGROUND

The literature on financial analysts is rather rich and has various focuses. The main cause of the widespread attention is the analysts' central role in the capital markets. They are generally viewed as the most prominent users of accounting information and act as information intermediators between firm management and investors (Givoly and Lakonishok 1984; Schipper 1991; Brown 1993; Lang and Lundholm 1996). Thus, biased outputs may consequently lead investors to make sub-optimal investment decisions (Abarbanell et al. 1995) and therefore research aims at getting a profound understanding of the quality of the outputs in order to improve these as proxies for future movements in the capital markets (Kothari 2001).

Financial analysts can be divided in two broad groups– the sell-side analysts and the buy-side analysts. However, the literature generally argues that sell-side analysts are better informed and more sophisticated than the buy-side analysts (Day 1986; Schipper 1991; Bence et al. 1995) partly because buy-side analysts often rely on sell-side analysts outputs (Core 2001; Fogarty and Rogers 2005; Galanti 2006; Abhayawansa et al. 2015).

The outputs from sell-side analysts are rich including forecasts of earnings and cash flows, price targets, written reports and recommendations (e.g. Womack, 1996; Barber et al., 2001; Brav and Lehavy 2003; Asquith et al., 2005; Bradshaw 2011). Although it is argued that analysts' outputs have dynamic influences and thus should be seen as a whole (e.g. Brown et. al. 2015), research tends to isolate the output of interest for simplification. Earnings forecasts are generally considered one of the most central outputs (Barker and Imam 2008) and have historically been given the most attention (Givoly and Lakonishok 1984; Schipper 1991; Brown 1993; Kothari 2001; Bradshaw 2011).

Within the literature of analysts' earnings forecasts a distinction between the focus of research can also be made. One stream focuses merely on the input side, including reporting quality (e.g. Hopkins 1996; Duru and Reeb 2002; Hirst et al. 2004) and management incentives (e.g. Brown 2001; Matsunaga and Park 2001; Matsumoto 2002; Skinner and Sloan 2002; Mayew 2008). Another stream focuses solely on the output side including market reactions (e.g. Stickel 1991; Gleason and Lee 2003; Ivkovic and Jegadeesh 2004; Frankel et al. 2006; Altinkilic and Hansen 2009; Loh and Stulz 2011), informativeness (e.g. Lui and Thomas 2002; Clement and Tse 2003), and explanatory power for future market movements (e.g. Dechow and Sloan 1997; Shane and Brous 2001; Theo and Wong 2002). And yet some focus more exclusively on the individual analysts (Dugar and Nathan 1995; Lin and McNichols 1998; Brown 2001; Hirst et al. 2004; Jacob et al. 2008). It is in the latter perspective research of analysts' decision making processes and potential biases are centered.

The most widely observed systematic biases in financial analysts' forecast are general optimism¹ (e.g. Francis and Philbrick 1993; Lin and McNichols 1998; Dechow et al., 2000; Bradshaw et al. 2006; Libby and Rennekamp 2012; Cheng et al. 2013), pronounced herding behavior² (e.g. Hong et al. 2000; Hirshleifer and Hong 2003; Guedj and Bouchaud 2005; Clement and Tse 2005; Seybert and Bloomfield 2009; Jegadeesh and Kim 2009; Durand et al. 2014) and prominent underreaction to news³ (e.g. Shane and Brous 2001; Markov and Tan 2006; Friesen and Weller 2006).

A rather narrow stream in this literature focuses merely on theories from the psychology literature and on cognitive biases to explain these behaviors of

¹ The tendency to provide higher forecasts than realized.

² The tendency to follow the consensus estimate generated from the forecast of other analysts.

³ The tendency to hesitate to fully react in the instant upcoming forecast to new information released in the market.

financial analysts (Markov and Tan 2006; Friesen and Weller 2006; Seybert and Bloomfield 2009; Libby and Rennekamp 2012).

Friesen and Weller (2006) call for more focus on psychological factors as potential drivers for biases in financial analysts' forecasts and Zhang (2006) argues that a more comprehensive understanding of systematic biases in financial analysts' forecasts includes an expanded focus on psychological factors. Further, recent reviews of the literature also underline this need for an increased understanding of the cause of these biases by focusing on analysts' personal traits (Ramnath et al. 2008; Bradshaw 2011) and argue that other methods than empirical studies relying on archival data need to be applied (Bradshaw 2011; Brown 2015).

This thesis seeks to respond to these calls. Thus, to sum up, this thesis is merely concentrated on financial analysts' forecasts at the sell-side with a main focus on individual analysts' decision process, personal traits and characteristics in order to deepen our understanding of when and why behavioral biases occur. Specifically, the first paper included in this thesis (referred to as Paper 1) concentrate on herding behaviors in forecasting by proposing individual risk-willingness as an explanatory variable. The second paper included in this thesis (referred to as Paper 2) includes individual confidence (in own estimates) as an explanatory variable of non-revisions in forecasts after the release of new information, indicating this to be a central tenet in explaining the general underreaction to news observed in financial markets. The third paper included in this thesis (referred to as Paper 3) concentrates on the potential effects on forecasting behavior of a feedback-channel between information intermediators and end-user. This feedback-channel is an integrated part of an existing compensation system for financial analysts. Thus, this paper expands the view compared to the other two papers by including the

uses of the forecasts (investors) additional to solely concentrate on the issuers of forecasts (analysts).

3. THEORY

Focusing on financial analysts' decision making in the context of issuing earnings forecasts the environment is highly uncertain (and ambiguous) but they are forced to making decisions under these circumstances on an everyday basis. Thus, theories about decision making under uncertainty are applicable in this context and highly relevant in order to understand when and why analysts' behavioral biases occur and affect their forecasts.

All three papers rely heavily on theories of decision making under uncertainty and cognitive biases mainly from the literature of psychology. This section gives a general explanation of how theories of decision making has developed and how the perspectives have increasingly aligned across the two dominant areas of literatures, economics and psychology, in order to position this thesis in a broader theoretical sense. At the end of this section the position in each of the three papers included in this thesis is stated. However, detailed descriptions of the specific theories that hypotheses are built on in the three papers can be found within each of the papers.

3.1. Rational Decision Making

Decision making under risk and uncertainty can be traced back to the neoclassic economic theory by Von Neumann and Morgenstern (1944), the expected utility theory (EUT). While EUT models how people *should* make decisions (by maximizing expected utility) the psychology literature is more interested in addressing how people *actually* make decisions and thus challenges some of the basic assumptions in the economic models. Prospect theory⁴ (PT) by Kahneman and Tversky (1979) suggests that individuals systematically violate basic

⁴ It is also in this theory the S-shaped value function was developed, illustrating loss-aversion. More specifically, loss-aversion occurs when mental accounting is framed by gains and losses.

assumptions in EUT. Thus at this time economic- and psychological literature had very different stands and the research perspective differed substantially between being narrative and descriptive.

While both EUT and PT explain behaviors of individuals facing choices with known probabilities these led to another stream of theories concerning choices with unknown probabilities. Savage (1954) developed the subjective expected utility (SEU) from EUT and relaxed some of the rather strict assumptions. In short, SEU allows people to make different (but still fully rational) decisions because of differences in either individual utility functions or individual beliefs. SEU combined with Bayesian inference (on probability and updating beliefs) has gained much attention. Relying on the Bayesian approach, research first focused on building models to make forecasts (e.g. Harrison and Stevens 1971, Pole et al. 1994). In addition, the Bayesian approach was found useful for understanding how individuals conduct forecasts. Applying Bayesian rules to subjective probabilities (i.e. taking perspectives from SEU into account) a ground for economic literature and the literature of psychology to agree on the usefulness of this methodology and its applicability is built and behavioral economics and –psychology developed). Hence, research is able to better test how individuals make decisions under uncertainty since it allows for each individual to differently weight each piece of information with individual probabilities at given points of time only constrained by rationality (see Goldstein (2006) for a critical view). Thus, studies on cognitive biases no longer necessarily reflect a dismissal of the rationality assumption⁵ (as most economic theories in the field of decision making under uncertainty relies on).

⁵ As an example from the literature on financial analysts where this approach is applied see Friesen and Weller (2006).

As an alternative to mathematical modeling, Simon (1955; 1979) developed the idea of bounded rationality which broadly suggests that individuals are limited in their decision making by cognitive constraints amongst other limitations. Thus, according to this the perfectly rational solution is often not possible and therefore individuals seek to make a satisfactory solution instead. However, whether or not bounded rational behaviors, and thus behaviors limited by cognitive biases, can be defined as rational is unclear because the view on rationality differs between perspectives, research traditions and sometimes even between scholars within the same research field.

3.2. Cognitive Biases

Cognitive biases can be viewed as processes in our mindset that lead to systematic deviations from standard rational decision models. They are argued to occur primarily due to mental short-cuts, also referred to as heuristics, which can be caused by innate traits, personal characteristics as well as social influences (e.g. Kahneman et al. 1982; Gilovich et al. 2002). These short-cuts are in many cases ideal for making (quick) decisions (Gigerenzer, G. 1996) but in other cases lead to biased decision making. The work of Simon has set the ground for most theoretical frameworks and observations in the context of cognitive biases especially reflected in a long series of papers by Kahneman and Tversky. The observation of these cognitive biases has spread across various disciplines and literatures, including economics. There are many examples of observed cognitive biases e.g. the tendency to value a good higher just because it is in one's own position (the endowment effect, Kahneman et al. 1991), a tendency to have unstable preferences of an outcome just because the (same) situation is described from different perspectives (the framing effect, Tversky and Kahneman 1981), the tendency to overestimate the probability of an event just because it is in fresh memory (availability heuristic, Tversky and Kahneman 1973), the tendency to be

more negatively affected by a loss than positively affected by a gain at the same size (loss-aversion and disposition effect, Kahneman and Tversky 1979).

In order to map thinking based on cognitive biases Tversky and Kahneman (1971) came up with a framework that has later been named System 1 and System 2 by Stanovich and West (2000) and gained renewed attention after the release of Kahneman's book "Thinking, fast and slow (2011). System 1 is characterized by fast, effortless and automatic processes and System 2 is characterized by slow, effortful and controlled processes. Whereas System 1 is merely based on intuition and habits which are hard to modify (Kahneman 2003), System 2 is based on elaborated reasoning and thus can more easily be modified e.g. through learning and feedback (Einhorn & Hogarth 1981).

There is a general agreement that the two systems should not solely be considered as parallel but interact with each other and can be activated at the same time. However, thinking of the two systems in isolation may make it easier to distinguish between processes and theories in decision making as opposed to trying to resolve whether or not a given behavior is rational or not, because the latter is more dependent on the viewpoint of the researcher. Therefore, drawing parallels to the two-system view (although this distinction is not explicitly made in the papers included in this thesis) this thesis is generally positioned in decision making by cognitions integrated in System 1 (with one exception being the last hypothesis in Paper 3).

Paper 1 argues that social influences are central for herding behavior. Thus, the tendency to follow others with your own decision (herding), occurs partly as an intuitive reaction to feeling uncertain about the decision to be made (Baddeley 2010) making the use of available heuristics more likely (Tversky and Kahneman 1974; Gilovich et al. 2002; Kahneman 2011) and thus rely merely on explanations related to System 1 thinking. This paper posits that a greater cognitive resistance

towards uncertainty and risk leads to a greater likelihood of herding. This is the basis for suggesting that individual risk-willingness is positively related to herding towards a consensus estimate when financial forecasts are made. Paper 2 argues that non-revisions in the context of issuing financial forecasts can be a reflection of confirmation bias, the tendency to discard contradicting information in order to reduce cognitive dissonance (Festinger 1957; Mahoney 1977), and consequently lead to underreactions to new information (Lichtenstein et al.1977). Thus, new information is unconsciously treated as confirmatory suggesting System 1 is merely activated. Because people with a higher confidence in their own beliefs are more likely to be subjects of confirmation bias this paper posits that individual confidence in an initial financial forecast is positively related to the likelihood of not revising that forecast following new information.

In Paper 3 argues that the expectation of receiving feedback alone has an impact on how a task is approached because the need to retain a positive self-image (Festinger 1954; Steele 1988), by receiving positive feedback, is awakened in the cognitive processes in System 1. Therefore, this paper posits that information intermediators will issue financial forecasts more in line with the requests of the end-users when they expect them to provide feedback. Additionally, the end-users who provide feedback are expected to approach the task with more awareness and attention in line with evidence from educational literature (as opposed to the end-users that does not provide feedback) because this appeals to meta-cognitive processes within System 2. Thus, it is proposed that providing feedback will increase the end-users critical evaluation of the financial forecasts received from the information-intermediators.

4. RESEARCH METHOD

The use of experiments to examine hypotheses has a long tradition in many research fields. Conducting experiments have always been especially popular to directly test effects e.g. from new products in the medical industry or behaviors related to a new political intervention. This is because the experimental method allows isolating the variables of interest from confounding variables. Thus, it is possible to observe the pure effect of the variable of interest and draw more causal conclusions than allowed from data gathered by other research methods such as surveys, interviews or archival datasets. The experimental method is therefore characterized by a high internal validity but on the other hand, the generalizability of the results from experimental studies is usually low as a result of the controlled environment (e.g. Smith 2014 amongst many others). In other words, experiments have the advantage of narrowing down the view to the problem of interest but this “snap-shot” approach means that typical dynamics existing in real-world settings are not taken into account. Conversely, empirical research relying on archival data may include various factors that could interact with the main variables of interest and may span a long time. This method therefore has high generalizability but because various factors are at play at the same time the internal validity is typically somewhat vague. Thus, the magnitude of an effect found in an experiment and its persistence in other settings are hard to determine or predict but the documentation and cause of the effect is typically concise as opposed to effects observed in archival data.

In the accounting literature archival data is by far the most prominent basis for published papers in the top-ranked journals (Oler et al. 2010). However, the use of experiments has been growing for the past decade and the attention to experimental research in the accounting literature seems to continue to grow (Bloomfield et al. 2016). One of the main motivations to do experimental research

in this thesis rather than to rely on archival data has been to elude the risk of being limited by the access to data. First, considering that my research questions are concerned with behaviors at the individual level many variables of interest are not included in the databases and thus indirect proxies would have to be used. As an example, gender is often used as a rough proxy of risk-willingness but also for confidence (as an example, see Barber and Odean 2001). Two of the papers in this thesis (Paper 1 and Paper 2) investigate these two variables as explanatory for behavioral biases and thus it is crucial for this thesis to apply more direct measurements of these. Second, one of the papers in this thesis (Paper 3) is investigating behavioral effects of an existing compensation system in the market called the broker vote system. These so-called votes, on which this system is based, are not publicly accessible (Maber et al. 2014) but research call for more attention on the system (Brown et al. 2015). By using the experimental method the central mechanism of interest in the broker vote system, a feedback-channel between an information intermediary and an end-user of the information, can be simulated in the lab and thus investigated more directly and without the requirement of data-access.

Relying on theories suggesting that human behavior is sometimes limited by cognitive restrictions which may lead to decisions based on intuition or driven by social forces it is implicitly assumed that people are not always aware of these biases. Thus, if this thesis was merely based on data from alternative methods like surveys or interviews the conclusions are likely to be biased by peoples' self-perception rather than reflecting their true behavior. This also explains why I have chosen the experimental method where it is possible to observe actual behavior instead of attempting to infer it. However, relying on surveys and especially interviews would have been beneficial in order to support arguments of the underlying reasons behind behavioral patterns and thus increase the possibility of

making discrimination between the underlying theories. Although there is still a risk of biases caused by peoples' self-perception, debriefings and enclosed check-questions or a questionnaire in the experimental materials has been used to address this. This allows me to examine if some of the key variables suffer from peoples self-perception and therefore also increases the validity of the results reported.

The long tradition in both psychology and economics to use experiments has led to a list of general procedures including for instance randomization, voluntary participation and disguising the exact purpose of the experiment. Because the general procedures in economic experiments are far stricter than in psychological experiments, e.g. participants must be incentivized, typically by money, and they may not be deceived in any way in terms of hidden information etc., the experiments in this thesis were designed with a special attention to the procedures applied in economic experiments.

4.1. Design of Experiments

The three papers (referred to as Paper 1, Paper 2 and Paper 3) included in this thesis rely on data from two experiments. For simplification the first experiment, which both Paper 1 and Paper 2 rely on, is referred to as Experiment A and the second experiment, which Paper 3 relies on, is referred to as Experiment B. Relevant experimental materials are provided in the appendices. Below is a description of the two experiments.

4.1.1. Experiment A

In this experiment the main task is referred to as the forecasting task. Here participants are asked to forecast EPS one year ahead for a given firm (referred to as Step 1). Available information they may base this forecast on are rather rich in information including financial statements, expectations about the industry and an EPS forecast from management (See Step 1 in Figure 1 below or Appendix A for

details about the information in the experimental materials). Thus, the participants have access to various pieces of information in order to best reflect the ambiguity faced by real-world analysts. As opposed to it they were allowed to gather the information themselves e.g. from the internet (which would probably have been closer to a real-world setting) this setting allows me to keep control over all the accessible information. After they have made their EPS forecast the participants are informed that half of the year has passed and they now receive new information from which they may choose to revise their EPS forecast for the year (referred to as Step 2). The new information includes second quarterly reports from this and last year and a statement that management withholds their EPS forecast for the year (See Step 2 in Figure 1 below or the example in Appendix B for details about the information the experimental materials). Striving to reflect a real-world setting largely all information available to the participants is actual information gathered from an existing firm. However, the identity of the firm is disguised to the participants in order to avoid that initial perceptions about the firm will affect their answers in the experiment. Whereas Step 1 includes the exact same information across all participants, and thus creates a baseline, Step 2 has varying information across participants along two dimensions forming four groups (a 2x2 between-subject design). These two dimensions are referred to as treatments and the variations of information between the four groups are illustrated in the separate boxes in Figure 1, Step 2 below.

Figure 1

An Illustration of the Steps and how Information is Distributed between Participants in the Forecasting Task.

Step 1

All participants receive the same information and make a one-year ahead forecast of EPS. We call this forecast F1.

289 participants receive qualitative and quantitative information including:
<ul style="list-style-type: none"> • Company information (i.e. number of stores and product information) • Industry information (i.e. competitive situation) • A chart illustrating historical stock price development • Selected financial figures from the last four years income statements (including number of outstanding shares) • Expectations for the (retail) industry (i.e. opportunities in online sales) • Expectations for the firm (i.e. management expectations for next year's EPS)

Step 2

Some information are given to all participants while other information vary between four groups. Participants then revise their EPS forecast. We call this forecast F2.

289 participants receive information that the first quarter went as expected and are given the same figures about last year's second quarterly report.	74 participants receive good news and a consensus estimate	289 participants receive information that management does not revise their expectations for the year based on this year's second quarterly report.
	73 participants receive bad news and a consensus estimate	
	75 participants receive good news but no consensus estimate	
	67 participants receive bad news but no consensus estimate	

Consensus-treatment

In this treatment one half of the participants receives a consensus estimate (\$2.14 EPS) based on the average of 11 EPS forecasts made by others. In a real-world setting financial analysts usually have access to forecasts made by other analysts which they may perceive as worse or better informed and/or less or more skilled than themselves and therefore choose to rely little or heavily on. However, they all have the same title as financial analysts. Conversely, if the students in my experiment are informed that the consensus forecasts are conducted by 11 other analysts they may perceive this estimate as made by experts as opposed to someone with the same "title" as themselves. Thus, to the degree they consider themselves novice compared to professional analysts it is likely that they choose to allocate more weight on the consensus forecasts, in the process of conducting their own forecast, than professional analysts normally does. To overcome this

potential imbalance between the experimental setting and the real-world the consensus estimate is framed as an average forecasts calculated from 11 colleagues (instead of 11 analysts). The primary objective of this treatment is to construct the central dependent measure of Paper 1 (measuring herding behavior but referred to as *boldness* in the paper). The other half of the participants, who does not receive a consensus estimate, acts as a control group and functions as an important input to this measure.

News-treatment

In this treatment one half of the participants receives bad news and the other half receives good news. The news is reflected by the second quarterly report having been manipulated upwards or downwards (with equal magnitudes). Further, those receiving bad (good) news get a statement from management that the quarter went below (above) the expected but that management maintain their expectations for the year i.e. they keep their EPS forecast for the year in both treatments. The primary objective is to investigate if the characteristic of news (bad or good) serves as a moderating effect as stated by the second hypothesis in Paper 1.

Additional Tasks

In both Step 1 and Step 2, the participants are asked to state a 90 % confidence interval within which they expect the EPS for the firm will fall. This task is included just after each of their two EPS forecasts. The primary objective of the confidence intervals is to construct central measures in Paper 2 (referred to as *confidence1*, *confidence2* and *changeconf*).

After the forecasting task is completed all participants must evaluate their own performance in the forecasting task compared to how they expect the other participants in the experiment performed. They may do so on a five-point scale with the middle point reflecting that they assess their own performance around

average (see appendix C where the task is disclosed). This task provides a measure used in Paper 1 and Paper 2 robustness checks in which I seek to eliminate the influence of a dimension of confidence referred to better-than-average effects that may unintentionally interact with central variables of the two papers).

Hereafter a short questionnaire is included to collect demographic information such as participant's age, gender, grade point average, disposable income etc. These answers serve as control variables in both Paper 1 and Paper 2. Participants are also asked to guess the main scope of the experiment by providing a couple of keywords. These are used to check if the overall purpose of the experiment is kept unknown to the participants.

Participants are also asked to state their general risk-willingness from a 10-point scale. Answers from this question serve as the central independent variable in Paper 1. The question, from the Socio-Economic Panel Study (SOEP, e.g. Wagner et al. 2007), is framed as follows:

How do you see yourself - Are you generally a person who is fully prepared to take risks or do you try to avoid taking risks? Please write a number between 1 and 10, where 1 means "not willing to take risks" and 10 means "very willing to take risks".

A valuation task is included in the experiment primarily as a distraction task between the forecasting task and the risk-related question in an attempt to avoid spill-over effects. In the valuation task the participants are asked to calculate the value of a given firm based on hard (numerical) information. An example is provided in appendix D. This task is chosen because it is course relevant and similar to tasks that may be included as a part of the final exam for the course. Thus, as a secondary purpose results of the valuation task are used as a proxy for course related skills included as a robustness check in Paper 2. Finally, as in the

forecasting task the participants are asked to state a 90 % confidence interval within which they expect that the correct answer in the valuation task falls. This can be used as proxy for miscalibration which is found to affect confidence and is therefore also included as a robustness check in Paper 2.

To keep early finishers occupied a section of a published academic papers covering next week's topic of the course and some Sudoku's were included at the end of the experiment.

4.1.2. Experiment B

In this experiment the participants are either assigned the role as a financial analysts or an investor. The financial analysts are asked to state an EPS forecast together with a written justification of that forecast for a given firm based on information that is framed as publicly available information and based on information that is framed as private information. The distribution of hard information between analysts and investors is illustrated in Table 1 below. The private information, which is only available to the analysts, is presented as a phone conversation with the CFO of the firm. Here the CFO expresses his concerns about the performance of a division in the firm indicating that the EPS will probably be lower than expected.

The investors are also asked to state an EPS forecast (framed as a trading decision) but their informational basis is reduced compared to the analysts' (in Table 1 the missing pieces of information are denoted N/A). However, each investor has access to one of the analysts' EPS forecast together with the analysts' written justification for that forecast (see appendix E5 for 'the attached sheet' where analysts state their answer and later this sheet is attached to the experimental materials of an investor). Thus, investors and analysts are matched up one-on-one in this experiment and the analysts are free to choose how much information they

want to pass on to the investors (via their written justification). The match-up are done with a time lag such that the analysts complete the experiment first and the investors that they are matched up with complete the experiment at the earliest one day after. For both analysts and investors there are two treatments along which information varies (following a 2x2x2 between-subjects design).

TABLE 1

Hard information distributed to analysts and investors for each company.

Company	n	Role	Last Quarter's Earnings	Analysts' Consensus			Next Quarter's Earnings		
				Estimate	Distribution	SD	Lower	Upper	Distribution
ABC	63	Analyst	2.40	2.40	normal	0.05	2.20	2.40	uniform
	48	Investor	2.40	2.40	normal	0.05	N/A	2.40	N/A
GHJ	65	Analyst	3.84	3.84	normal	0.08	3.52	3.84	uniform
	52	Investor	3.84	3.84	normal	0.08	N/A	3.84	N/A
MNO	67	Analyst	1.92	1.92	normal	0.04	1.76	1.92	uniform
	49	Investor	1.92	1.92	normal	0.04	N/A	1.92	N/A

Table 1 reveals the hard information available to analysts and investors respectively in the experimental materials.

Three different versions exist referred to with different company names.

The number of observations (n) are also included for each of the three versions for analysts and investors respectively.

Incentive-treatment

The analysts are randomly given one of two incentives – either to diverge from- or converge towards a consensus estimate (see appendix E for experimental materials where the exact formulation of these incentives is disclosed). The consensus estimate is disclosed for both analysts and investors. Making the analysts' (biasing) incentives transparent to the investors reflects a world with full disclosure of analysts' incentives. If the analysts follow their given incentive they earn more money which is known to the investors.

Feedback-treatment

Additional to the incentive treatment half the investors are asked to rate their matched-up analysts on a five-point scale. This requirement for the investors to provide feedback to their matched-up analysts by rating them is known to the analysts before they state their forecast and written justification. A high rating will result in a bonus to the analyst whereas the investors are only monetarily incentivized to provide accurate forecasts (framed as a trading decision). This feedback-treatment aims to simulate an existing system in the market called the broker vote system. Here investors allocate votes to analysts as a reward for making good research and the analysts' compensation structure are based on these votes.

Additional Tasks

After the forecasting task all participants are asked to answer eight questions including check-questions like *"were you playing the role as an analysts or an investor?"* and *"How much could you at maximum earn from the task?"* (see appendix F for all questions to the analysts and investors respectively). These are merely used as exclusion criteria to make sure that the participants remaining in the sample provided answers based on a fair understanding of the task. Other

questions are concerned with which considerations the participants had when completing the forecasting task including questions like “*Was helping the investor important when making your forecast?*” and “*Did you trust the analyst to make an honest forecast?*”. These questions are used for robustness checks to increase the understanding of the underlying reasons behind the participants’ behaviors in the experiment in order to support the argumentation in the analyses of the main results in the paper.

A short questionnaire is also included in order to make a detailed description of the respondents including the distribution of gender and experience with trading.

4.2. Planning

The two experiments were performed on students, in the classrooms (five different classes in each experiment) by paper. An alternative would be to recruit students for example via an online recruitment system, to which they have voluntarily assigned, and hereafter execute the experiments in an experimental lab. However, no such system or an experimental lab exists at CBS. Although in-class experiments often lay ground for published academic papers I considered the potential disadvantages from this procedure, compared to lab-based experiments, in order to take precautions as early in the design phase as possible. The most prominent of them are described in detail here.

4.2.1. Voluntary participation

Voluntary participation is important in order to assure motivation from the participants and thus avoid disturbing behaviors such as a participant providing intentional inconsistent answers in the experiment. For both experiments, which were executed in 2013 and 2015, respectively, it was announced one week ahead to the students and again on the day of the experiment. Further, the experiments were executed at the end of a lecture (after the topic of forecasting had been

extensively covered in class) in order to assure that students who did not wish to participate had the chance to leave class without further notice.

4.2.2. Individuality

Before the experiments were executed all students were asked to clean their desks so that only the things necessary to complete the experiment was accessible (i.e. pencils, calculator and the experimental material). The experiments contained a lot of different versions (Experiment A has 16 different versions and Experiment B has 24 different versions); a fact which was explicitly made known to the students. The various versions served not only a purpose in relation to the design of treatments but also in order to address the potential issue that the participants did not sit in a lab with isolated booths but instead sat in a classroom. The experimenter was present in the classroom while the experiment was completed and did not observe any attempt from students to communicate.

4.2.3. Randomization

In Experiment A the 289 participants are randomly assigned a version of the experiment leading to a roughly equally distribution of participants between the four groups in the forecasting task (see Figure 1, Step 2 for the number of participants in each group). In Experiment B the randomization approach is a little constrained by the matching requirement (see Table 1 where the number of participants in each group is reported). Because the experiments are conducted at different times it is possible to match up two participants entailing that the second participant (the investor) has access to the first participant's (the analyst) answer in the task. Consequently, the overall distribution of different versions of the experiments was not completely random between classes in terms of the role (analyst or investor) but how the different versions were hereafter distributed between students was totally random

4.2.4. Coding

For both experiments, I manually coded all the answers from paper into an excel file. Hereafter I randomly drew 25 experiments and checked the coding. When there was no errors found another researcher recoded 25 experiments for comparison. This procedure was done in order to avoid errors and adjust for possible subjective perceptions that could unintentionally affect the coding. Finally the file was exported into Stata where all statistical analyses have been made. Although this coding-procedure demanded a lot of time, which would have been avoided in a computer-based experiment, it gave me a good overview of the collected data and thus I assess that it has saved me some time in the phases of constructing variables and during descriptive analyses.

4.3. General Considerations and Possible Limitations

Considerations prior to designing and executing an experiment were remarkably widespread spanning from practicalities to carefully choosing the correct wordings in the experimental materials. To the point where the design of the experiment was satisfactory additional obstacles appeared in terms of complying with general Danish- as well as internal university rules concerning ethics, relevance, approvals, monetary payments etc. Significant demands for changes to the design in order to comply with the rules were few but potentially impactful. All students that receive payments from experiments are required to be registered by social security number etc. which provides two main concerns. First, it is important to assure the students that their answers in the experiment remain anonymous although they need to disclose sensitive personal information in order to collect their payments. Since most of the students are Danish they are rather used to this kind of requirements so even when I explained this requirement prior to experiments being performed no student expressed any concern according to this procedure. Second, as a consequence of the rules of registration the payments

were delayed and could not be given in cash. According to the literature in experimental economics these feature may potentially affect how people behave in an experiment and the monetary motivation can be smaller.

4.3.1. Subjects

I use graduate students within the areas of accounting and finance as participants in the two experiments that this thesis is based on. The benefits of using students instead of professionals are that the sample size typically is larger because financial analysts, as with most professionals in the context of accounting research, are less accessible, highly time constrained and harder to motivate (Libby et al. 2002). However, an ongoing discussion in experimental accounting research, as well as in many other streams of literature, is whether or not the use of students as surrogates for professionals is acceptable or decreases the external validity (see Liyanarachchi 2007 for a recent review on this matter in the literature of financial accounting).

In the 1970s professional subjects in experimental research was considered crucial but for at least the last couple of decades, top journals in accounting have increasingly accepted studies using students instead of professionals (Smith 2014). As examples, Bloomfield and Hales (2002) use students as surrogates for investors, Magilke et al. (2009) use students as surrogates for auditors, Libby and Rennekamp (2012) use students as surrogates for managers and Kadous et al. (2006) use students as surrogates for financial analysts. These are all published in top-journals.

It seems to be especially accepted to use students in psychological contexts like information processing because students should not behave differently than professionals (Ashton and Kramer 1980). Therefore, some argue that experimental research generally overstates the potential drawbacks of using students (Brownell

1995). Thus, to the extent that the behaviors of interest do not depend on analyst specific characteristics, students are sometimes even preferable to professionals (Peecher and Solomon 2001; Libby et al. 2002). For instance, in the literature on financial analysts Whitecotton (1996) finds that analysts are even more subject to optimism bias than students. Further, Elliott et al. (2007) conclude that students are a valid proxy for professionals when enrolled in a financial statement analysis course as long as the complexity of the task used in the experiment is aligned with the level of the students.

In my two experiments, all 633 students were enrolled in the course financial statement analysis and valuation. Also, they have on average completed more than five accounting and finance courses. Further, more than 40 % of the participants are active investors in stocks and around 70 % have a relevant part-time job. Thus I assess that students are appropriate participants in my experiments given that the focus is on behavioral biases, which are argued to be at least as present in professionals as in students, and further given that the students are well 'educated' to complete the tasks included in the experiments. Therefore, I do not consider the use of students in the experiments of this thesis a limitation nor do I expect it to decrease the external validity of the results.

4.3.2. Pre-tests

Experiments typically incentivize by money and are therefore often expensive to run. Further, an experiment cannot be rerun using the same participants if something goes wrong. Thus, it is crucial that the design of the experiment is acceptable before it is executed. In an attempt to assure that the design of the experiment is satisfactory pre-tests are often used. They may give an indication of how the final results are going to turn out and any discussions with the pre-test participants after they have completed the experiment can be valuable. For example there could be wordings in the experiment that are easily misunderstood

or the participants might add considerations and reasons behind their answers to the experiment that the researcher did not think about.

In both experiments, pre-tests were executed in order to test the design of the experiments and to discuss any consideration that may have come to mind for participants when completing the experiment. First, the experiments were completed by a few colleagues and hereafter we discussed their answers and considerations they had had, leading to some changes in the experimental materials. Hereafter the experiments were tested by students (Experiment A was tested by a class of Graduate Diploma students in accounting and Experiment B was tested by a class of Undergraduate students enrolled in the course Behavioral Finance and later by a class of Graduate students in auditing) which gave an indication of where to set an appropriate time-limit of the experiment and also how the results would turn out. Minor changes were done to the experimental materials after these pre-tests and the experiments were again completed and discussed with a handful of (other) colleagues before they were performed in the classrooms. Naturally, all results of the pre-tests are excluded from the final samples.

5. CONTRIBUTION, IMPLICATIONS AND LIMITATIONS

This thesis broadly contributes to the literature on financial analysts' forecasts by shedding light on how mental constraints and social forces affect decision making at the individual level. Thus, drawing on theories from the educational literature and the literature of psychology can contribute to our understanding of when and why financial analysts are subjects to behavioral biases in the process of forecasting.

More specifically, this thesis makes at least three separate contributions. First, herding behaviors in the context of financial forecasts are influenced by individual risk-willingness. Not only does this suggest that herding behaviors exist beyond rational and strategic explanations like informational- or reputational herding, it also indicates that herding towards a consensus can be an intuitive reaction connected to mental short-cuts and behavioral biases. Thus, personal traits are likely to affect decision making in the context of financial analysts' forecasts to a larger extent than currently reflected in the literature. Second, when an initial forecast is conducted with high confidence the likelihood of being subject to confirmation bias increases. Confirmation bias can explain why some individuals hesitate to revise a prior forecast although new market information arrives. This finding adds to our understanding of why financial analysts have a general tendency to underreact to new information beyond existing explanations based on strategic incentives. Third, incentive systems based on integrated feedback-channels between an information intermediary and end-user reduce biases in the information to the end-users and enhance the end-users critical evaluation of that information. This contributes to the ongoing debate between researchers and regulators if the broker vote system, which has a build-in feedback-channel between financial analysts and investors, should be abolished or maintained.

Complementing the rather narrow stream of behavioral accounting research, the findings of this thesis have general implications for the literature on financial analysts' forecasts by suggesting that an enhanced focus on decision theories from the psychology literature can be applicable to investigate behavioral biases at the individual level. Future research can implement the perspective of this thesis suggesting that unconscious processes such as intuition and cognitive biases may be important to consider in explaining observed forecast biases like optimism bias or underreactions to news. This thesis also proposes an alternative way of measuring herding behavior in controlled environments which future research may adapt. Further, it provides indications that increased confidence as a consequence of non-revisions affects the preferences for performance based payments. Future research may more directly address this issue in the context of bonus structures.

To the extent that findings from this thesis persist in real-world settings, practical implications are especially relevant for regulators. First, the positive effects of incentivized feedback-channels indeed suggest that the broker vote system should be maintained, or at least that a system with similar features should be used instead. Similar systems might also be considered outside the context of analyst-investor associations where the end-user of information needs to be critical in their interpretation hereof. Second, to the extent that the biases observed in financial analysts' forecasts can be explained by cognitive constraints and thus translates into more unconscious reactions, regulations in terms of disclosure may not have the sufficient effect. Further, findings in this thesis rely on personal traits as explanatory factors to behavioral biases present in the context of financial analysts' forecasts. Therefore, analysts who are exposed to these biases may continue to (unintentionally) do so even under different circumstances suggesting that more customized regulations and increased accessibility of analyst specific data may be useful to investors. The findings of this thesis may also have

implications for financial analysts to the extent that they are interested in evading potential behavioral biases.

The common generalizability limitations for studies based on experimental methods are not an exception for findings in this thesis. Thus, the magnitude and persistence of the results in real-world settings is hard to predict because other factors than those in focus in this thesis may have moderating effects. As examples, whereas this thesis can document individual risk-willingness as an important explanatory variable of herding behaviors on the individual level it cannot make conclusions about to what extent this effect contributes to the observed herding behavior of financial analysts' forecast on the market level. Nor is it possible to compare with effects stemming from informational- or strategic herding. Similar limitations of generalizability apply to estimating whether the confirmation bias explanation for non-revisions can explain underreactions to news in financial analysts' forecasts observed at the market level. Further, the documented positive effects from incentivized feedback-channels similar to central mechanisms in the broker vote system are potentially limited by relationships between the agents that could be developing in the long run. More specifically, if analysts and investors develops loyal relationships the allocation of votes may be affected by this relation and thus potentially compromising the welfare-enhancing effects. However, current literature investigating this issue has found no support for this speculation but in order to expand our knowledge on this issue increased data access is needed.

Despite of these limitations, findings from this thesis provides important indications of personal traits and cognitive biases as explanations for errors in decision making in the context of financial analysts' forecasts.

6. APPENDICES

APPENDIX A - AVAILABLE INFORMATION TO ALL PARTICIPANTS PRIOR TO STATING THEIR FIRST FORECAST

Forecasting Task

On the next page you are asked to state your **one-year-ahead earnings per share (EPS) forecast** for a particular company. Today is year 0 and you are asked to forecast EPS for year 1.

$$\text{EPS} = \text{Net Income} / \text{Number of Shares}$$

The company is an actual listed company but in this experiment you will just know it as “The Firm”.

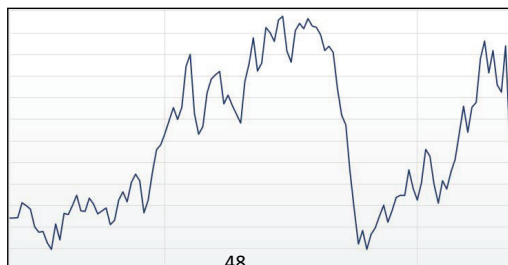
Company info:

The Firm was founded in 1892 and operates today through 842 stores in the United States, and 157 stores in Canada, Europe, Asia, and Australia. The Firm is within the retail industry with clothes as the main product line. The Firm’s products are considered to be medium-price. The sales are highly seasonal and usually peak in the spring and fall. Approximately 25 % of The Firm’s total revenue comes from online sales. According to The Firm: *“The brand is our lifestyle, our focus—the value of having a great brand is far-reaching and cannot be overstated—it’s a snowball effect”*.

Industry info:

The industry is known by its intense competition between its many players which is characterized by very volatile earnings and volatile stock prices. Within the last five years The Firm has experienced many new competitors which can be of future threat according to The Firm itself: *“In light of the competitive challenges we face, we may not be able to compete successfully in the future. Further increase in competition could reduce our sales and harm our operating results and business”*.

This figure illustrates the development in stock prices for The Firm in the last ten years:



The Firm's Income Statement from the annual report.

(year 0 = current, year -3 = three years ago)

(in thousand \$)	Year -3	Year -2	Year -1	Year 0
Revenue	3,468,777	4,158,058	4,510,805	4,116,897
<u>Cost of Revenue</u>	<u>-1,251,348</u>	<u>-1,607,834</u>	<u>-1,694,096</u>	<u>-1,541,462</u>
Gross Profit	2,217,429	2,550,224	2,816,709	2,575,435
Sales, General etc.	-1,980,249	-2,260,818	-2,435,069	-2,366,397
<u>Non-Recurring Items</u>	<u>0</u>	<u>-68,022</u>	<u>-7,407</u>	<u>-128,215</u>
Operating Income/EBIT	237,180	221,384	374,233	80,823
<u>Interest Expense</u>	<u>-3,362</u>	<u>-3,577</u>	<u>-7,288</u>	<u>-7,546</u>
Earnings Before Tax/EBT	233,818	217,807	366,945	73,277
<u>Income Tax</u>	<u>-78,109</u>	<u>-74,669</u>	<u>-129,934</u>	<u>-18,649</u>
Net Income	155,709	143,934	237,011	54,628
EPS (\$)	1.67	1.47	2.85	1.45
Stock price (\$)	45.64	58.70	49.61	46.20
Total Outstanding Shares (thousand, Year 0 and 1)	-----	-----	-----	37,693

Expectations for the industry:

The National Retail Foundation (NRF) says its retail sales forecast for year 1 predicts a growth of 4.1% (3.7 % year 0). Online sales are expected to increase between 9% and 12% this year. The NRF President and CEO said: "Improvements in economic growth combined with positive expectations for continued consumer spending will put the retail industry in a relatively good place in year 1. Though headwinds from the looming debates about the debt ceiling, increased health care costs, and regulatory concerns still pose a risk for both consumers and retailers".

Expectations of The Firm:

The Firm partly explains the EPS level at year 0 by unusual expenses due to restructuring costs as well as an ongoing lawsuit about management ethics. The Firm expects little or no restructuring costs and no impact from the lawsuit in year 1. The Firm forecasts EPS for year 1 to be in the range of \$2.25 to \$2.35.

Task:

I expect the EPS for The Firm for year 1 to be \$ _____. With a probability of 90% I believe the EPS will then lie between \$ _____ and \$ _____.

APPENDIX B – AVAILABLE INFORMATION IN THE SECOND STAGE BEFORE REVISING THEIR FORECASTS (THIS EXAMPLE IS FOR THE CONSENSUS GROUP RECEIVING BAD NEWS)

New information in the market

The first quarterly report for year 1 was roughly as expected. The second quarterly report for year 1, which just got released, reveals the following numbers.

Highlights from the second quarter report, year 0 and year 1, in thousand \$:

	Year 0, Q2	Year 1, Q2
Revenue	945,698	<u>890,605</u>
Gross profit	604,122	<u>552,956</u>
Operating income/EBIT	19,165	<u>17,493</u>
Net Income	11,371	<u>10,877</u>

After the release of the second quarterly report the CEO of The Firm said in a press release: “Because of a continued challenging environment, our sales for the second quarter were somewhat below plan.” However, The Firm does not revise their total expectations for year 1.

On the other hand, based on 14 estimates from your colleagues, expected EPS for The Firm at year 1 is downgraded to an average (consensus) of \$2.14.

Please revise your EPS forecast for The Firm for year 1 (If you do not deem a revision necessary, please write your forecast from the prior task again).

Task:

I now expect the EPS for The Firm for year 1 to be \$ _____. With a probability of 90% I believe the EPS will then lie between \$ _____ and \$ _____.

APPENDIX C – ASSESSMENT OF OWN PERFORMANCE

Performance Task

Please evaluate how you consider your own performance, of forecasting EPS for The Firm, compared to your fellow students.

Tick off the box that best represents your performance:

1. ☐ I expect my performance in the forecasting task to be in the top 20 % of the class.
2. ☐ I expect my performance in the forecasting task to be above average but not in the top 20 % of the class.
3. ☐ I expect my performance in the forecasting task to be around average of the class.
4. ☐ I expect my performance in the forecasting task to be below average but not in the bottom 20 % of the class.
5. ☐ I expect my performance in the forecasting task to be in the bottom 20 % of the class.

APPENDIX D – THE VALUATION TASK

Valuation Task

In this task you are asked to state your valuation estimate at the end of year 0 for a particular company.

The company is an actual listed company but in this experiment you will just know it as "The Company".

Information

The following information is selected from the annual report of year 0 for The Company:

(in thousand DKK)	Year 0 (book)	Year 1 (expected)
NOPAT	381	389
Financial income	212	216
Financial expenses	-372	-379
Invested Capital	8,252	8,417

Assets	Year 0	Year 1	Liabilities	Year 0	Year 1
Operating	12,995	13,255	Operating	4,743	4,838
Financial	0	0	Financial	2,579	2,631
			Equity	5,673	5,786

Assumptions for The Company:

- A constant WACC of 6 %
- An infinite, constant growth rate at 2 %

Task:

I estimate the enterprise value (EV) of The Company at the end of year 0 to be thousand DKK _____. With a probability of 90% I believe the EV lies between thousand DKK _____ and thousand DKK _____.

APPENDIX E – EXPERIMENTAL MATERIALS IN EXPERIMENT B

E1 - EXPERIMENTAL MATERIALS FOR ANALYSTS WITH CONVERGE INCENTIVE AND NO FEEDBACK

Forecasting earnings as an analyst

Background

In this experiment, you will play the role of a *financial analyst* making an earnings forecast about ABC Company's quarterly earnings. Your forecast may help other CBS students (*the investors*) in later experiments. The *investors* will have access to the (consensus) forecast of other analysts, your forecast and justification, and may have access to your compensation scheme. The *investors* will make an investment decision that may result in their making or losing money depending on the actual earnings that the company announces (this will be announced sometime after the experiment is finished). You will forecast what the actual quarterly earnings will be for ABC based on the information below.

ABC Company

The company makes machines used in the food processing industry. Their quarterly earnings are generally quite stable. Last quarter the earnings were \$2.40.

Your Phone Call with the CFO

Yesterday, you had a private phone conversation with the CFO of ABC about the dairies (milk processing) division and the snacks division. The dairies division makes about 60 % of the profits of the company and it has been under pressure from a new entrant into the market. While the profit of the dairies division has been falling slightly, the profit at the snacks division has been increasing modestly. When the phone conversation turned to the performance of the dairies division, the CFO seemed very nervous and defensive.

Your Earnings View

For this quarter, recent forecasts of the 10 other analysts are normally distributed (with a standard deviation of 0.05) around an average (consensus) of \$2.40 that is identical to last quarter's earnings. The other analysts are not aware of your phone call and will not be talking to the CFO themselves. Therefore, you decide the consensus forecast is probably too optimistic

about the dairies division. You (correctly) believe the earnings could be anywhere between \$2.20 and \$2.40 (uniformly distributed).

Your Compensation

One analyst is expected to be fired at your firm. You probably won't be fired if you act strategically with your forecast and hide in the crowd of the other analysts' forecasts (consensus). If you avoid being fired you will earn your regular amount of DKK 500. But you will be fired and earn only DKK 100 if your forecast is the most inaccurate compared to the other 10 analysts (who have already made their forecasts).

Your Forecast

You must now provide a forecast (a single number) using the attached sheet and a written justification that may help the *investors* make an investment decision. Please only write your input in the section called 'to be completed by the financial analyst'.

APPENDIX E2 - EXPERIMENTAL MATERIALS FOR ANALYSTS WITH DIVERGE INCENTIVE AND FEEDBACK

Forecasting earnings as an analyst

Background

In this experiment, you will play the role of a *financial analyst* making an earnings forecast about ABC Company's quarterly earnings. Your forecast may help other CBS students (*the investors*) in later experiments. The *investors* will have access to the (consensus) forecast of other analysts, your forecast and justification, and may have access to your compensation scheme. The *investors* will make an investment decision that may result in their making or losing money depending on the actual earnings that the company announces (this will be announced sometime after the experiment is finished). You will forecast what the actual quarterly earnings will be for ABC based on the information below.

ABC Company

The company makes machines used in the food processing industry. Their quarterly earnings are generally quite stable. Last quarter the earnings were \$2.40.

Your Phone Call with the CFO

Yesterday, you had a private phone conversation with the CFO of ABC about the dairies (milk processing) division and the snacks division. The dairies division makes about 60 % of the profits of the company and it has been under pressure from a new entrant into the market. While the profit of the dairies division has been falling slightly, the profit at the snacks division has been increasing modestly. When the phone conversation turned to the performance of the dairies division, the CFO seemed very nervous and defensive.

Your Earnings View

For this quarter, recent forecasts of the 10 other analysts are normally distributed (with a standard deviation of 0.05) around an average (consensus) of \$2.40 that is identical to last quarter's earnings. The other analysts are not aware of your phone call and will not be talking to the CFO themselves. Therefore, you decide the consensus forecast is probably too optimistic

about the dairies division. You (correctly) believe the earnings could be anywhere between \$2.20 and \$2.40 (uniformly distributed).

Your Compensation

One analyst is expected to be promoted at your firm. You probably will be promoted you if you act strategically with your forecast and stand out from the other analysts' forecasts (consensus). If your forecast is the most accurate compared to the other 10 analysts (who have already made their forecasts), then you will be promoted and earn DKK 300. Otherwise you will earn your regular amount of only DKK 100.

In addition, *investors* (who earn money according to the accuracy of their own forecast) will rate your help from 1-5 (where 5 is the highest rating). You will receive a bonus of DKK 200 if your help is rated 4 or 5 (this is paid whether you are promoted or not).

Your Forecast

You must now provide a forecast (a single number) using the attached sheet and a written justification that may help the *investors* make an investment decision. Please only write your input in the section called 'to be completed by the financial analyst'.

APPENDIX E3 - EXPERIMENTAL MATERIALS FOR INVESTORS MATCHED WITH AN ANALYST WITH CONVERGE INCENTIVE AND NO FEEDBACK

Predicting earnings as an investor

Background

In this experiment, you will play the role of an *investor* making an investment decision by predicting ABC Company's quarterly earnings. The outcome of that investment (reflecting your payment for this task) depends on your accuracy (the actual quarterly earnings will be announced sometime after the experiment is finished). Another CBS student (the *financial analyst*) has already made an earnings forecast that may help you. The *financial analyst* had a recent private phone conversation with the CFO of ABC. You will predict what the actual quarterly earnings will be for ABC, based on the *financial analyst's* forecast and justification (see the attached sheet on the following page), together with the (consensus) forecast of 10 other analysts (more information below).

ABC Company

The company makes machines used in the food processing industry. Their quarterly earnings are generally quite stable. Last quarter the earnings were \$2.40. For this quarter, recent forecasts of 10 other analysts are normally distributed around an average (consensus) of \$2.40 (and a standard deviation of 0.05). These analysts are not aware of the *financial analyst's* private phone call with the CFO and will not be talking to the CFO themselves.

Financial Analyst Compensation

The firm that employs the *financial analyst* has announced that one analyst is expected to be fired. The *financial analyst* (correctly) believes he is less likely to be fired if he acts strategically with his forecast and hides in the crowd of the other 10 analysts (consensus). If he avoids being fired he will earn the regular amount of DKK 500. But he will be fired and earn only DKK 100 if his forecast is the most inaccurate compared to the other analysts (who already made their forecasts).

Your Compensation

Reflecting the importance of earnings announcements for investment performance, you will “trade the announcement”. That is, you will write down your prediction of the earnings on the attached sheet. If you are exactly correct, you will earn DKK 500. For every \$0.01 that the actual earnings are away from your forecast, the payment will reduce by DKK 20 (i.e., you will earn DKK 460 if the actual earnings are \$0.02 higher or lower than your forecast).

Your Prediction

You must now provide a prediction (a single number) and a written justification of your prediction using the attached sheet.

APPENDIX E4 - EXPERIMENTAL MATERIALS FOR INVESTORS MATCHED WITH AN ANALYST WITH DIVERGE INCENTIVE AND FEEDBACK

Predicting earnings as an investor

Background

In this experiment, you will play the role of an *investor* making an investment decision by predicting ABC Company's quarterly earnings. The outcome of that investment (reflecting your payment for this task) depends on your accuracy (the actual quarterly earnings will be announced sometime after the experiment is finished). Another CBS student (the *financial analyst*) has already made an earnings forecast that may help you. The *financial analyst* had a recent private phone conversation with the CFO of ABC. You will predict what the actual quarterly earnings will be for ABC, based on the *financial analyst's* forecast and justification (see the attached sheet on the following page), together with the (consensus) forecast of 10 other analysts (more information below).

ABC Company

The company makes machines used in the food processing industry. Their quarterly earnings are generally quite stable. Last quarter the earnings were \$2.40. For this quarter, recent forecasts of 10 other analysts are normally distributed around an average (consensus) of \$2.40 (and a standard deviation of 0.05). These analysts are not aware of the *financial analyst's* private phone call with the CFO and will not be talking to the CFO themselves.

Financial Analyst Compensation

One analyst is expected to be promoted at the *financial analyst's* firm. The *financial analyst* (correctly) believes he is more likely to be promoted if he acts strategically with his forecast and stands out from the crowd of the other 10 analysts (consensus). If his forecast is the most accurate compared to the other analysts (who already made their forecasts), then he will be promoted and earn DKK 300. Otherwise he will not be promoted and earn the regular amount of only DKK 100.

In addition, you (as an investor) will be able to rate the help of the *financial analyst* on a scale of 1-5 (where 5 is the highest rating). If the help is rated as 4 or 5, then the *financial analyst* will

earn an additional DKK 200 payment (this is paid whether he is promoted or not). The *financial analyst* is aware of your control over this payment.

Your Compensation

Reflecting the importance of earnings announcements for investment performance, you will “trade the announcement”. That is, you will write down your prediction of the earnings on the attached sheet. If you are exactly correct, you will earn DKK 500. For every \$0.01 that the actual earnings are away from your forecast, the payment will reduce by DKK 20 (i.e., you will earn DKK 460 if the actual earnings are \$0.02 higher or lower than your forecast).

Your Prediction

You must now provide a prediction (a single number), a written justification of your prediction and a rating of the *financial analyst*’s help using the attached sheet.

APPENDIX E5 - THE ATTACHED SHEET

TO BE COMPLETED BY THE *FINANCIAL ANALYST*

Enter your earnings forecast:

(this quarter's earnings will not exceed last quarter's earnings)

Enter a justification of your forecast to help the *Investor*:

TO BE COMPLETED BY THE *INVESTOR*

Enter your earnings prediction:

(this quarter's earnings will not exceed last quarter's earnings)

Enter a justification of your prediction:

Rate the *Financial Analyst's* help on a 1-5 scale (5 being the best rating):

APPENDIX F1 – CHECK-QUESTIONS FOR ANALYSTS

Check-questions for the task where you had to provide a forecast of a firms future earnings (tick the box most suitable for your answer)			
For every question you answer (correctly) you additionally earn 2 DKK			
How do you think your performance was in the task compared to your fellow student-colleagues?	Above average <input type="checkbox"/>	Around average <input type="checkbox"/>	Below average <input type="checkbox"/>
Were you playing the role as an analyst or an investor?	Analysts <input type="checkbox"/>	Investor <input type="checkbox"/>	Don't know/neither of the two <input type="checkbox"/>
Would you have preferred playing the opposite role?	Yes <input type="checkbox"/>	No <input type="checkbox"/>	Don't know/neither of the two <input type="checkbox"/>
How much could you at maximum earn from the task?	100 DKK <input type="checkbox"/>	500 DKK <input type="checkbox"/>	Don't know/neither of the two <input type="checkbox"/>
What was currently the issue at your firm?	You could be promoted <input type="checkbox"/>	You could be fired <input type="checkbox"/>	Don't know/neither of the two <input type="checkbox"/>
What strategy would be best to earn the greatest expected amount?	Forecast towards consensus (hide in the crowd) <input type="checkbox"/>	Forecast away from consensus (stand out from the crowd) <input type="checkbox"/>	Don't know/neither of the two <input type="checkbox"/>
Did you try to follow this strategy with your forecast?	Yes <input type="checkbox"/>	No <input type="checkbox"/>	Don't know/neither of the two <input type="checkbox"/>
Was helping the investor important in making your forecast?	Yes (to some extent) <input type="checkbox"/>	No (not much) <input type="checkbox"/>	Don't know/neither of the two <input type="checkbox"/>

APPENDIX F2 – CHECK-QUESTIONS FOR INVESTORS

Check-questions for the task where you had to provide an estimate/forecast of a firm's future earnings (tick the box most suitable for your answer)				
	For every question you answer (correctly) you additionally earn 2 DKK			
How do you think your performance was in the task compared to your fellow student-colleagues?	Above average <input type="checkbox"/>	Around average <input type="checkbox"/>	Below average <input type="checkbox"/>	
Where you playing the role as an analyst or an investor?	Analyst <input type="checkbox"/>	Investor <input type="checkbox"/>	Don't know/neither of the two <input type="checkbox"/>	
Would you have preferred playing the opposite role?	Yes <input type="checkbox"/>	No <input type="checkbox"/>	Don't know/neither of the two <input type="checkbox"/>	
How much could you at maximum earn from the task?	100 DKK <input type="checkbox"/>	500 DKK <input type="checkbox"/>	Don't know/neither of the two <input type="checkbox"/>	
What current issue did the analyst face from his/her firm?	A chance to be promoted <input type="checkbox"/>	A risk of getting fired <input type="checkbox"/>	Don't know/neither of the two <input type="checkbox"/>	
Did you trust the analyst to make a honest forecast/justification?	Yes (to some extent) <input type="checkbox"/>	No (his/her estimate was probably biased) <input type="checkbox"/>	Don't know/neither of the two <input type="checkbox"/>	
What strategy would be best to earn the greatest expected amount?	Follow the analyst's forecast <input type="checkbox"/>	Go towards the midpoint of the range <input type="checkbox"/>	Follow the consensus forecast <input type="checkbox"/>	Don't know/none of them <input type="checkbox"/>
Did you try to follow this strategy?	Yes <input type="checkbox"/>	No <input type="checkbox"/>	Don't know/neither of the two <input type="checkbox"/>	

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8. PAPERS (ARTICLES)

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Individual Risk-Willingness and Herding Behaviors in Financial Forecasts

Simone Staehr

ABSTRACT

Literature on financial analysts' forecasts (FAF) documents that financial analysts tend to demonstrate herding behaviors and thus issue forecasts that are in line with consensus estimates which sometimes compromises accuracy. A number of explanations spanning rational economic logics, cognitive biases and social forces have been suggested. Relying on data from a paper-based, in-class experiment completed by 289 graduate students participating in the course Financial Statement Analysis and Valuation I posit and find support for individual risk-willingness (or lack of) as an explanatory variable of herding behavior. Specifically, I predict and find that less risk-willing individual's forecasts with less boldness and instead issue forecasts in line with the consensus forecast. The results are argued to be at least partially a product of cognitive biases and an intuitive reaction to uncertainty. Additionally, I find evidence that the relationship is particularly pronounced when bad news (rather than good news) is received prior to forecast revisions.

1. INTRODUCTION

A generally accepted meaning of herding is that people tend to follow the decision of the crowd as a reaction to uncertainty (Keynes 1930). This paper focuses on herding behavior in the context of financial analysts making forecasts. Herding behavior in financial analysts' forecasts (FAF) is at least five times more pronounced than accuracy in FAF (Guedj and Bouchaud 2005). Consequently FAF can mislead investors and cause significant losses and misallocation of resources (see Ramnath et al. 2008, Bradshaw 2011 for recent reviews and Brown et al. 2015 for recent insights). Similarly to the broadly accepted meaning of herding that it is a reaction to uncertainty, Evgeniou et al. (2010) show that high market uncertainty enhances herding behavior among financial analysts. Due to the substantial consequences and theoretically challenging potential explanations, herding behavior has received significant attention from researchers (see among many others Cont and Bouchaud 2000; Bikhchandani and Sharma 2000; Hirshleifer and Hong 2003). In the literature of FAF different stands on herding behavior are taken and thus explanations are somewhat widespread in the area in-between perspectives aligned with the economic literature and socio-/cognitive psychological perspectives depending on the research question assigned.

One group of studies focus on the consequences of herding behavior, in particular studies in economics. These studies explain bubbling in financial markets as an extreme consequence of herding behavior (e.g. Anderson and Holt 1997). This stream of research in herding behavior is often referred to as informational herding, rational herding or cascading. Another group of studies focus on the causes of herding behavior. Most of these focus on practical logics or externally created incentives for when and why financial analysts' herd (e.g. Trueman 1994; Hong et al. 2000; Clement and Tse 2005; Seybert and Bloomfield 2009). Here, herding is explained more as a kind of trade off for analysts e.g. following

incentives that may result in less accurate forecast and thus mislead the investors or following the best analyst in an attempt to establish a better reputation. This stream of research in herding behavior is often referred to as strategic- or reputational herding. Finally, a rather small group of studies focuses on free-riding or emotions to play a role when herding behavior occurs (e.g. Hirshleifer and Shumway 2003; Bloomfield and Hales 2009) suggesting intuition or mental shortcuts to be more pronounced. Further, articles reviewing the literature of financial analysts (e.g. Ramnath et al. 2008; Bradshaw 2011) have called for more research on the role of individual analysts' personal characteristics and how they affect forecast behaviors.

This paper aims to contribute to the literature by responding to these calls for research on the importance of personal characteristics. Specifically, this paper addresses the relationship between individual risk-willingness as a personal trait and herding behavior in financial forecasts at the individual level by arguing that dissimilarities in risk-willingness will result in different reactions to the uncertainty inherent in forecasting tasks. Thus, the scope of this paper is more in line with perspectives in psychology to investigate “when” and “why” analysts herd rather than to “what extent” they herd, which is often the focus in economic literature (Rook 2006). This paper takes the view that financial analysts, as decision makers under uncertainty in the task of providing a forecast, to some extent are restricted by cognitive biases or mental shortcuts where social forces also play a role and they are therefore constrained in their choice to display a herding behavior towards a consensus estimate. In the literature on financial analysts' forecasts (FAF) Hirshleifer and Hong define herding behavior as “*the propensity of analysts to follow the consensus*” (Hirshleifer and Hong 2003, p. 374, 1 2 fb.). Although the underlying research question differs from that of this paper this commonly accepted definition is followed. Furthermore this paper also

refers to making bold forecasts, or rather to the boldness in forecasts, as being the opposite of forecasting close to the consensus estimate (herding).

As for the theoretical predictions, this paper posits that there is a positive relationship between individual risk-willingness and the boldness in forecasts (less herding). Relying on aspects from theories and positions in social psychology such as group conformity (Asch 1951; 1952; 1956), social comparison theory (Festinger 1954) and partly behavioral decision theory (Einhorn and Hogarth 1981), it is argued that individuals with lower risk-willingness will be more likely to herd towards the consensus. This is because less risk-willing people feel more need of safety in their decision making and thus they use mental short-cuts. Therefore, conforming to the group with their forecast is more pronounced than for more risk-willing individuals. This is the first and primary hypothesis of the paper. Furthermore, this paper also seeks to add depth by developing a theory on differences in the strength of this relation depending on the (perceived) strength of external stimuli. Specifically, considering findings in psychology literature which presents “a general principle across a broad range of psychological phenomena” that in individuals’ minds “bad is stronger than good” (Baumeister et al. 2001, p. 323) it is likely that the characteristic of news (bad or good) affects the relationship stated in the first hypothesis. Therefore, it is argued that the positive relation between risk-willingness and the boldness in forecasts will be moderated so that the effect of the risk-willingness is amplified when analysts are faced with bad company news relatively to a setting where analysts are faced with good company news. This is the second hypothesis of this paper.

The hypotheses are tested on data collected via an experiment using 289 graduate students. This method allows providing controlled stimuli and directly observing analysts’ individual characteristics and forecasting outcomes. First, the participants forecast next year’s earnings per share (EPS) based on qualitative and

quantitative information of an actual firm (the identity of this firm is disguised to the participants). This information is the same for all participants, making the resulting pre-manipulation forecast a baseline to which future post manipulation forecast revisions are compared. Before making a forecast revision (updating their beliefs) the participants are randomly split into four groups pre-determined by four different versions of the experiment. The four groups are based on a 2x2 matrix based on the combination of two treatments. One treatment is whether participants receive a consensus estimate or do not receive a consensus estimate before making their forecast revision. This is referred to as the consensus treatment. The other treatment is whether participants receive bad news or good news about the company in focus before making their forecast revision. This is referred to as the news treatment. After having made their forecast revision participants are asked a number of questions primarily aimed at measuring their individual risk-willingness and to include a number of other variables as controls in regression analyses.

Naturally the group of participants who do not have a consensus estimate cannot herd (according to the definition of herding followed by this paper) when issuing their forecast revision. Therefore, for testing the hypotheses, the group of participants who receive a consensus estimate is solely included. However, the participants that do not receive a consensus estimate serve an important purpose as a control group. Specifically, each individual participant in the consensus group is compared with the participants in the control group that stated a similar forecast in the baseline i.e. before revisions. This allows me to assess the influence of the consensus estimate on the revised forecast of each participant in the consensus group by comparing their individual revised forecast with the revised forecast of the control group participants that were most comparable in terms of the initial forecast. This is the basis of the measurement of boldness.

The results, based on t-tests, show a positive relationship between analysts' risk-willingness and the boldness in forecasts and thus support the first and primary hypothesis. This is the main contribution of the paper. The second hypothesis is that the strength of the relation between individuals' risk-willingness and the boldness in forecasts is larger in a setting where participants receive bad company news than in a setting where participants receive good company news. The relation between individual risk-willingness and the boldness in forecasts are tested in each of the two subsamples formed by the news treatment. The results show that individual risk-willingness significantly explains boldness in the bad news group while the significance disappears in the group receiving good news. This is the second contribution of this paper.

Various robustness checks including regression analyses are performed allowing to statistically testing the difference between coefficients for the two groups in the news treatment. The regression results suggest that there is a significant difference between the coefficients in the two news groups providing further support for the second hypothesis. Further, when control variables measuring skills and experience are included, the main results persist and the controls are all insignificant in explaining the boldness in forecasts. Rerunning all main tests using an alternative and simpler measure of boldness (the distance between a forecast revision and the consensus estimate) does not change the overall results except that the difference between the regression coefficients from the tests made separately for each of the two news groups (good-/bad news) is no longer significant. The latter implies that results of the second hypothesis are not as robust as the results of the first. Additionally, previous studies have argued that risk-willingness and overconfidence are somewhat related concepts and hard to separate. Thus, as a final robustness check it is attempted to remove a dimension of overconfidence (often referred to as "better than average"- effects) from the

measure of individual risk-willingness to get a more pure test of the effect. Although this reduces the sample size considerably, the results persist.

To the extent findings from this paper applies in real-world contexts, academic implications of the contributions of this paper related to the importance of personal traits found via this experiment may also be applicable in studies using archival data to examine other well documented biases in FAF such as general optimism- and conservatism bias. Hence, biases in FAF may occur because cognitive biases or intuitions are used to make decisions. Further, this paper also speaks to regulators by suggesting that broad and general enforcements may not be sufficient in effectively protecting investors from biased FAF. Thus, more customized interventions directly pointed at the financial analysts and perhaps an increased supply of analyst specific data to investors may be additionally useful.

The rest of the paper is organized as follows; Section 2 contains background and theory followed by hypothesis development. Section 3 describes the research method and presents central measures and descriptive statistics. Section 4 contains analyses and results. In Section 5 robustness checks are presented and Section 6 concludes.

2. BACKGROUND, THEORY AND HYPOTHESES DEVELOPMENT

2.1. Herding Behavior

The phenomenon of herding behavior goes way back and is broadly the tendency of individuals to follow others when making decisions as a reaction to uncertainty (Keynes 1930). Because people generally seek to avoid uncertainty⁶ (e.g. Hogarth 1975) herding behavior is a widespread phenomenon in many contexts. As financial analysts are forced to make decisions under uncertainty, they work in an environment where herding behavior is likely to occur (see Devenow and Welch 1996; Raafat et al. 2009 for reviews). Guedj and Bouchaud (2005) conclude that financial analysts agree more than five times more often with each other than with the actual result which implies that herding behavior amongst FAF is not only very pronounced but in fact also compromises forecast accuracy.

Previous literature has provided a wide range of explanations of why people herd both in financial markets in general and also in the specific context of FAF (see e.g. Devenov and Welch 1996; Bikhchandani and Sharma 2000; Cont and Bouchaud 2000; Baddeley 2010 for reviews). The explanations can roughly be divided into three groups. One group of explanations hold as a central tenet that market participants are strictly rational and make decisions that are rational, purposive and oriented towards a goal of economic welfare. A second group of explanations can be considered in line with Simon's (1955; 1979) idea of bounded rationality and acknowledge the view that individuals do act in manners that are not always optimal in an economic sense and may thus be rational in a wider context by encompassing other goals such as pleasure or satisfaction or because of cognitive constraints (Stanovich 1999). Finally, a third group of explanations

⁶ Although prospect theory (Kahneman and Tversky 1979) suggests a general tendency of people to behave (more) risk-willing in the loss domain.

accept the idea that decisions may in fact be irrational even when judged on a wider range of goals leading to biased and dysfunctional behavior. The borders between the categories can in some cases be blurred depending on the approach and perspective. However, all these above mentioned groups of explanations have also been found for some decades in the broader judgment and decision literature (Einhorn and Hogarth, 1981).

Economists generally present herding as a rational result of sophisticated logics that follow the principles of Bayesian updating and information cascades (Scharfstein and Stein 1990; Anderson and Holt 1997; Bikhchandani et al. 1998). Economic experiments evidence that informational herding (often referred to as cascading) can be reflected as a perfectly rational behavior. As an example, Anderson and Holt (1997) use an experimental setting to reflect how herding behavior can occur in financial market forecasting. The participants in the experiment must in turn guess from which of two urns a ball has been drawn. Each participant can base their decision on the color of the ball they draw (private signal) and from access to the guess of all the participants who have drawn a ball from the same urn before them (public signal). After a few participants, participants generally ignore their private signal and follow the prior participants' guesses. This is explained as the aggregated (public) signal (of e.g. four other guesses) being weighted more heavily than a single private signal (e.g. that one of the remaining balls in urn A is blue). Importantly, this experiment underlines that although herding behaviors sometimes cause information cascading around the wrong outcome (e.g. causing financial bubbles) the behavior is in line with rational models. Consistent with a rational view on herding, financial analysts may herd by relying on other analysts to have superior information or have superior skills as often suggested in the literature (e.g. Clement and Tse 2005; Guttman 2010; Kim et al. 2011). This is sometimes referred to as informational herding and

is considered rational. In the grey area between perfectly rational and bounded rationality lies the concept referred to as strategic herding. Here, external factors are argued to cause analysts to have strategic incentives, such as career concerns, which in some cases make a forecast close to the consensus the better choice (Hong et al. 2000).

Amongst those relying on a less narrow view on rationality, mostly pronounced in the literature of psychology, we find Asch (1951; 1952; 1956) who moved the literature towards a view of social reality with the group being central. In his line of experiments it was evidenced that most people conformed to a group even when they realized this answer was wrong. This is explained by the importance of a reference group to individuals and Asch argued that even when the choice to follow a group creates mental conflicts in the individual (because the individual realizes that the answer of the group is wrong) this conflict is solved by reasoning that the choice of a majority should be correct. Further, this is in line with Festingers (1954) social comparison theory suggesting that in order to evaluate themselves, people generally compare to others especially in situations with high uncertainty. Much later this view is still significant in the literature and Turner's (1991) work on social influences argues that numbers are less influential than the consensus. Additionally, Fiske and Taylor (1991) argue that even rational people rely on cognitive biases such as convincing themselves that 'consensus is almost always correct' implying that it is reasonable to follow it. Similar ideas are reflected in the literature on financial markets, where Shiller (1995) argues that, even after making all the correct calculations along the way, social influence alone can result in people making the wrong choice at the end by herding towards the group.

While the work of Asch, Festinger, Turner and Shiller explain herding as a phenomenon that can be seen as (bounded) rational and in fact optimal if one considers non-economic social goals, recent experimental studies suggest explanations that can be considered suboptimal and a result of cognitive biases leading the information value of consensus to be weighted too heavily (Seybert and Bloomfield 2009; Libby and Rennekamp 2012). That is, herding behavior can also be caused by human inability to optimally extract information from the aggregated consensus estimate. Some studies further seek to explain herding with reference to emotions leading to heuristics (see e.g. De Bondt 1999 that touches upon this in the context of financial analysts' herding behavior). According to this view, the fear of standing out from the crowd seems to dominate the benefit of staying true to one's own beliefs which can make the group consensus far more influential than is appropriate. In the literature of evolutionary biology it is argued that a cause of the depth of the fear of standing out may be that it has historically been too dangerous in terms of survival to not be part of a group (e.g. Simon 1990). This implies that herding is likely to correspondingly be an intuitive reaction to uncertainty or based on mental short-cuts because it feels like a safer choice.

Thus in the literature on FAF, a consensus estimate is not only viewed as something analysts relate to in a strategic sense or as an aggregated information signal but also as a signal that analysts may intuitively follow to make a choice which feels safer. This paper supports a view that not one single theory or explanation can cover all aspects of herding behavior amongst financial analysts. However, I aim to provide a targeted contribution and therefore this paper focuses on a rather limited subset of explanations based on social psychology and in particular cognitive biases and the notion that herding occurs partly as an intuitive reaction to feeling uncertain about the decision one is about to take. As Baddeley

et al. (2010, p.7, l. 9 fb.) argues: *“When people are influenced by social information then this may reflect an interaction between a deliberative learning process and a more instinctive, affective, emotional response”*. In the following, it is argued that individuals’ risk-willingness is an important antecedent of this reaction.

Individual Risk-willingness and Herding Behavior

Risk-willingness is considered an individual characteristic influencing how people make decisions under (risk and) uncertainty in various contexts (Brockhaus 1980). It is generally agreed that individuals dislike risk (e.g. Hogarth 1975). However, although the general notion is that most people dislike risk, the level of risk-willingness differs between people and hence may lead them to react differently to the same stimulus. Further, how individuals perceive and react to risk appears a very ingrained personal trait sometimes attached to emotions (Slovic 1999; Loewenstein et al. 2001). Some studies even suggest that genetics play a role as risk-willingness seems to vary between individuals but to remain somewhat stable over time (e.g. Andersen et al. 2008) and even over generations (Zyphur et al. 2009).

Within research of humans’ herding behavior in general (including research of herding in financial markets), there is widespread evidence that herding at least in part is a response to individuals feeling insecure about how to process stimuli presented to them (Baddeley, 2010). Given this aversion towards the unknown (described by Shefrin (2002) as fear of the unknown in relation to ambiguity), individuals are likely to use the availability heuristic which entails relying intuitively on information that is more available to the mind, including information perceived salient as it stems from a group to which one belongs (Tversky and Kahneman 1974; Gilovich et al. 2002; Kahneman 2011). This suggests that those who most dislike uncertainty and risk, are most likely to herd,

because these individuals use the availability heuristic more and rely on information which is salient and thus easily available to the mind.

This is formally stated by the first hypothesis:

H1: The individual risk-willingness is positively associated with the boldness in their forecasts.

2.2. Asymmetries Caused by News (Bad/Good)

Some studies observe asymmetric patterns in FAF behavior created by different reactions to negative vs. positive market information (e.g. Easterwood and Nutt 1999). Studies relying on archival data (e.g. Elliot et al. 1995; Basu 1997) find that financial analysts use information inadequately more often in market upturns than in market downturns. In the same line, other studies (e.g. Conrad et al. 2006; Beyer 2008) conclude that financial analysts are more likely to downgrade when prices decline than to upgrade when prices increase. This asymmetric behavior is often argued to occur because management delays bad news relatively to good news and hence a stronger reaction to bad than good news is rationally expected in FAF since it contains more information⁷.

Nonetheless I suggest that at least part of the explanation is that individuals process and react differently to positive than to negative news. This assertion is founded in research across various fields finding that “bad” is stronger than “good” and that people usually are unaware of this asymmetry within themselves (for a review, see Baumeister et al. 2001). For instance, experimental studies find that negative information is more processed, weighted more strongly and provokes larger amplitude in brain responses compared to positive information (Anderson 1965; Abele 1985; Peeters and Czapinski 1990; Ito et al. 1998). This asymmetry is

⁷ Some studies rely on conservatism bias (e.g. Beyer 2008) whereas other rely on asymmetric loss-functions in line with prospect theory (Markov and Tan 2006; Raedy et al. 2006) to explain this asymmetric behavior by analysts.

observed even in (unimportant or uninfluential) everyday events (Nezlek and Gable 2001) where the magnitude of these events seems to play only a modest (if any) role (Hajcak et al. 2006). These latter findings suggest that individuals' asymmetric reaction to negative relatively to positive information is unconsciously generated and perhaps evolutionarily adaptive (Baumeister et al. 2001). In the same line, Kahneman (2003) suggests that the brain quickly decides if something should be perceived as good or bad which supports the idea that it provokes intuition rather than more elaborate thinking.

Based on the above-mentioned good/bad asymmetry I expect that financial analysts feel more exposed if underreacting to bad news than to good news as overlooking obviously negative information about the future of a firm is likely to be intuitively perceived as careless behavior whereas overlooking positive information is likely perceived as being careful. Therefore, analysts receiving bad news prior to revision are likely to perceive that they are exposed to more risk or uncertainty than analysts receiving good news. To the extent that the first hypothesis of this paper is supported the more risky or uncertain the situation, the more likely individuals are to herd with their forecasts. This is because bad news seems to apply to cognitive processes that are in closer connection to intuitional reactions to a larger extent than good news does. Therefore I expect that the type of news in the market (good or bad) related to the company in focus moderates the relationship between individual risk-willingness and the boldness in forecasts so that the difference in reactions between the risk-willing and the less risk-willing analysts stands out stronger when bad news are presented than when good news are presented. This is the second hypothesis of this paper:

H2: The positive relationship between risk-willingness and the boldness in forecasts is stronger when bad news is presented prior to forecast revisions (as opposed to good news).

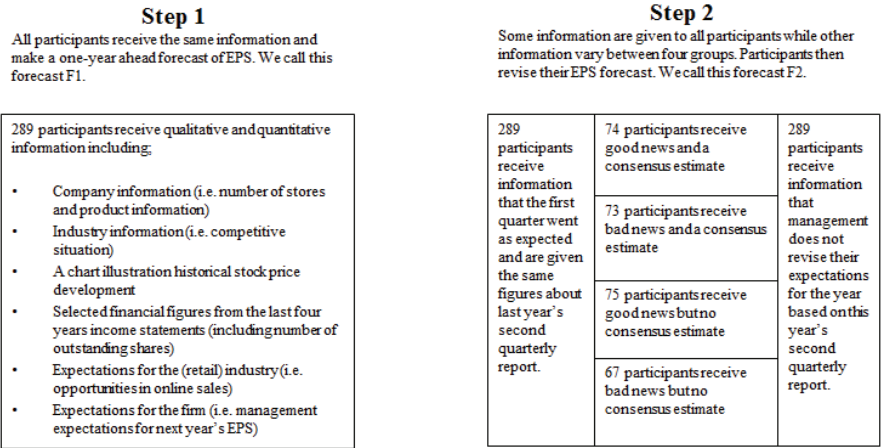
3. METHOD

The hypotheses are tested on data collected via an experiment. This method allows me to provide exact stimuli and directly observe analysts' characteristics and forecasting outcomes (see e.g. Libby et al. 2002 for examples of when experimental research is particularly beneficial in financial accounting). The experiment in essence contains a written introduction followed by the central task of forecasting. After the forecasting task a short questionnaire and a small risk-related task are included. At the end participants must choose between two lottery options in order to receive potential earnings. Debriefings and lottery draws were done in class a week after the experiment.

3.1. Design and Task

Participants face a two-step task on forecasting earnings per share (EPS) for a given firm (see appendices for experimental materials). In step one all participants receive the same information about the firm in focus. They are told that they are at the end of year 0 and must forecast EPS for year 1 (next year). This forecast in step one is named F1 and later used as a baseline. In step two participants are told that two quarters have passed since their first forecast and they are now asked to revise the EPS forecast (still for year 1) based on newly released information. This revised forecast in step two is named F2. Beforehand participants are (randomly) split into four groups differing by the information received before making forecast revisions in step two. The information varies randomly along two treatment dimensions, a consensus vs. no-consensus and a good- vs. bad news. That is, one half receives a consensus estimate, while the other half does not. The latter is referred to as the control group. One half receives good news about the firm's outlook while the other half receives bad news. Thus the experiment can be categorized as following a 2 x 2 between-subjects design. The distribution of participants' random assignment to each treatment group is illustrated by Figure 1.

Figure 1
 An Illustration of the Steps and how Information is Distributed between Participants in the Forecasting Task.



When financial analysts conduct forecasts they work under ambiguous conditions in the sense that various information is available to them and they need to be able to extract and processes the important parts of that information. The aim is to reflect similar characteristics of ambiguity in the design of a forecasting task. To do so roughly two (normal) pages with both qualitative and quantitative information are presented in step 1 (see figure 1 for details about the information). Simulating a close to real-world task, actual information for an existing listed firm⁸ is largely repeated. The information contains various publicly available information including historical financial performance and strategy, a chart illustrating historical stock prices and expectations about the future of the industry.

⁸ The firm is Abercrombie and Fitch with minor changes made to the public available information. However, the firm is kept anonymous to avoid potential biases (e.g. representativeness heuristics or confirmation bias). No participant gave the impression of knowing the identity of the underlying firm neither from their written answers nor at debriefings.

Furthermore it is stated that firm management expects EPS for year 1 in the range of 2.25-2.35.

Given the 2 x 2 design there are four groups receiving slightly different information in step 2 but some information is common. All participants are informed that the first quarterly report for the firm was roughly as expected and that the second quarterly report is just released. Further, some highlights from last year's second quarterly report are presented together with a statement from the CEO clarifying that the firm maintains its expectation for year 1; i.e. an EPS of 2.25-2.35. The above mentioned information is given to all participants independently of the treatment group assigned meaning that the groups only vary along two treatment dimensions; consensus vs. no consensus and good vs. bad news.

Treatments

Consensus vs. no consensus: Half of the participants receive a consensus estimate (2.14) and are told this estimate is a result of a revision performed after the release of new information. The other half does not receive the consensus estimate. The latter is merely used as a control group to establish an effect of the consensus estimate, i.e. to obtain a measure of the boldness in forecasts. Thus, hypothesis tests are only performed on the half of the participants who receive a consensus estimate, since this is the only group who have a possibility to herd towards the consensus estimate. Because the treatment group receives one more piece of information than the control group (the consensus estimate) they are generally expected to revise their forecast according to this to the extent that they find this information relevant. Thus, the treatment group will most likely provide forecasts closer to 2.14 on average than the control group (which is tested prior to hypotheses testing at the end of this section). A management forecast of 2.25-2.35 (which is kept constant across all participants) and a consensus estimate of 2.14

are presented regardless of news treatment assigned. Thus, if the managements' forecast serves as an anchoring point to the participants in the experiment it is expected to do so regardless of which treatment group they are assigned. Therefore, although it may potentially create some noise it is not expected to affect the results in the hypothesized directions. However, in the section with manipulation- and other checks I make an attempt to test if the strength of the management forecast as an anchoring point varies according to the consensus treatment but I find no support for this. Further, the direction of the difference between management forecasts and consensus is chosen because the accounting literature finds managers to generally be optimistic (Kothari et al. 2009), even more than analysts. The decision to hold management forecasts and consensus constant across the news treatment is based on an ambition to hold other stimuli than the news stimuli constant in order to be able to isolate the effect of that stimulus.

Good vs. bad news: All financial numbers in this year's second quarterly report are manipulated upwards (good news group) or downwards (bad news group) equally in absolute terms compared to the numbers in last year's second quarterly report. Further, the qualitative information (the statement from the CEO) is either positive in nature and indicates a positive earnings outlook (good news group) or negative in nature and indicates a negative earnings outlook (bad news group). While the numerical information regarding the quarterly reports can be manipulated without substantial asymmetries I recognize perceptions of written text (the CEO statement) may be subjective and hence vary in perceived magnitude amongst the readers (participants). To minimize this variation I only allow a few words to differ between the two groups in the news treatment.

Participants

The participants are 289 graduate students all enrolled in a course on Financial Statement Analysis and Valuation. On average, participants are 25 years old (mean and median), 27 % are female, 38 % invest in stocks and 67 % have a part-time job (57 % within investment/trading, accounting or corporate finance).

It may be argued that students are less sophisticated users of financial information than professional analysts. Therefore, students are likely to put more trust into the consensus estimate if this is framed as conducted by professional analysts because students likely expect professionals to have superior skills or information. This is consistent with findings in social psychology that individuals are more likely to confirm to the behavior of a group if these are viewed as more skilled (Festinger 1954; Bandura 1965). Thus, investigating herding towards experts while being a novice is not the scope of this paper and may potentially dilute the results. To overcome this issue I frame the information so that students perceive the consensus estimate as stemming from equally skilled people as themselves⁹. In a real-world setting, financial analysts consider other analysts more or less skilled than themselves in the same way as students probably consider other students more or less skilled than themselves. I strive to avoid making the consensus estimate more desirable to conform to in the experimental design than in a real-world setting by this approach. Additionally, Libby et al. (2002) argue that students with sufficient knowledge of the task can, and should, be used as participants. Students participating in a course at this level are well familiar with the task of forecasting EPS and biases generally present in financial markets and I therefore perceive them as a relevant subject pool¹⁰.

⁹ Consensus is presented as an average based on 14 estimates from colleagues. Hence, the participants should view this estimate with the same degree of trust as financial analysts view a consensus estimated from their colleagues and are therefore not expected to herd more.

¹⁰ See Koonce and Mercer (2005) for further discussions of students as surrogates for sophisticated participants. See also Whitecotton (1996) where professional analysts are found with a larger optimistic bias than MBA students.

Procedure

The experiment was completed on paper in class. Only pens and calculators were allowed as aids. Participants were given a limited time frame to complete the experiment¹¹. Following standard guidelines in economic experiments only little verbal introduction prior to the actual experiment was given. In the experimental material a more substantial written introduction was included (see Appendix D). In the written instructions it was stipulated that participation was voluntary, that all tasks should be solved in order and that communication was not allowed. Not complying with the rules lead to exclusion from the experiment and a lost opportunity to receive monetary compensation. However, the experimenter, who was present throughout all experiments, found no reason to exclude anyone. All experiments were executed by the same experimenter.

Participating in the experiment included potential monetary gains in line with tradition in experimental economics. This is expected to enhance participants' effort in the experiment and thus help capturing a natural behavior. Inspired by Davis and Holt (1993, Chap. 2) I included a lottery offering few but relatively high stakes to motivate people to make an effort. The lottery chances are based on performance, the choices made throughout the experiment and luck combined. Thus, participants are not given any direct monetary incentives to play strategic with their forecast e.g. to stand out from the other participants or follow the management or consensus estimate. Nor are they directly incentivized to be accurate with their forecasts although the intention with the payment structure is to imply, without saying, that accuracy is beneficial.

¹¹ Pre-tests by colleagues and Graduate Diploma students gave an indication of where to set the time limit in order to balance a bit of time pressure (as professional analysts too experience) but still receive predominantly complete answers. Answers from pre-tests are excluded from the final sample.

I follow experimental instructions by Libby and Rennekamp (2012, p 208 footnote 13) and denote all earnings from the experiment in an experimental currency (“Coins”) and the exchange rate of the experiment currency is unknown until the end of the experiment. Participating in the experiment offers a chance to earn 2000 coins convertible to lottery tickets. All lottery prizes are of \$286. Chances of winning depend on the amount of experimental currency earned during the experiment. This amount depends on the participant’s choices during the experiment in manners that award effort and insight. For instance uncompleted tasks always lead to fewer coins. Participants are (truthfully) informed that lottery draws cannot be completed until the next lesson as their earned coins need to be calculated manually to determine their individual performances. The week after executing the experiment debriefings and lottery-draws were (transparently) done in the class-room.

In total 10 participants won the lottery whereas each received \$286. This corresponds to an average hourly wage of around \$14 per participant. Further, the prize (\$286) is about 62 % of their average self-reported monthly disposable income (\$395) which I believe to be sufficiently high stakes. Because Andersen et al. (2008) find risk-willingness to sometimes vary with personal finances I check but find no income effect. The participants reported monthly disposable income and their individual answer in the risk related task has no noteworthy correlation.

At the debriefing, none expressed concerns about the specific calculation of coins. Nor did anyone question if the best solution to the forecasting task was also the most accurate or how it was calculated.

3.2. Measurements and Descriptive Statistics

Boldness

By keeping the information constant across participants in the first step a baseline is created. As Welch (2000, p. 394, l. 12 fa.) points out at the end of his paper “...if a researcher had access to...information sets available to individual analysts when making decisions, one could discriminate between true herding and information that is simply received simultaneously and interpreted likewise by two analysts.”. This is what the setting of this paper is aiming for. To measure the boldness in forecasts, I take advantage of the baseline being the first forecast (F1) that all participants conduct based on identical information. I do so by comparing each individual participant in the consensus group with the participants in the control group that have a similar F1. Thus, by comparing the individual revised forecast (F2) in the consensus group with F2 of the participants in the control group that stated a similar F1 and thus have approximately the same baseline I can capture the effect of the consensus estimate. This is the central idea underlying the measurement of boldness. According to Bernhard et al. (2006, p. 658, l. 14 fb.) a forecast is unbiased if “...it corresponds to the analyst’s best estimate of earnings given all available information...In its most basic form, herding amounts to biasing a forecast away from an analyst’s best estimate, toward the consensus forecast of earlier analysts; while anti-herding amounts to biasing a forecast away from that consensus.” Following this idea of when a forecast is biased because of herding, the idea of the boldness measurement in this paper is as follows; First, for each individual in the consensus group I start by identifying all participants in the control group who have submitted similar forecasts in F1. I perceive similar forecasts as forecasts that differ with less than 0.10¹². E.g. if a participant in the consensus group stated a F1 of 2.10 I match him/her with all participants from the

¹² The results generally persist if the interval is changed. I tried intervals of 0.05 and 0.15. Results are available on request.

control group that stated a F1 within the interval 2.00 – 2.20. I do this separately for each participant in the consensus group. Thus, for each participant in the consensus group I can now identify how the participants in the control group that stated similar forecasts in F1 behave with their revised forecast of F2. This allows me to estimate how each participant in the consensus group would likely have behaved with their F2 if they had not additionally received a consensus estimate. Consequently, comparing F2 for each participant in the consensus group ($F2_{\text{actual}}$) with the average of F2 of their matched participants from the control group ($F2_{\text{pure}}$) enables me to estimate the direct effect of the consensus estimate and thus allows recognizing the boldness in forecasts.

The measure of boldness for each individual in the consensus group measures the degree to which $F2_{\text{actual}}$ is close to $F2_{\text{pure}}$ relatively to the consensus and can be formulated like this:

$$\text{Boldness} = |(F2_{\text{actual}} - \text{Consensus})| / |(F2_{\text{pure}} - \text{Consensus})|$$

Where:

$F2_{\text{actual}}$ = the actual revised forecast for each individual in the consensus group

Consensus = the consensus estimate of 2.14 given to the consensus group

$F2_{\text{pure}}$ = the average of the revised forecast for the matched participants in the control group

If:

Boldness > 1, then I assign it 1.

$F2_{pure} < Consensus < F2_{actual}$ or $F2_{pure} > Consensus > F2_{actual}$, then I assign it 1.

Because I cap the formula by 1 the measure of boldness in forecasts can only take values between 0 and 1. If F2 for the consensus group is exactly at consensus (*i.e.* $F2_{actual} = Consensus$) the formula assigns it 0 reflecting the very least bold forecasts (most herding). If F2 for the consensus group moves away from the F2 of the matched participants in the control group and towards consensus (*i.e.* $F2_{pure} < F2_{actual} < Consensus$ or $F2_{pure} > F2_{actual} > Consensus$) the formula assigns a value between 0 and 1 depending on how much it moves. Hence, a value of 0.5 reflects a F2 for the consensus group exactly between the F2 of the matched participants in the control group and consensus. Further, if F2 for the consensus group moves away from the F2 of the matched participants and also away from the consensus estimate (*i.e.* $F2_{actual} < F2_{pure} < Consensus$ or $F2_{actual} > F2_{pure} > Consensus$) it is assigned 1 by the formula reflecting the most bold forecasts. Finally, a group (42 observations) of participants move away from F2 of their matched participants and state a F2 on the other side of the consensus estimate (*i.e.* $F2_{pure} < Consensus < F2_{actual}$ or $F2_{pure} > Consensus > F2_{actual}$). I perceive this group as having extreme boldness in their forecasts by placing their forecast on the other side of the consensus estimates than the control group does. In a paper on herding behavior of financial analysts' forecasts Clement and Tse (2005) perceive all forecast revisions that move in the other direction than consensus relative to their own prior forecast as bold (measured by a dichotomous variable). Thus, I manually assign a 1 to this group¹³. However, a small amount of participants in

¹³ If these 42 observations are not assigned a 1 but instead use the formula the general results still persist.

this group (15 observations of the above mentioned 42 observations) is also moving in a direction contradictive to their news signal with their $F2$ (i.e. $F2_{pure} < Consensus < F2_{actual}$ and receiving bad news or $F2_{pure} > Consensus > F2_{actual}$ and receiving good news). I am sceptic if their behavior should be perceived as ignorant instead of extremely bold. I check if the behavior of these 15 participants could be explained by the position of the management forecast in the experimental materials. However, $F2$ of these participants are not significantly closer to the management forecast than $F2$ for the rest of the participants. Because I am doubtful about how the behavioral motive of this small group should be interpreted I drop these 15 observations¹⁴.

Because this measure of boldness in forecasts requires at least one observation in the control group that is 0.1 or less away from the $F2$ made by each participant in the consensus group I lose 17 observations which do not meet this requirement. This leaves a total sample of 115 observations for which a value for the boldness measure can be calculated.

Risk-Willingness

My main measure of risk-willingness (*RiskWillingness*) is based on answers to a question from the Socio-Economic Panel Study (SOEP, e.g. Wagner et al. 2007):

How do you see yourself - Are you generally a person who is fully prepared to take risks or do you try to avoid taking risks? Please write a number between 1 and 10, where 1 means "not willing to take risks" and 10 means "very willing to take risks".

¹⁴ If these 15 observations are included the general results persist except for the regression analyses in robustness checks where the difference between coefficients for *RiskWillingness* in the two news groups gets insignificant.

The measure has been widely used to determine individual risk-willingness as a personal trait to predict behavior (e.g. Weber et al. 2012; Caliendo et al. 2014). Although sometimes criticized by economic literature for being too subjective and not directly incentivizing participants to respond according to their true preferences, this 10-point scale measure is recently validated by a number of studies comparing risk measures across literatures and domains. The authors concluded that this measure is the best all-round predictor of risky behavior across various domains (Dohmen et al. 2005; Wagner et al. 2007; Dohmen et al. 2011). In the experiment by Dohmen et al. (2011) the measure is compared to other popular risk measures including lottery choices and is proven to outperform other measures in terms of predicting behavior. These results are further supported by Lönnqvist et al. (2015). Further, Charness et al. (2013) argue that this measure might be more applicable in experimental settings to reflect real-world behaviors than measures frequently used in economic experiments. Thus, I perceive this measure of individual risk-willingness as appropriate for the purpose of this paper. I drop one participant that did not respond to this question leaving the sample with 128 observations for which a value for the risk-willingness measure is obtained.

I do not perform list-wise deletions and I therefore allow my sample size to vary between variables.

Descriptive Statistics and Correlations

TABLE 1							
Descriptive Statistics and Correlations							
	n	Mean	Median	SD	Min	Max	1
1. Boldness	115	0.69	1	0.40	0	1	
2. RiskWillingness	128	6.07	6	1.76	1	10	0.20**

Descriptive statistics and pairwise correlations between the two main variables.
Stars indicate significance on level: ***=p<0.001, **=p<0.05, *=p<0.1.

3.2. Manipulation and Other Checks

After the main task is completed I check the overall understanding of the experiment. 78.2 % of the participants wrote that the experiment was about behavioral finance, risk-perception, expectations, decision making or similar, reflecting a good general understanding. Furthermore only six participants wrote keywords like “influence from others” or “adjustments to news” indicating that there was a low risk that participants gave answers that were affected by their understanding of the theory and hypotheses. Rerunning the main analyses without these participants show largely the same results (not reported, available on request). Therefore, in order to keep the sample size as large as possible I do not drop any observations according to this. I also check whether the management forecast impacts participants’ F2 more in the group that does not receive consensus (control group) than in the group that additionally gets a consensus estimate (consensus group) and therefore have more points to anchor on. If this is the case, one would expect the control group rather than the consensus group to act in line with management who do not revise their forecast. However, results from a t-test refute this idea. The difference between numbers of participants who do not revise their forecast in the control group (46) and the consensus group (47)

is insignificant (t-stat. = -0.01). When additionally sorted on the news treatment the results remain insignificant. These results indicate that though the decision to include and hold constant the management forecast in the experimental design may create some noise, it does not seem to have a differential effect on the four groups of participants. Therefore management may influence forecasts but seem unlikely to bias the results in the hypothesized directions.

Treatment Effects

To test the effects of my treatments and to validate the measure of boldness in forecasts, if and how the participants respond to the consensus-treatment is investigated. I generally expect that the consensus group (the group that additionally receives a consensus estimate of 2.14) revises their forecasts significantly closer to the consensus estimate than the control group because the participants should assess this extra piece of information as relevant to incorporate in their forecast revisions. T-tests are used to test if the absolute distance to the consensus estimate is significantly different for the two groups in the consensus treatment. In line with my expectations, results of the t-test¹⁵ confirm that participants in the consensus group revise their forecasts significantly closer to the consensus estimate with a mean distance to consensus of 0.33 compared to a mean distance to consensus of 0.54 for the control group (t-stat. of 4.25, two-tailed). Further, I test and find that the absolute difference between F2 in the consensus group and the F2 of their individually matched participant in the control group are significantly different from zero (t-stat. of 5.57). This suggests that the consensus estimate causes a behavioral difference between the two group's revised forecasts. I therefore conclude that the consensus treatment works as expected (providing additional information to the consensus group) and believe that the measure of boldness in forecasts reliably captures the intended.

¹⁵ All results are generally supported by non-parametric tests (available on request).

Furthermore I want to test if the characteristic of news received prior to revision affects the participants' forecasting behavior. In this test the control group (the group that does not receive a consensus estimate) is excluded. I use a t-test to test if F2 is significantly different for the two groups formed by the news-treatment (i.e. the group that receives good news prior to revision and the group that receives bad news prior to revision). The mean of F2 for the good (bad) news group is 2.15 (1.92), just above (somewhat below) the disclosed consensus estimate. This difference is statistically significant (t-stat. of -2.25, two-tailed) suggesting the news-treatment has the anticipated effect.

As expected, the measure of risk-willingness does not vary significantly with any treatment in the forecasting task confirming the randomization effect (results not tabulated, available on request).

Hence, the experimental design and manipulations work as intended and I therefore move on to test the two main hypotheses in the next section.

4. ANALYSES AND RESULTS

As stated in H1, I expect that the individual risk-willingness is positively associated with the boldness in forecasts. This hypothesis is tested on the 115 consensus group participants for whom *Boldness* can be measured. To allow for t-tests the participants are split into two groups based on the median value of *RiskWillingness*. Hence, participants who stated a higher value than 6 on the 10-point scale called *RiskWillingness* are assigned a 1 and referred to as the *More RiskWilling* group, the other half receive a 0 and are referred to as the *Less RiskWilling* group.

TABLE 2

T-tests of Differences in Boldness Between the Two RiskWillingness Groups

	Total Sample		Bad News		Good News	
	n	Mean	n	Mean	n	Mean
Less RiskWilling	61	0.58	28	0.47	33	0.68
More RiskWilling	54	0.81	22	0.86	32	0.77
t-stat (two-tailed)		-3.14***		-3.76***		-0.99
z-stat		-2.73***		-3.14***		-0.83

Means of *Boldness* tested on total sample and for the two news groups respectively.

T-statistics (t-tests) and z-statistics (Mann-Whitney tests) are reported for two-tailed tests of difference in means.

Stars indicate significance on level: ***= $p < 0.01$, **= $p < 0.05$, *= $p < 0.1$.

Results of the t-test (the first column in Table 2 under the headline “Total Sample”) show that the least risk-willing group has a mean *Boldness* of 0.58 whereas the most risk-willing group has a mean *Boldness* of 0.81. The two means are significantly different at the 0.01 level (t-stat. of -3.14, two-tailed). The results

are supported by non-parametric tests. These results support H1 stating that individual risk-willingness is positively related to the boldness in forecasts¹⁶.

My second hypothesis predicts that the type of news (good vs. bad) received prior to forecast revisions moderates the relationship between individual risk-willingness and the boldness in forecasts. I expect that the relationship is stronger for the bad news group than for the good news group. To test this, the sample is split by the news-treatment and the tests of H1 are rerun (results tabulated in Table 2 in extension of results of H1).

The results (the second and third column in Table 2 under the headlines “Bad News” and “Good News”) show a significant difference between the boldness in forecasts in the least risk-willing group and the most risk-willing group for the subsample of participants receiving bad news prior to forecast revision (t-stat. of -3.76, two-tailed). However, the significance disappears when the same test is conducted for the subsample receiving good news prior to forecast revision (t-stat. of -0.99, two-tailed). These results are generally in line with H2 that the relationship between individual risk-willingness and the boldness in forecasts is more pronounced when bad news is received prior to forecast revisions. In the next section, where the robustness of the main results are tested partly by the use of regression analyses, I further test if the coefficients for the two news groups are statistically significant different from each other which may strengthen my interpretation of the results of H2.

¹⁶ Additional tests of sensitivity to this procedure of cutting the measure of risk-willingness by the median of 6 largely reveal the same results. When the measure of risk-willingness is cut by 5 results are significant at the 5 % level (t-stat. = -2.26) and when cut by 7 results are significant at the 10 % level (t-stat. = -1.78).

5. ROBUSTNESS CHECKS

In this section I check if the main results are robust to alternative ways of measuring boldness and to other methods of analysis. Finally, main tests are rerun based only on a subsample which allows subtracting one dimension of confidence that might interact with individual risk-willingness. This is done to make sure confidence (rather than risk-willingness) is not driving the results.

5.1. Alternative Measure of Boldness

Studies relying on archival data cannot isolate the effect of a consensus estimate on financial analysts' forecasting behavior as the experiment allows me to do in this study. Therefore, many studies rely on proxies of boldness. A common way of measuring boldness in earnings forecasts in the FAF literature is by the absolute distance from each individual (revised) forecast to the consensus estimate, sometimes ranked (e.g. Hong et al. 2000). Inspired by these studies, I measure the distance of the revised forecast (F2) to the consensus estimate (2.14) for the consensus group in and rank each distance relatively to the other participants in the consensus group (i.e. the control group is excluded). I name this measure *Boldness2* and treat it as a continuous variable.

Descriptive statistics and correlations are shown for all main and control variables in table 3 (descriptions of these controls are found in the next paragraph). T-tests related to hypotheses testing are rerun. All results persist (available on request) suggesting support of the hypotheses even with this less nuanced measure of boldness in forecasts. In the next section control variables are introduced and regression analyses are run separately for both measures of boldness.

5.2. Regression Analyses

To test the robustness of the main results from t-tests I further test the hypotheses using OLS-regressions. This model includes control variables that could potentially influence the boldness in the participants' forecasts. Further, it allows for a more sophisticated statistical test of H2.

Controls

Experience and skills may influence the boldness in forecasts (Clarke and Subramanian (2006); Leone and Wu 2007; Jegadeesh and Kim 2009; Jiang and Verardo 2013). To control for aspects of experience and skills I follow the use of proxies in prior literature (e.g. Dearman and Shields 2005) and include four variables. The first variable (*Course*) equals 1 if a participant already passed one or more other courses on graduate level in accounting/finance, 0 otherwise. The second variable (*Grade*) reflects the participants' grade point average from the bachelor's studies on a five-point scale with 3 reflecting a grade point average around the median for the year. A higher number reflects a better grade point average. The third variable (*Invest*) takes the value of 1 if people invest in stocks and 0 otherwise. The fourth variable (*Job*) equals 1 for people with a relevant part-time job and 0 otherwise.

Descriptive Statistics and Correlations

Boldness (*Boldness2*) and *RiskWillingness* have a moderate positive correlation of 20 % (23 %). None of the control variables correlates significantly with any of the main variables.

TABLE 3												
Descriptive Statistics and Correlations												
	n	Mean	Median	SD	Min	Max	1	2	3	4	5	6
1. Boldness	115	0.69	1	0.40	0	1						
2. RiskWillingness	128	6.07	6	1.76	1	10	0.20**					
3. Boldness2	124	72.86	75	41.45	10.5	142	0.74***	0.23**				
4. Job	129	0.76	1	0.53	0	1	0.10	0.03	0.12			
5. Invest	127	0.40	0	0.49	0	1	-0.08	0.04	-0.14	-0.01		
6. Grade	126	3.85	4	0.83	1	5	0.03	0.05	-0.10	-0.08	0.00	
7. Course	119	0.62	1	0.49	0	1	-0.07	0.01	-0.03	-0.23**	-0.22**	0.01

Descriptive statistics and pairwise correlations between all variables.
Stars indicate significance on level: ***-p<0.001, **-p<0.05, *-p<0.1.

Results

As stated in H1 I expect the individual risk-willingness to be positively associated with the boldness in forecasts. This hypothesis is tested on the 115 participants in the consensus group using an OLS regression with *Boldness* as the dependent variable and *RiskWillingness* as the main independent variable. Further, the four control variables described above are included. Hereafter the test is rerun but including *Boldness2* as the dependent variable. Table 4 shows the result of the following models:

Model 1a:

$$\text{Boldness} = \alpha_0 + \beta_1 \text{RiskWillingness} + \beta_2 \text{Job} + \beta_3 \text{Invest} + \beta_4 \text{Grade} + \beta_5 \text{Course} + \varepsilon_i$$

Model 1b:

$$\text{Boldness} = \alpha_0 + \beta_1 \text{RiskWillingness} + \beta_2 \text{News} + \beta_1 \text{RiskWillingness} * \beta_2 \text{News} + \beta_3 \text{Job} + \beta_4 \text{Invest} + \beta_5 \text{Grade} + \beta_6 \text{Course} + \varepsilon_i$$

The full model insignificantly explains 8 % of *Boldness* in the forecasting task ($F(5, 100) = 1.80, p < 0.12$). *RiskWillingness* explains *Boldness* significantly with a coefficient of 0.05 suggesting that more risk-willing people are more likely to make bold forecasts (away from the consensus estimate) than are less risk-willing people¹⁷. This is in line with my predictions in H1. However, all controls are insignificant suggesting the model might improve if some variables are dropped. Using a backwards selection I try different combinations but all other versions of the full model decreases R^2 whereas the significance of *RiskWillingness* persists. A forward selection reveals the same results. A VIF test shows no sign of

¹⁷ As often implied in the literature males are generally more risk-willing than females. Thus, as expected additional analyses reveals that *RiskWillingness* are significantly correlated with gender (22 %) in my data as well. I therefore implement an interaction term between *RiskWillingness* and gender in the regression model but this interaction term turns out highly insignificant in explaining *Boldness* (coefficient = 0.01, t-stat. = 0.25, p-value = 0.80). Thus, relations between individual risk-willingness and gender do not seem to drive the results of this paper.

multicollinearity with the highest (mean) VIF being 1.10 (1.04) which is well below the recommended ceiling of 10 (Kutner et al. 2004)¹⁸.

TABLE 4
Regressions of RiskWillingness on Boldness while Controlling for Experience and Skills

	Model 1a		Model 1b		Bad News		Good News		Bad vs. Good	
	β	t	β	t	β	t	β	t	chi	z
RiskWillingness	0.05**	2.20	0.11***	2.89	0.11***	2.82	0.00	0.10	4.14**	2.03**
News			0.74**	2.25						
RiskWillingness * News			-2.12**	-2.12						
Job	0.04	0.41	0.05	0.58	0.04	0.25	0.06	0.50		
Invest	-0.10	-1.25	-0.06	-0.74	-0.08	-0.67	-0.05	-0.47		
Grade	0.02	0.34	0.00	0.10	-0.01	-0.10	0.03	0.42		
Course	-0.08	-1.01	-0.09	-0.14	-0.01	-0.13	-0.16	-1.43		
n	106		106		46		60			
R ²	0.08		0.14		0.25		0.05			
F	1.80		2.00*		2.58**		0.61			

Stars indicate significance on level: ***=p<0.001, **=p<0.05, *=p<0.1.
Model statistics are reported separately for each model at the end of the table.
Tests of difference between coefficients (Bad vs. Good) are two-sided.

I rerun the regressions but include *Boldness2*. Table 5 shows the result.

TABLE 5
Regressions of RiskWillingness on Boldness2 while Controlling for Experience and Skills

	Model 2a		Model 2b		Bad News		Good News		Bad vs. Good	
	β	t	β	t	β	t	β	t	chi	z
RiskWillingness	5.61**	2.5	8.96	2.17**	8.53**	2.15	2.69	0.98	1.14	1.07
News			37.31	1.15						
RiskWillingness * News			-5.92	-1.16						
Job	8.83	0.95	9.17	0.94	-9.68	-0.57	20.29	1.83		
Invest	-14.93*	-1.98	-13.11*	-1.66	-14.88	-1.24	-9.16	-0.86		
Grade	-6.58	-1.56	-7.11*	-1.70	-2.14	-0.33	-9.27	-1.82		
Course	-5.90	-0.74	-5.94	-0.76	-4.15	-0.36	-2.8	-0.25		
n	113		113		49		64			
R ²	0.12		0.14		0.19		0.15			
F	3.44***		2.39**		2.71**		2.81**			

Stars indicate significance on level: ***=p<0.001, **=p<0.05, *=p<0.1.
Model statistics are reported separately for each model at the end of the table.
Tests of difference between coefficients (Bad vs. Good) are two-sided.

The support of H1 generally persists with *Boldness2* included as the dependent variable. However, this model is statistically significant in opposed to the model

¹⁸ All main variables (but none of the controls) are treated as normal based on a Shapiro-Wilk test for normality and a skewness- and kurtosis test for normality. Further, *RiskWillingness* shows no sign of endogeneity based on a Durban Wu-Hausman test.

where *Boldness* is included as the dependent variable. This suggests that I may improve the explanation of what determines the boldness in forecasts by including controls only when the measure of boldness in forecasts cannot isolate the behavior from other factors. Further, for both dependent measures *RiskWillingness* is only significant in the group receiving bad news. While the difference between the coefficients for *RiskWillingness* in the two subsamples is significant for the model including *Boldness*, is it insignificant when *Boldness2* is included as the dependent variable. This suggests that results of H2 should be interpreted with a bit of caution while results for H1 seem very robust. However, the fact that the relationship between individual risk-willingness and the boldness in forecasts is only significant in the bad news group for both measures of boldness still indicates different behaviors in the two groups.

5.3. Confidence Driving the Results

Prior studies suggest risk-willingness and confidence are overlapping constructs which can be difficult to separate (e.g. Slovic 1999; Loewenstein et al. 2001). Further, Moore et al. (1999) and Menkhoff et al. (2006) find some aspects of confidence¹⁹ to affect herding behavior in forecasts. I therefore retest my hypotheses on a subsample attempting to control for one dimension of confidence sometimes referred to as the “better than average”-effect (Svenson 1981).

Just after the forecasting task is completed participants are asked to evaluate their own performance in the task relatively to how they expect others have performed, on a five-point scale²⁰. Inspired by methods used by Niederle and Vesterlund (2007) I rerun my tests but include only the 49 participants answering in the middle of this scale (3) reflecting that they expect their own performance to be

¹⁹ Referred to as illusion of control and positive illusions.

²⁰ Given this task is performed just after the forecasting task the participants' perception of their own performance could potentially be affected by the treatment group they were assigned in the forecasting as. I therefore test for this but find no treatment effects on this measure of BTA-effects.

around average. Thus, the behavior of these participants should be unaffected by their individual perception of their performance in the forecasting task and therefore I expect to get a purer effect of individual risk-willingness on herding behavior.

TABLE 6
T-tests of Differences in Boldness Between the Two RiskWillingness Groups on the Subsample Assessing Their Own Performance as Around Average

	Total Sample		Bad News		Good News	
	n	Mean	n	Mean	n	Mean
Less RiskWilling	22	0.46	11	0.42	9	0.51
More RiskWilling	27	0.78	9	0.91	13	0.73
t-stat (two-tailed)		-2.96***		-3.22***		-1.41
z-stat		-2.64***		-2.36**		-1.48

Means of *Boldness* tested on total sample and for the two news groups respectively.

T-statistics (t-tests) and z-statistics (Mann-Whitney tests) are reported for two-tailed tests of difference in means.

Stars indicate significance on level: ***= $p < 0.01$, **= $p < 0.05$, *= $p < 0.1$.

Results from t-tests (Table 6) on the relevant subsample reveal about the same results as t-tests on the full sample. People that are more risk-willing are significantly more likely to make bolder forecasts supporting H1. When the sample is split according to the news treatment the significance persists for the bad news group but disappears for the good news group suggesting support of H2. Although the sample size is reduced significantly and the results therefore should be interpreted with some caution, I believe that this attempt to remove a possible confounding dimension from my main results adds credibility to the findings from the primary analyses.

6. CONCLUSION

This study concentrates on decision making under uncertainty comparable to the environment of financial analysts in the process of conducting forecasts. The literature on financial analysts is concerned about so-called biases, such as herding behaviors, since they can decrease the usefulness of the forecasts by compromising accuracy. Because herding behavior is a very pronounced mechanism in FAF, that more often results in biased forecasts than in accurate forecasts, an improvement of the understanding of how personal traits like individual risk-willingness may impact this behavior is important and called for.

In this paper I predict that less risk-willing people are more likely to herd towards consensus with their forecasts than are more risk-willing people. Further, I expect this relationship to be more pronounced when bad news is received prior to a forecast revision than when good news is. To this end I rely on recent findings in the literature on financial analysts and on theories mainly in the literature of behavioral- and social psychology. Thus, I accept the perspectives that cognitive biases and social forces play a role in explaining herding behavior. The predictions are tested based on a 2x2 between-subjects experimental setting using 289 graduate students as participants. The experiment involves a close to real world forecasting task where forecast revisions are solicited from participants.

Supporting the predictions I find that less risk-willing people do herd more towards a consensus estimate than more risk-willing and that these findings are largely driven by an effect found in the subsample consisting of those receiving bad news prior to the forecast revision. The results suggest that forecasting towards the consensus is not solely an outcome of informational herding (expecting others to have superior information or skills) or based on strategic incentives such as reputational advantages. Rather, it seems that part of the explanation of why some individuals display a herding behavior can be connected

to mental short-cuts and behavioral biases leading to a more intuitive reaction based on personal traits like individual risk-willingness.

This paper seeks to contribute to a rising literature generally suggesting that personal traits affect decision making to a much larger extent than reflected by its attention in current literature. Thus, expanding the view beyond perfectly rational agents and relying more on bounded rationality and sub-optimal decisions in the chase to understand herding behaviors of financial analysts might move the literature in the desired direction (e.g. the call from Bradshaw (2011)). For instance, future research may be concerned with the degree to which observed biases in FAF (e.g. herding behavior, optimism- or conservatism bias) on the individual level may occur from more unconscious mechanisms such as intuition, cognitive biases or emotions. Extensions of our knowledge on this matter may serve as important inputs to improve the usefulness of FAF as proxies for future movements in the stock market. Further, because the results in this paper partly shed light on decisions made from intuitions that can be affected by personal traits this paper also speaks to regulators by suggesting that broad and general enforcements may not be sufficient in effectively protecting investors from biased FAF. If intuitions play a more pronounced role than previously assumed, analysts' exhibiting a herding behavior are likely to continue on that path even if external incentives change. Hence, more customized interventions directly pointed at the financial analysts to change their instinctive behavior and perhaps an increased supply of analyst specific data to investors may be useful. Finally, as a secondary contribution this paper suggests a method to capture and measure herding behavior which may inspire other studies relying on setting where information can be controlled.

Although the experimental method used in this paper has the advantage of controlling information and isolating herding behaviors from confounding factors

and thus more directly associate it with individual risk-willingness, limitations concerning external validity and generalization are recognized. Specifically, this experimental setting is not directly able to discriminate between the effects of different theories about herding behavior on the participants' behavior e.g. separating informational herding from social herding or herding related to cognitive biases. However, the setting provides no strategic or reputational benefits of herding which makes an explanation of the results that solely relies on this aspect of herding unlikely. Further, although participants in this setting may have informational reasons to follow the consensus estimate, explaining the relation to variations in individual risk-willingness by strict rational models or informational herding theories seems unfitting.

While the results pertaining to the relationship between individual risk-willingness and herding behavior seem quite robust the results about the news-treatment as a moderator are a bit more sensitive. This sensitivity could be related to how the magnitude of the news is perceived. Future research could directly address this issue by varying the magnitude of news in a controlled setting to investigate whether the results of this paper persist. Finally, while the experiment in this paper relies on forecasts from a single round setting (including two forecasts for each participant) without feedback on performance it could be interesting to see if the results persist in a setting with multiple rounds and immediate feedback where learning effects are likely to be present. One could imagine that a learning effect reduces individuals' tendency to rely on intuition because solving the task for the first time may demand more cognition than solving it for the second or third time. However, it is equally likely that intuitive thinking increases with experience of the task because it may result in more comfort and hence decrease individuals' perceived need for more elaborate analyses. In the latter case, results from this paper are likely more generalizable than expected. Nevertheless, it was assessed

that implementing multiple rounds could potentially bias the results from e.g. spill-over effects and thus the drawbacks of addressing the limitations of a single round experiment by including more rounds would dominate the benefits.

APPENDIX A

AVAILABLE INFORMATION TO ALL PARTICIPANTS PRIOR TO STATING THEIR FIRST FORECAST (F1)

Forecasting Task

On the next page you are asked to state your **one-year-ahead earnings per share (EPS) forecast** for a particular company. Today is year 0 and you are asked to forecast EPS for year 1.

$$\text{EPS} = \text{Net Income} / \text{Number of Shares}$$

The company is an actual listed company but in this experiment you will just know it as “The Firm”.

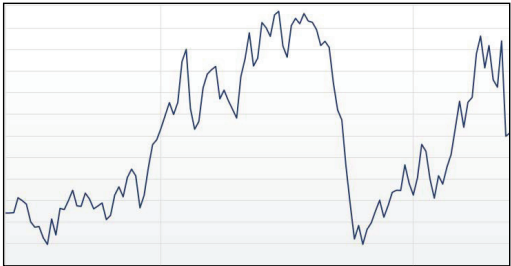
Company info:

The Firm was founded in 1892 and operates today through 842 stores in the United States, and 157 stores in Canada, Europe, Asia, and Australia. The Firm is within the retail industry with clothes as the main product line. The Firm’s products are considered to be medium-price. The sales are highly seasonal and usually peak in the spring and fall. Approximately 25 % of The Firm’s total revenue comes from online sales. According to The Firm: *“The brand is our lifestyle, our focus—the value of having a great brand is far-reaching and cannot be overstated—it’s a snowball effect”*.

Industry info:

The industry is known by its intense competition between its many players which is characterized by very volatile earnings and volatile stock prices. Within the last five years The Firm has experienced many new competitors which can be of future threat according to The Firm itself: *“In light of the competitive challenges we face, we may not be able to compete successfully in the future. Further increase in competition could reduce our sales and harm our operating results and business”*.

This figure illustrates the development in stock prices for The Firm in the last ten years:



The Firm's Income Statement from the annual report.

(year 0 = current, year -3 = three years ago)

(in thousand \$)	Year -3	Year -2	Year -1	Year 0
Revenue	3,468,777	4,158,058	4,510,805	4,116,897
Cost of Revenue	-1,251,348	-1,607,834	-1,694,096	-1,541,462
Gross Profit	2,217,429	2,550,224	2,816,709	2,575,435
Sales, General etc.	-1,980,249	-2,260,818	-2,435,069	-2,366,397
Non-Recurring Items	0	-68,022	-7,407	-128,215
Operating Income/EBIT	237,180	221,384	374,233	80,823
Interest Expense	-3,362	-3,577	-7,288	-7,546
Earnings Before Tax/EBT	233,818	217,807	366,945	73,277
Income Tax	-78,109	-74,669	-129,934	-18,649
Net Income	155,709	143,934	237,011	54,628
EPS (\$)	1.67	1.47	2.85	1.45
Stock price (\$)	45.64	58.70	49.61	46.20
Total Outstanding Shares (thousand, Year 0 and 1)	-----	-----	-----	37,693

Expectations for the industry:

The National Retail Foundation (NRF) says its retail sales forecast for year 1 predicts a growth of 4.1% (3.7 % year 0). Online sales are expected to increase between 9% and 12% this year. The NRF President and CEO said: "Improvements in economic growth combined with positive expectations for continued consumer spending will put the retail industry in a relatively good place in year 1. Though headwinds from the looming debates about the debt ceiling, increased health care costs, and regulatory concerns still pose a risk for both consumers and retailers".

Expectations of The Firm:

The Firm partly explains the EPS level at year 0 by unusual expenses due to restructuring costs as well as an ongoing lawsuit about management ethics. The Firm expects little or no restructuring costs and no impact from the lawsuit in year 1. The Firm forecasts EPS for year 1 to be in the range of \$2.25 to \$2.35.

APPENDIX B

AVAILABLE INFORMATION TO THE PARTICIPANTS IN THE CONSENSUS-TREATMENT GROUP (ADDITIONALLY RECEIVING A CONSENSUS ESTIMATE) THAT RECEIVED BAD NEWS PRIOR TO STATING THEIR REVISED FORECAST (F2)²¹

New information in the market

The first quarterly report for year 1 was roughly as expected. The second quarterly report for year 1, which just got released, reveals the following numbers.

Highlights from the second quarter report, year 0 and year 1, in thousand \$:

	Year 0, Q2	Year 1, Q2
Revenue	945,698	<u>890,605</u>
Gross profit	604,122	<u>552,956</u>
Operating income/EBIT	19,165	<u>17,493</u>
Net Income	11,371	<u>10,877</u>

After the release of the second quarterly report the CEO of The Firm said in a press release: “Because of a continued challenging environment, our sales for the second quarter were somewhat below plan.” However, The Firm does not revise their total expectations for year 1.

On the other hand, based on 14 estimates from your colleagues, expected EPS for The Firm at year 1 is downgraded to an average (consensus) of \$2.14.

Please revise your EPS forecast for The Firm for year 1 (If you do not deem a revision necessary, please write your forecast from the prior task again).

²¹ The pieces of information that vary across treatments are underlined.

APPENDIX C

AVAILABLE INFORMATION TO THE PARTICIPANTS IN THE CONTROL GROUP (NOT RECEIVING A CONSENSUS ESTIMATE) THAT RECEIVED GOOD NEWS PRIOR TO STATING THEIR REVISED FORECAST (F2)²²

New information in the market

The first quarterly report for year 1 was roughly as expected. The second quarterly report for year 1, which just got released, reveals the following numbers.

Highlights from the second quarter report, year 0 and year 1, in thousand \$:

	Year 0, Q2	Year 1, Q2
Revenue	945,698	<u>1,000,791</u>
Gross profit	604,122	<u>655,288</u>
Operating income/EBIT	19,165	<u>20,837</u>
Net Income	11,371	<u>11,865</u>

After the release of the second quarterly report the CEO of The Firm said in a press release: Despite a continued challenging environment, our sales for the second quarter were somewhat below plan. inued challenging environment, our sales for the second quarter were some
On the other hand, based on 14 estimates from your colleagues, expected EPS for The Firm at year 1 is upgraded to an average (consensus) of \$2.14.

Please revise your EPS forecast for The Firm for year 1 (If you do not deem a revision necessary, please write your forecast from the prior task again).

²² The pieces of information that vary across treatments are underlined.

APPENDIX D

WRITTEN INSTRUCTIONS TO THE EXPERIMENT

In-class experiment

This experiment takes approx. **40 minutes** and all your answers will be treated anonymously.

You can earn real money from this experiment. **You have a possible pre-tax payoff of DKK 2,000.**

If you decide to participate you need to remain seated until the experiment is over in approx. 40 minutes. If you do not wish to participate please exit the room now.

Paper, pen and calculator (e.g. on cell-phone) are required. Please place everything else by the wall (bag, jacket, computer, books etc.).

The number attached to the front page is your identification number. Detach one snip with the number on and leave the other snip with the number on attached to the front page. You will have to show the number in order to get your earnings so make sure you can find it again.

Answer all questions in chronological order. You are **not allowed to communicate** in any way during the experiment or to look at others' answers. After giving an answer you are not allowed to flip back and change it. If these rules are not obeyed, you may be excluded from the experiment and are not allowed to receive any potential earnings from the experiment.

Please read instructions carefully before you make your answers!

General instructions

Everybody has an equal chance of earning money from this experiment. However, **your earnings are dependent on the choices you make.**

Although you are paid in DKK we use **an experimental currency called "coins"**.

You will use your coins to participate in one of two lotteries between which you can choose at the end of the experiment where detailed information is presented.

After the results have been processed and the winners have been registered, the winners will be paid. Further information about time and place for the lotteries and payments will be available at LEARN within one week from today.

You start the experiment with 60 coins.

The maximum possible amount of coins you can earn from this experiment is 2000. From now on you will not get any feedback on how much you have earned during the experiment.

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Cognitive Dissonance Reduction and Confirmation Bias in Financial Forecast Revisions

Simone Staehr

ABSTRACT

Research has shown that confirmation bias, the tendency to seek for, and rely more heavily on information that is confirmatory to an initial belief as a reaction to cognitive dissonance, exists for most people in various contexts. From an experimental setting, performed by 289 graduate students in finance and accounting, this paper provides evidence that people with high confidence in their own initial forecast are more hesitant to deem a revision necessary after receiving new information. This is argued to be a result of confirmation bias leading to inertia. This paper also finds that those hesitant to make revisions express increased confidence in their forecast following the new information compared to those revising their forecast. Thus, a non-revised forecast following new information in the market is not necessarily a reflection of that new information already being incorporated in the forecast but might also be a result of cognitively biased decision making. The findings have implications for studies in the context of financial analysts' forecasting behavior and may add to the understanding of why underreactions to new information in the market are often found.

1. INTRODUCTION

Financial analysts provide earnings forecasts amongst other inputs to investors' investment decisions (Givoly and Lakonishok 1984) and have consequently spurred great research attention (for recent literature reviews and insights see Ramnath et al. 2008; Bradshaw 2011; Brown 2015). Some concentrate on the output side such as when and why earnings forecasts are more informative (e.g. Lui and Thomas 2002; Clement and Tse 2003), better at explaining stock prices (e.g. Dechow and Sloan 1997; Shane and Brous 2001; Theo and Wong 2002; Elgers et al. 2003) as well as how the market reacts to changes in the forecasts (e.g. Baginski et al. 1990; Stickel 1991; Gleason and Lee 2003; Ivkovic and Jegadeesh 2004; Chen et al 2005; Frankel et al. 2006; Altinkilic and Hansen 2009; Loh and Stulz 2011). Others concentrate exclusively on the input side such as reporting quality (e.g. Hopkins 1996; Duru and Reeb 2002; Hirst et al. 2004) or management incentives (e.g. Brown 2001; Matsunaga and Park 2001; Matsumoto 2002; Skinner and Sloan 2002; Mayew 2008). Further, while some studies concentrate on external drivers like environmental factors (e.g. Haw et al. 1994; Hopkins et al 2000) and regulations (e.g. Berger and Han 2003; Ivkovic and Jegadeesh 2004) others focus on more internal factors such as analysts' incentives (e.g. Dugar and Nathan 1995; Lin and McNichols 1998; Jacob et al. 2008) and expertise (e.g. Mikhail et al. 1997; Brown 2001; Hirst et al. 2004). In addition to the above mentioned studies, in order to understand the analysts' decision process in more detail, the research has advanced towards perspective from social- and cognitive psychology.

Most commonly researchers *“examine correlations between inputs, outputs, and conditioning variables to understand the analysis process”* (Bradshaw 2011, p. 6, l. 5 fb.). By focusing more directly on the financial analyst a line of research has found behavioral biases such as herding behavior (e.g. Hong et al. 2000; Clement

and Tse 2005; Jegadeesh and Kim 2009; Durand et al. 2014) to sometimes be influential to analysts' decision process. Further, a narrower stream of research concentrates on psychological factors or biases to explain analysts behaviors such as herding behaviors (explained by miscalibration) (Glaeser and Sunstein 2007; Seybert and Bloomfield 2009; Libby and Rennekamp 2012) and underreactions (explained by asymmetric loss functions by Markov and Tan 2006, and by cognitive dissonance by Friesen and Weller 2006). This is where this paper seeks to contribute.

The dynamic market environment, in which financial analysts work, requires constant awareness because new information is often released and analysts are expected to consider this information in their forecasts. Thus, when new information becomes available in the market (e.g. when firm management issues quarterly reports) financial analysts have to decide if their prior forecasts should be revised following this new information and to what extent. However, no study has focused on what causes analysts to *not* change their prior forecast following new information. That is, following new information in the market which otherwise leads most analysts to revise their forecasts, what make some analysts decide not to revise their prior forecasts? Since releases of quarterly reports is a very common event that leads to many forecast revisions (Barron 1995; Cooper et al. 2001) this paper mainly relates to the release of a quarterly report when mentioning a release of new information in the market.

There are at least two strands of reasons why analysts sometimes decide not to revise their prior forecast upon receiving new information. The first is related to the content of information received by the analysts. That is for example, if the new information in the market is interpreted by the analysts as none value-adding for instance by being in line with an analyst's prior expectations and therefore already included in the prior forecast. This group of reasons would generally suggest

similar behavior by the analysts, i.e. upon release of new information analysts would revise or not revise depending on the content of the information. The second is related to the fact that individuals (i.e. financial analysts) place different emphasis on the new information they receive. This element of reasons suggests that analysts would vary in their response to new information. When faced with the same new information, some would revise while others would not. Complementing prior research this paper focuses on aspects of the latter strand, i.e. the manner in which individuals receive, treat and react to new information, to explain why financial analysts sometimes refrain from revising their forecast upon receipt of new information which leads other analysts to revise. In the accounting literature, Koonce and Mercer (2005) suggest confirmation bias as a plausible explanation of why financial analysts sometimes reach very different conclusions about a company's future performance from identical information. Following the suggestion by Koonce and Mercer (2005) this paper relies on psychological theory about *cognitive dissonance* and *confirmation bias* to explain why some individuals do not revise a forecast upon reception of new information. And further why individuals, who do not revise, tend to subsequently strengthen their confidence in own forecasts compared to those individuals who actually react on the new information and revise.

Cognitive dissonance occurs when our brains are faced with information contradicting our beliefs (Festinger 1957; Festinger and Carlsmith 1959; Aronson 1968). In order to solve this mental disturbance individuals tend to disregard the contradicting elements of the information - often unconsciously (Nickerson 1998). When dissonance leads to a biased reaction to new information towards a prior belief, it is often referred to as *confirmation bias* (Mahoney 1977; Edwards and Smith 1996). Inspired by the view of these studies, this paper seeks to explain financial analysts' revision behavior by looking at their decision processes.

Experimental research in accounting has occasionally applied confirmation bias but focused on other issues than analysts' revisions. For instance Mayew (2008) argues that managers suffer from confirmation bias because they seem to favor analysts that share their own view about future prospect of the company. Further, Nocera (1999) rely on confirmation bias to explain analysts' behaviors during the dot.com crash in the 1990's.

This paper theorizes that analysts receiving new information may pick out the dimensions of the new information which best fit with prior beliefs so that the same information may be interpreted differently by different analysts who tend to all interpret in line with their prior beliefs. The possibility of making information fit with prior beliefs is higher the stronger prior beliefs are. This leads to the hypothesis that strength of prior beliefs is positively associated with the likelihood of a non-revision. Thus, by drawing on psychological literature this paper argues that a possible cause of non-revisions in forecasts following new information is confirmation bias.

Further, this paper argues that the non-revision in turn strengthens beliefs as oppose to revisions. The argument for this is related to cognitive dissonance reduction (a central tenet of confirmation bias). According to Festinger (1957) dissonance almost always occurs after a decision has been made. He predicts that the chosen (rejected) alternative gets more (less) attractive after the decision is made due to dissonance reduction. Therefore, even if most people are unaware of this bias, after a decision is made, people rely more heavily on confirmatory information. Consequently, this makes them indisposed to reduce their confidence in that decision even after new and disconfirming information arrives (Pitz 1969). When new information is perceived as confirmatory, the strengths of people's beliefs even increases (Foran and DeCoster 1974; Tiller 1983).

In line with suggestions of this paper, experimental studies in related literatures have shown that people tend to find a revision of their initial belief less necessary if they are presented with confirmatory information (Yaniv et al. 2009) and that confirmation bias increases our confidence in our own belief (Plous 1991). In line with how prior studies test similar hypotheses this paper relies on the experimental method.

The experiment in this paper is executed on 289 finance and accounting graduate students. By providing a wide range of quantitative and qualitative information regarding an existing firm, this paper's experiment strives to replicate the complexity of information that financial analysts are required to sort and process. Participants are asked to use the available information in order to conduct a one year ahead EPS forecast and to provide an interval in which they feel 90 % confident that the true earnings will fall. This interval is used to gauge the strength of their beliefs i.e. their individual level of confidence in their own forecast. Hereafter, participants are presented with new available information about the market and firm in focus (e.g. the release of a quarterly report) and asked to revise their prior forecast according to this information and again state a 90 % confidence interval.

The hypotheses are tested and supported by regression analyses and t-tests. The confidence in the participants' own forecast is negatively associated with the likelihood of a revision. This is interpreted as confirmation bias leading individuals with high confidence in their initial belief to be more likely to perceive information as confirmatory and hence be more hesitant to revise their prior forecast following new information. Further, not revising the forecast after receiving new information is positively associated with an increase in confidence

indicating that individuals become more confident in their own forecast as a result of not revising it. This is interpreted as individuals seeking to validate their choice of not revising a forecast in order to reduce dissonance by committing to their own beliefs and thus increase their confidence in their own forecast. A number of additional tests pertaining to alternative explanations, and alternative statistical methods indicate the robustness of these findings.

This paper contributes in at two least manners to the understanding of financial analysts' forecasts in general and non-revisions (or very modest revisions) in particular. Firstly, the paper shows that analysts can vary much in their reactions following identical information for reasons that relate not necessarily to the context (e.g. other analysts' forecasts) but more to the course of actions the analysts happen to be following for justified or unjustified reasons. This contribution arises because this paper applies an experimental method which allows controlling the information available to the participants which is not possible when using other methods such as empirical analyses of archival data. Further, other methods typically lack direct measures of individual level of confidence which this paper posits as an important addition to the explanation. Second, complementing the research on cognitive dissonance in relation to analysts' forecasting behavior by Friesen and Weller (2006) this paper contributes by highlighting the need to consider psychological factors and cognitive biases in order to achieve a more comprehensive understanding of forces that drive analyst forecasts. As previously inferred in the literature of financial analysts' forecasts by Zhang (2006) an improved understanding of reactions caused by cognitive biases may very well add to the explanation of systematic errors in financial forecasts such as analysts' underreactions to new information. Thus in aggregated data on financial analysts' forecasts, confirmation bias may contribute to general observed underreactions to news.

Findings from this paper shed light on the individual decision process related to financial analysts deciding whether or not to revise a current forecast. Whereas prior studies ignore non-revised forecasts for methodological and theoretical reasons, this paper argues that reasons of why these forecasts are not revised following new information in the market may be important to consider. Hence, findings from this paper can have practical implications in terms of guidelines of when and how financial analysts should be required to make forecast revisions in an attempt to reduce behavioral biases like confirmation bias. As an example, it might be beneficial in terms of minimizing the risk of inertia to require, internal in the firms, that financial analysts provide suggestions of revisions of the forecasts of other financial analyst's prior forecasts following new information.

The remainder of this paper is organized as follows; In Section 2 theory and hypothesis development are included. Section 3 describes the method, measurements and includes descriptive statistics. In Section 4 analyses and results are presented. Section 5 includes robustness checks. Section 6 concludes.

2. THEORETICAL FRAMEWORK AND HYPOTHESES

After an introduction to the applied theory, this section presents two separate hypotheses that can be tested separately but may predict a casual path when combined (see Figure 1 at the end of this section). When referring to a revision opportunity this paper largely talks about the release of quarterly reports as a source of new information available in the market although many other information sources might be applicable as well.

Whereas economic literature often assumes that people update their beliefs in a strict rational manner the literature on psychology generally accepts that once people have formed a belief it is rather resistant to change (e.g. Klayman and Ha 1987). This paper relies on the latter perspective and perceives an initial belief in the case of financial analysts as the forecast made prior to a revision opportunity.

2.1. Mental Reasoning and Heuristics

Every time an individual makes a decision, the brain uses complex mechanisms to help process, sort and understand information in order to create the best possible foundation for a judgement. Shortcuts in cognitive processing, sometimes referred to as heuristics, are essential in decision making (e.g. Kahneman et al. 1982a; Gilovich et al. 2002) to sort information and quickly discard useless information thus helping individuals to make decisions without spending too much cognitive effort and within a not too wide timeframe (e.g. *Gigerenzer, G. 1996*). *But the* same shortcuts can also lead to cognitive biases and thus contribute to bias individuals' information selection and prejudice the perception of the available information in ways that may end up biasing their judgements and decisions (e.g. Tversky and Kahneman 1974; Fiske 1991).

When faced with an upcoming decision, individuals tend to rely on an anchoring point and adjust beliefs with reference to this point (Kahneman et al. 1982a; see

also Furnham and Hua 2011 for a thorough review of anchoring). In the case of financial analysts' forecast revisions, one anchoring point, amongst many possible points such as a consensus forecast, last year's earnings, management's forecasts etc., is likely to be the individual's initial belief; i.e. the forecast made prior to a revision opportunity. In this paper, analysts' prior forecasts are considered the central anchoring point. One suggested explanation of anchoring bias relies on aspects of *cognitive dissonance* wherefrom *confirmation bias* is developed. These concepts are discussed in detail below and set the basis for developing the two hypotheses of this paper.

Cognitive Dissonance and Confirmation Bias

Cognitive dissonance occurs when individuals are presented with evidence that contradicts their initial perception or past choices (Festinger 1957; Festinger and Carlsmith 1959; Aronson 1968). The generally accepted theory of cognitive dissonance was first formulated by Festinger (1957) and later reformulated by Aronson (1968). According to the theory contradictory evidence provokes a discomfort in the mind. Because all individuals are more or less primed to solve the mental disturbance that contradicting information makes in the mind, people attempt to make all evidence consistent and hence reduce this mental discomfort. One way to defend a belief and hence solve the cognitive disturbance is to disregard the contradicting elements of the information rather than changing the belief because we generally prefer to view ourselves as smart. Thus disregarding contradicting evidence is more aligned with this view of being smart, believing we have the correct belief, than changing our belief is (Festinger, 1957; Akerlof and Dickens 1982; Frey 1986; Olson and Stone 2005). Effects of cognitive dissonance are shown in many contexts. E.g. fund investors' positive bias is conditioned by previous investment decisions (Goetzmann and Peles 1997) and may even explain the puzzle of the disposition effect; i.e. the tendency to be more reluctant to realize

loses than gains (Chang et al. 2016). Further, Egan et al. (2007) provide evidence that cognitive dissonance and consequently reactions to favor a prior belief exists even in monkeys and small children suggesting the underlying mechanisms of cognitive dissonance to be at least partially evolutionarily adaptive and thus may provoke unintentional behaviors.

Confirmation bias²³ is the tendency to search for information consistent with an initial belief and the tendency to evaluate contradictory information more critically than confirmatory information (e.g. Mahoney 1977; Edwards and Smith 1996; Jonas et al. 2001). Hence, confirmation bias can be a reaction to cognitive dissonance leading to underreactions to new information (Lichtenstein et al. 1977) and has proven to be strong, persistent (Arkes 1991) and occurring unconsciously (e.g. Nickerson 1998) in line with Egan et al.'s (2007) conclusion regarding cognitive dissonance. In the case where an initial belief is strong, confirmation bias may lead to inertia effects (Geller and Pitz 1968), i.e. the tendency to be reluctant to change a belief, as a consequence of making a commitment to one's initial belief in order to reduce cognitive dissonance (Pitz 1969).

The existence of confirmation bias is usually evidenced by experimental studies. As an example, Plous (1991) provides evidence of confirmation bias by first detecting all participants' initial perception of nuclear power (pro- or against). Thereafter their attitudes towards nuclear power are again observed after providing all participants with identical but new informative material about nuclear. As expected, results showed an increased strength of individuals' respective initial perception of nuclear (pro- or against) in about 50 % of the participants in both groups (pro- or against) after receiving the same informational

²³ Also referred to as *congeniality* bias (e.g. Eagly and Chaiken 1993).

material. Only 7 % in each group expressed a decreased confidence in their own initial perception (the remaining participants expressed no change in their initial perception). The explanation for such difference in interpretations of exactly the same informational material is assigned confirmation bias.

In line with theory of dissonance leading to confirmation bias and experimental evidence it is likely that financial analysts facing new information will process this information in a way that makes them perceive it as confirmatory to their beliefs. However, the degree to which each individual is likely to be exposed to confirmation bias is expected to be reflected by the confidence or strength of that initial belief. According to Kahneman and Tversky (1982b) confidence can be seen as a measure of individuals' uncertainty. More specifically, *"A statement of confidence expresses One's uncertainty in a prediction, estimate or inference to which one is already committed...Confidence is the subjective probability or degree of belief associated with what we "think" will happen."* (Kahneman and Tversky 1982b, p. 12, l. 16 fb.). Hence, individual confidence in an estimate, e.g. a financial forecast, is perceived as a reflection of the strength of that initial belief.

Although financial analysts are generally considered too confident about their own forecasting abilities (e.g. Barber and Odean 2001) their individual confidence in their own forecasts is likely to vary amongst them (e.g. Brenner et al. 1996; Hirshleifer 2012). Thus, analysts holding a high confidence are expected to be committed to that belief to a higher degree and hence be more hesitant to revise a prior forecast than analysts with less confidence in their initial belief. Because confirmation bias generally leads to underreactions to new information (e.g. Lichtenstein et al. 1977) it is likely that analysts will underreact to new information by not revising it at all when being subjects to confirmation bias

Thus, the first hypothesis of this paper posits that individual who conducted a forecast with high confidence are more resistant to revise this forecast following new information because they most likely will treat this information as confirmatory to their initial beliefs (their prior forecast):

H1: Confidence in an initial forecast is negatively related to the likelihood of a forecast revision following new information.

Cognitive Dissonance Reduction

When confirmation bias leads to inertia effects, as a reaction serving to reduce cognitive dissonance, it will further lead to a greater confidence in that belief (Budescu and Yu 2006). The reason for this is, that after new information is received and no revision is deemed necessary people commit to their initial belief and hence reduce the cognitive dissonance similar to a validation of their belief (Pitz 1969). That is, one dimension of Festinger's (1957) theory of cognitive dissonance predicts that once a decision is made, this decision is perceived even more attractive than it was prior to the decision due to dissonance reduction. Hence, after deeming a revision unnecessary following new information the confidence in people's own estimates increases (Foran and DeCoster 1974; Tiller 1983). In line with this, in an experiment by Yaniv et al. (2009) participants are to estimate calories and may choose to revise their answer following information about their peer's estimates. Some are given randomly chosen peer estimates and some are given peer estimate particularly chosen to fit with the participant's initial estimate. Although the participants are completely aware whether the peer estimates presented to them are randomly picked or picked to be as close to their own initial estimate as possible, confirmatory peer estimates lead to fewer

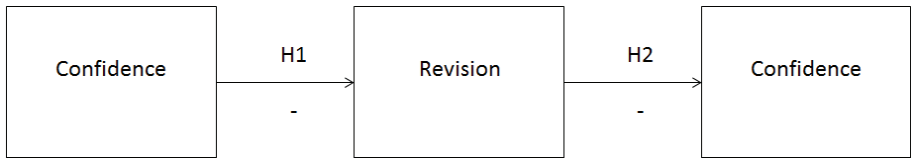
revisions than random peer estimates. Hereafter, Yaniv et al. investigate how the participants' individuals' confidence in beliefs changes after a revision opportunity. The study finds that the participants' confidence increases more in the cases where a revision is not deemed necessary relatively to when a revision is deemed necessary suggesting that revising an estimate leads to limited trust in that estimate as opposed to non-revised estimates. This is in line with theory of dissonance reduction since being only presented with confirmatory information, although this information is transparently selected in a subjective way, leads to less cognitive dissonance and thus a greater confidence in the initial belief as oppose to when contradicting information appears.

The focus of Yaniv et al.'s (2009) experiment is to make a design where information to participants prior to a revision decision is *either* confirmatory to their prior belief *or* randomly chosen. But the experiment does not shed light on the possible variation between participants' perceived need for a revision if they all receive *similar* information prior to revisions. In the case of financial analysts, new information in the market such as quarterly reports is accessible to all analysts. Thus it is usually the case that all financial analysts will consider the need for a forecast revision following the same information set. Given that confirmation bias is driven by individuals unconsciously seeking for, and relying more on, confirmatory information, it is likely that even when people receive similar information those more prone to be subjects to confirmation bias (and hence those less likely to revise their prior belief) increases in confidence compared to those less inclined to be subjects to confirmation bias. This is stated by the second hypothesis of this paper:

H2: Not revising a forecast following new information is positively related to the subsequent confidence in the forecast.

The hypotheses can be illustrated by the following path:

Figure 1 – Hypothesized path.



3. METHOD AND MEASUREMENTS

The main task in this experiment is a forecasting task (described in detail below). After the forecasting task the participants are presented with a valuation task, primarily serving as a distraction task, and are hereafter asked to answer a short questionnaire²⁴. At the end of the experiment participants must choose in which of two different lotteries they wish to participate in order to determine their final monetary compensation. Experimental materials are provided in the appendices.

3.1. Forecasting Task

The forecasting task follows two stages. In the first stage, participants are given historical information about a firm in focus as well as future prospects of the firm and industry (see Appendix A). From this information, they are first asked to state a one year ahead EPS forecast (referred to as F1) together with a confidence interval within which they feel 90 % sure that the realized EPS will lie. Hereafter, in the second stage, they are told that the first two quarters of the year have gone by and participants are now provided with new information including the latest quarterly report²⁵ (see Appendix B). From this new information, they are asked to revise their prior EPS forecast for the year-end (referred to as F2) and to state a 90 % confidence interval for their revised forecast. Allowing participants to not revise may unintentionally induce status quo bias; i.e. in terms of participants who deem a revision necessary but choose not to revise, simply to reduce effort. In an attempt to minimize the risk of this, participants are required to re-enter their prior forecast as opposed to not entering anything when a revision is perceived

²⁴ Because the forecasting task lays ground for directly testing the hypotheses and the valuation task merely serves as a distraction task but are used as inputs to robustness checks, it is not described in further detail here.

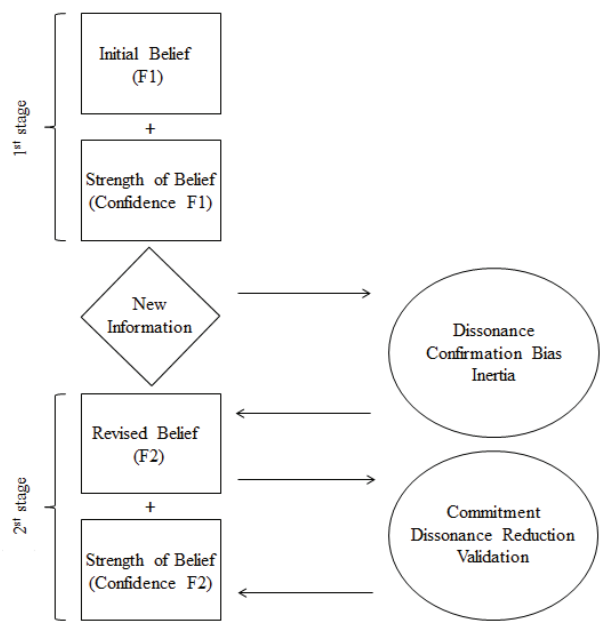
²⁵ This news information varies across two treatments because this experiment additionally serves as basis for another paper. These two treatments are i). whether or not the new information contains a consensus estimate and ii). whether the new information reflects a positive or negative outlook for the company. These variations are expected to create noise in the data in the same way as noise is expected in archival data. However, to make sure that the treatments does not create systematic differences in the data that may drive the results of this paper, robustness checks in section 5 control for the differences in the experimental materials.

unnecessary. This requirement is expected to reduce a potential status quo bias (Samuelson and Zeckhauser 1988).

To reflect the wide range of information types and sources that professional financial analysts base their forecasts on, the information available to participants in this experiment is rather rich. Hence, quantitative information, including excerpts from the firm's financial accounts, industry growth forecasts and earnings expectations from management may provide participants with various anchoring points to which they can allocate more or less weight when conducting their first EPS forecast. Furthermore, participants are given qualitative information, including statements and press releases from industry experts and the firm's CEO. This information is likely to be very subjectively perceived by the participants and hence interpreted differently in their respective first EPS forecasts. The new information participants subsequently receive in order to revise their EPS forecast contains highlights from the income statement of this year's second quarter together with last year's second quarter. Further, management underlines that the competition in the market is rather tough but at the same time their own EPS forecasts of the year are maintained (which were estimated in the beginning of the year). Hence, the information is rather ambiguous and leaves room for participants' individual perceptions and interpretations of the information. All participants have full discretion in terms of whether they revise or do not revise as well as in terms of the direction (upgrade or downgrade), if they choose to revise. Because this experiment additionally serves the purpose of another paper two variations in the information provided in the second stage of the forecasting task are present. In the robustness checks these two treatments are controlled for and all results persist.

This design is not constructed to form expectations of how participants *should* process the given information pieces or to predict which outcome they are more likely to state. Nor is it possible to predict which EPS forecast is the correct outcome. Instead, this experimental design allows for predictions about participants' post-decision behavior, i.e. how they are likely to treat new information depending on their first forecast. More specifically, relying on theory about cognitive dissonance leading to confirmation bias, this paper makes predictions about how participants will revise their forecast after receiving new information by considering each participant's size of confidence interval in their first forecast as a reflection of their strength of belief in that forecast. Participants with greater strength in beliefs are more likely to react to confirmation bias by inertia and hence be hesitant to revise their forecast following new information. Hence, they feel more strongly committed to their forecasting decision which further reduces the cognitive dissonance and thereby strengthens their belief in their decision. This is illustrated by Figure 2 below. Confirmation bias is more likely to occur in environments where the general uncertainty about the correct outcome is high, where there is no immediate feedback and where information is provided sequentially (Jonas et al. 2001). These are all characteristics present in the environment financial analysts' work. Therefore, because of the ambiguity in the information (i.e. the combination of qualitative- and quantitative information pieces) participants receive to base their forecasts on, this setting is expected to be suitable for the purpose of the paper and at the same time reflect a realistic simulation of the environment that financial analyst's work in.

Figure 2 - the two stages in the forecasting task together with steps in mental processing expected from theory.



3.2. Procedure and Participants

The experiment was conducted in-class on graduate students following the course ‘Financial Statement Analysis and Valuation’. The experiment was announced one week in advance and all students participated on a voluntary basis. Pens, papers and calculators were the only effects allowed during the experiment. Naturally, communication of any kind was forbidden. The experiment took 40 minutes to complete and all participants remained seated until the experimenter announced that the experiment was finished. Debriefings and lottery draws were transparently done in-class a week after the experiment was executed.

289 graduate students participated in the experiment. 14 of those failed to provide all the required responses in the forecasting task and were therefore dropped. Further, 9 participants gave extremely wide confidence intervals for their first forecast (the top 3 %) and are therefore also dropped. The remaining 266 participants are on average 25 years old and 27 % are female. 68 % have a relevant part-time job and 38 % are actively investing in stocks. Following their profiles they are assumed to have sufficient knowledge to complete the tasks and that the behaviors investigated in this paper are fairly comparable between these participants and professional analysts (see e.g. Libby et al. 2002 for a discussion of when students can be used as participants).

Compensation

Participants are informed at the beginning of the experiment that they are able to earn money by participating. During the experiment they will earn so-called coins (an experimental currency) which are later converted into lottery tickets by an (at that point) unknown exchange rate (comparable to the design of Libby and Rennekamp 2012, p. 208 footnote 13). In order to earn real money they have to win a lottery which is further explained to them at the end of the experiment where the exchange rate is also announced. However, it is made clear to the participants from the beginning of the experiment that their final amount of coins depends on their performance in the experiment and that unsolved tasks always leads to fewer coins. Hence, they are encouraged to make an effort in all tasks of the experiment and to make as accurate answers as possible. A stream of literature argues that how people process information according to their prior beliefs and attitudes is influenced by their motivation to state accurate answers (e.g. Chaiken et al. 1989; Kunda 1990; Chaiken et al. 1996; Wyer and Albarracín 2005; Chen et al. 2015). When motivation for accuracy is low, it may create an increased motivation to defend an existing belief as opposed to making an effort to state a correct answer.

Hence, incentivizing participants to make an effort to provide an accurate forecast in the forecasting task (and to be correct in the valuation task) is expected to mitigate their motivation to defend their prior beliefs and hence contribute to the reliability of the results.

At the end of the experiment, participants are presented with two optional lotteries and asked to choose to participate in one of them (see Appendix C for experimental materials where the lotteries are described to the participants). The first lottery is a random draw with known probabilities. In this lottery everyone who chooses to participate has an equal chance of winning independently of their performance in the experiment. In the second lottery, the probabilistic properties are unknown but based on the amount of coins each participant has earned during the experiment. The scheme of the lottery is known to students and is referred to as the performance based payment method. All winners of the lotteries, independent of which of the two lotteries is chosen, earn \$ 286. In total, 10 participants won the lottery corresponding to an average hourly wage of \$14 for all participants.

3.3. Measurements and Descriptive Statistics

To measure the initial confidence participants have in their forecasting estimates, I use the size of the confidence intervals that they are asked to state after each forecast (see e.g. Deaves et al. 2010; Ben-David et al. 2013; Glaser and Iliewa 2014 who uses the same measure). However, according to Langnickel and Zeisberger (2016), the use of confidence intervals may be problematic in the sense that people do not seem to change the size of their stated intervals when they are asked to state confidence intervals for different percentage levels. That is, people seem to state more or less the same confidence interval when they are asked to report e.g. 90 % confidence intervals compared to when they are asked to report e.g. 80 % confidence intervals. Although I acknowledge this criticism of the use of

confidence intervals in general, this paper is only interested in variations between individuals' perceived confidence expressed by confidence intervals and not the absolute size of the intervals compared to actual results. Thus, I do not expect this particular criticism to be relevant for this purpose that this paper uses the confidence intervals for.

In the experiment of the current paper, the absolute size of the confidence interval increases the higher the value the participants provide as their forecasting estimate (positive correlation of 28 %, not tabulated). As an example, participants that state an EPS forecast around \$4 in the experiment (F1) are more likely to provide a wide confidence interval (e.g. \$3 - \$5) than participants stating an EPS forecast around \$2 (e.g. \$1.5–\$2.5). Because I want to capture the confidence participants feel about their own forecast, I do not want this proxy to be affected by the level of the value they assess the forecasting estimate is around (\$2 or \$4 in the above example). Therefore, I construct a measure of the size of the confidence interval where the level of the upper bound- and the level of the lower bound are related and refer to this measure as *confidence1* for F1. Thus, in the above example both participants will receive a value of 0.6 for *confidence1* ($3/5=0.6$ vs. $1.5/2.5=0.6$) although the absolute size of their confidence intervals varies (2 vs. 1). Additionally, to address empirical challenges related to this measure different robustness checks are made.

$$Confidence1 = \text{lower bound}_{f1} / \text{upper bound}_{f1}$$

Thus, the larger the value of *confidence1* the lower interval and/or the higher values in the interval. Hence, larger numbers reflect more confidence.

Analogously, *confidence2* is constructed to reflect the participants' confidence in F2 which is further used to calculate the change in the participants' confidence:

$$Confidence2 = \text{lower bound}_{f2} / \text{upper bound}_{f2}$$

To measure whether their confidence increases or decreases in F2 compared to F1the following variable is constructed:

Changeconf = confidence2 – confidence1

Thus, positive values indicate an increase-, negative values indicate a decrease-, whereas zero indicates no change in the confidence after a revision opportunity.

To reflect whether a revision has been made or not, a dummy called *revisiondummy* is constructed. This dummy takes a value of 1 if a revision has been made, 0 otherwise.

Descriptive statistics are presented in Table 1 below.

TABLE 1											
Descriptive Statistics and Correlations											
	n	Mean	Median	SD	Min	Max	1	2	3	4	5
1. F1	266	2.46	2.30	1.07	1.00	8.11					
2. F2	266	2.15	2.10	0.89	0.30	7.50	0.72***				
3. confidence1	266	0.74	0.82	0.22	0.00	0.99	-0.01	0.05			
4. confidence2	266	0.73	0.81	0.23	0.00	0.99	-0.06	0.11*	0.86***		
5. changeconf	266	-0.01	0.00	0.12	-0.65	0.41	-0.11*	0.11*	-0.23***	0.31***	
6. revisiondummy	266	0.65	1.00	0.48	0.00	1.00	0.12**	-0.10*	-0.15**	-0.20***	-0.10
Descriptive statistics and pairwise correlations between all variables. Stars indicate significance on level: ***=p<0.001, **=p<0.05, *=p<0.1.											

4. ANALYSES AND RESULTS

Following the procedure of Libby and Rennekamp (2012) the hypotheses are tested by regression analyses (logit- and OLS models) as primary tests and additionally supported by t-tests (not tabulated).

The first hypothesis states that those who have a greater confidence in their first forecast (measured by *confidence1*) will be more hesitant to revise that forecast after receiving new information compared to those showing a lower confidence. Panel A of Table 2 shows results of an ordered logit model where *confidence1* is regressed on *revisiondummy*. The model is significant at the 1 % level (LR $\chi^2(1) = 6.14$, $\text{prob} > \chi^2 = 0.01$). The results support H1 with *confidence1* being significantly negatively associated with revisions ($p = 0.02$, two-tailed). Thus, those with more confidence in their own forecast (reflected by larger values of *confidence1*) are more likely to not revise their forecast (retain their forecast) than those with lower confidence in their forecasts. Results from t-tests (not tabulated) further support H1. Those who do not find a revision necessary (92 participants) have a mean *confidence1* of 0.78. This is significantly larger than those finding a revision necessary (174 participants) who have a mean *confidence1* of 0.71 (t-stat. of 2.43).

The second hypothesis states that those not revising their first forecast have more confidence in their second forecast (F2) as oppose to those revising. Results shown in Panel B in Table 2 are from an OLS regression where *changeconf* is regressed on *revisiondummy* with *confidence1* included as a control. The model is significant at the 1 % level ($F(2, 263) = 9.74$, $\text{Prob} > F < 0.001$). Results from this test are in line with the prediction of H2. *Revisiondummy* is significantly negatively associated with *changeconf* ($p = 0.03$, two-tailed) even after controlling

for the confidence in the first forecast (*confidence1*)²⁶. Thus, those that choose to retain their forecast instead of revising it after receiving new information become relatively more confident than those who make a revision after receiving new information. Further, *confidence1* is negatively associated with *changeconf* ($p < 0.001$, two-tailed) suggesting that the more confident participants feel about their first forecast the less likely they are to increase in confidence in their second forecast. Results of t-tests (not tabulated) are further in line with predictions by H2. Those who decrease in confidence (88 participants) predominantly deem a revision necessary after receiving new information (mean *revisiondummy* of 0.97). This is significantly more than for those who increase (or have no change) in confidence (178 participants, mean *revisiondummy* of 0.51). This difference in the post-revision confidence change is significant at the 1 % level (t-stat. of 8.44).

Together, the results confirm that forecasts made with a high initial confidence more often results in a hesitation to revise relatively to forecasts made with a lower initial confidence. This is in line with theory arguing that confirmation bias leads to more persistence in initial beliefs suggesting a positive relationship between confidence and the likelihood of being subjects to confirmation bias. Further, the results provide evidence that confirmation bias, because it leads to selective use of new information and hence make people more likely to perceive information as confirmatory to their initial beliefs (first forecasts), further increases the confidence in their revised forecast. In other words, people that feel strongly confident in their own beliefs are more prone to be subjects to confirmation bias which leads to even further increase in their confidence.

²⁶ The significance persists without any controls. This is further supported by t-tests (described in detail below).

TABLE 2
Tests of Hypotheses

Panel A: Test of H1

Test of the effect of first-forecast confidence on *revisiondummy*

Term	Expectation	Estimate	Std.Error	z-ratio	p-value
Intercept		-1.79	0.51	3.15	<0.001
<i>confidence1</i>	-	-1.54	0.65	-2.38	0.02

LR χ^2 (1) = 6.14, prob > χ^2 = 0.01

R² (Pseudo) = 1.79 %

Panel B: Test of H2

Test of the effect of revisions on *changeconf*

Term	Expectation	Estimate	Std.Error	t-ratio	p-value
Intercept		0.11	0.03	3.97	<0.001
<i>confidence1</i>		-0.13	0.03	-4.09	<0.001
<i>revisiondummy</i>	-	-0.03	0.02	-2.24	0.03

F (2, 263) = 9.74, Prob > F < 0.001

R² = 6.90 % (adj.R² = 6.19 %)

Panel A shows results based on a logit regression.

Panel B shows results based on an OLS regression.

Directional expectations are shown for the independent variable of interest.

N = 266 in all analyses.

5. ROBUSTNESS CHECKS

In this section I check for the sensitivity of the measure of confidence, alternative explanations and drivers of the main results of this paper and finally I try to separate a related dimension of confidence from the measure of confidence used in this paper.

5.1. Sensitivity of Confidence Measure - Lottery Choice

When individuals increase in their confidence during the forecasting task it could reflect that they perceive their own performance as relatively better than people who decrease in confidence during the task does. If this perception is strong enough, those with an increased confidence in the forecasting task should prefer to participate in the performance based lottery more often than those with a decreased confidence. I therefore predict and test if participants who increase in confidence (measured by *changeconf*) prefer the performance based payments to a higher degree than participants who do not increase in their confidence.

To reflect if the participants prefer the performance based lottery, a dummy called *perfdummy* is constructed. This dummy takes a value of 1 if the performance based lottery is chosen, 0 otherwise. 87 participants prefer the performance based lottery. The dummy variable *perfdummy* has a mean of 0.33 (standard deviation of 0.47).

Table 3 shows results from a logit regression supporting the prediction about a positive association between an increase in confidence after a revision opportunity and a preference of performance based payment. The model is significant at the 5 % level (LR $\chi^2(3) = 8.87$, $\text{prob} > \chi^2 = 0.03$). *Changeconf* is positively associated with *perfdummy* ($p = 0.09$, two-tailed) with a coefficient of 2.17. This indicates that the more a participant increases in confidence from the first forecast to the second forecast the more likely that participant is to choose the performance

based lottery. Importantly, this result is persistent even when controlling for *confidence1* and *revisiondummy*²⁷. Because the participants show behaviors in line with how their confidence changes in the forecasting task (reflected by their decisions in the lottery choice task, i.e. that those who increase in confidence are more likely to choose the performance based lottery) it could indicate that analysts hesitant to revise their forecast following new information, are more likely to prefer performance based payment structures as a possible consequence of confirmation bias. These results are additionally interpreted as supportive evidence of confidence intervals as a proxy of individual confidence validating the primary measure of this paper.

<div>TABLE 3</div> <div>Robustness Test</div> <div>Test of the effect of change in confidence on <i>perfdummy</i></div>					
Term	Expectation	Estimate	Std.Error	z-ratio	p-value
Intercept		0.19	0.53	-0.36	0.72
<i>confidence1</i>		-0.98	0.61	-1.60	0.11
<i>revisiondummy</i>		0.28	0.29	0.98	0.33
<i>changeconf</i>	+	2.17	1.30	1.68	0.09
LR chi2 (3) = 8.87, prob > chi2 = 0.03					
R ² (Pseudo) = 2.64 %					
<div>Results based on a logit regression.</div> <div>Directional expectations are shown for the independent variable of interest.</div> <div>N = 266.</div>					

²⁷ A probit model and t-tests supports this result (not reported).

Lottery vs actual earnings

Measuring the performance of the total experiment by total earnings in the experiment (where the valuation task is also influential on the total earnings) there is no significant difference between the performance of participants with an increased confidence in their forecasting task compared to participants with a decreased (or unchanged) confidence in their forecasting task (t-stat. of 0.38). Those with an increased confidence in the forecasting task have a mean of total earnings of 1,086 coins from the experiment which is not significantly different from the rest which have a mean of 1,096 coins. This suggests that participants increased confidence in the forecasting task, presumably driven by effects of confirmation bias, are unfounded and hence that an increased preference of getting paid by performance may make them worse off.

5.2. Alternative Test of Main Results - Nearest Neighbor Matching (Average Treatment Effects)

This paper seeks to make inferences about the relation between confidence and revision behavior but does not include either variable as a direct randomized treatment in the experimental setting. Hence, implicit assumptions that no other variables than the one of interest causes systematic changes in the dependent variable are not directly addressed by previous tests (regressions and t-tests). By applying the method of the *nearest neighbor matching* (e.g. Abadie and Imbens 2006; 2012), most commonly used on observable data where randomized treatments are not possible or desirable (such as event-studies using archival data or medical studies where a treatment might be unethical), I am able to simulate participants that are identical on a range of defined parameters and thus isolate the treatment variable as the “only” varying factor. For example, it is likely that a

certain type of people is generally more optimistic and hence states a higher F1 and thus a wider confidence interval in the experiment than others. If the design of the experiment makes it more obvious to revise a lower forecast than a higher one (or vice versa) then the participants' hesitation to revise a forecast is likely to be driven by the position of their first forecast as a consequence of their general optimism, rather than as a reaction to cognitive dissonance because of their level of confidence. Nearest neighbor matching can be used to address the issue. Therefore, tests are done conditioned on the value of each forecasting estimate to make sure that the results are not driven by how realistic the participants first forecast are according to the new information since this may additionally drive their decision of whether to revise or not.

In the following, all main analyses are re-run with nearest neighbor matching. Because this paper relies on an experimental setting with varying information along two dimensions²⁸ (for the purpose of another paper) it is additionally important to check that these variations does not influence the main results of this paper. Hence, in order to make sure that results from this paper are not unintentionally driven by effects of these two treatments, I include a requirement in the tests that treatments are exact matched²⁹.

Participants are matched across the value of their first forecast (F1) and across the two dimensions by which the new information they receive prior to revisions vary (exact matches). Table 4 first reports differences in confidence according to whether participants revise or do not revise their forecast (H1).

²⁸ One group of participant is given a positive outlook for the firm in focus in the second stage of the forecasting task whereas the rest is given a negative outlook. Further, in the second stage of the forecasting task, one group of participants is additionally given a peer-estimate conducted by other financial analysts whereas the rest is not given that estimate. However, all information in the first stage of the forecasting task are the same across participants.

²⁹ Because both *confidenceI* and *changeconf* are continuous variables there is a small risk of large-sample bias. I rerun the tests using a Stata command (*biasadj*) suggested by Abadie and Imbens (2006) to avoid this potential issue. All results persist (available on request).

TABLE 4
Robustness Checks of Hypotheses

	H1 <i>revisiondummy</i>	H2 <i>changeconfdummy</i>
% Change in <i>interf1</i>	7.26*** (2.79)	
% Change in <i>revisiondummy</i>		-50.83*** (-10.60)
n	266	266
Min./Max. matches	1/11	1/5

Results based on nearest neighbor matching (treatment effects).
 Conditioned on F1 and exact match requirement by the two variations in the information provided in the second stage of the forecasting task.
 Coefficients in percent (z-values).
 Min./Max. Matches report the min./max. number of matches at least one observation was made with.
 Stars indicate significance on level: ***=p<0.001, **=p<0.05, *=p<0.1.

The results show that if the participants' confidence in their first forecast (measured by *confidence1*) was 7.26 % lower than it actually is they would have chosen to revise their forecast as opposed to retaining their prior forecast after receiving new information (*revisiondummy* changes from 0 to 1). Next, the table reports differences in revisions according to whether participants increase in confidence or decrease in (or have unchanged) confidence (H2). The results show that if participants resistance to revise occurred 51.45 % more often than it actually does they would have increased in confidence (*changeconfdummy* going from 0 to 1) as opposed to have a decreased (or unchanged) confidence in their revised forecast compared to their first forecast. Both results are significant at the 1-% level providing additional support of the two main hypotheses in this paper. Also, I run a similar test to check if my results of the sensitivity analysis of the measurement of confidence persist. I test the differences in the change in

confidence according to whether participants prefer the performance based lottery or not using nearest neighbor matching with the same requirements as the above tests. Results (not reported) show that if participants change in confidence in their revised forecast as oppose to their first forecast (measured by *changeconf*) was 14 % higher than it actually is they would have preferred the performance based lottery (*perfdummy* going from 0 to 1, z-stat. of 2.30). Hence, all main results and the sensitivity analysis of the measurements of confidence are supported by using this alternative method. I interpret this as evidence that the main results are not driven by variations in the experimental materials or the absolute value of each participant's first forecast (F1)³⁰.

5.3. Better Than Average-Effects

A related but different dimension of individual (over-) confidence³¹ (argued by e.g. Svenson 1981) is referred to as better-than-average effects (BTA). BTA refers to the tendency of people to evaluate themselves as better than average and hence could be a possible alternative explanation of why some people choose to revise their forecasts and some do not. After the forecasting task, participants are asked to evaluate their own performance in the task compared to the other participants in the experiment. They provide answers on a five-point scale where 3 reflects those who consider themselves as having an “around average” performance in the forecasting task. Thus, by re-running t-tests of H1 limited to those that consider their own performance around average (119 observations) the results should be unaffected by the dimension of confidence called BTA (Niederle and Vesterlund

³⁰ All results persist when personal characteristics like gender, age, experience (if they have a relevant part-time job and whether or not they invest in stocks) and skills (grade average from their bachelor education and results from a valuation task additionally included in the experimental materials) are further required as matches in the model (results available on request).

³¹ Further, results of this paper generally persist when controlling for another dimension of (over-) confidence named miscalibration. Participants in this experiment are perceived as well-calibrated in the cases where they correctly evaluate their own performance after the valuation task and/or in the cases where the correct answer to the valuation task lies within their 90 % confidence interval \pm 5 % on each side of the range. Results not reported.

2007). Results of this test on the subsample remain significant at the 5 % level (t-stat. of 2.11) supporting H1.

Together, results of the main tests of hypotheses are robust to alternative explanations of the participants' behavior in the forecasting task of the experiment. That is, the results are not driven by alternative variables like the concrete number of each participant's first forecast (F1) or variations in the experimental materials. Nor are the results driven by BTA effects. This supports my theoretical reasoning according to which participants seem to react on their increased confidence in the forecasting task as a consequence of confirmation bias by preferring the performance based lottery to a greater extent.

Results of this paper suggest that the initial confidence people form a belief from will determine the likelihood of them being subjects of confirmation bias. Further, it indicates that confirmation bias gives people an unjustified comfort in their own performance (by choosing the performance-based payment method more often although their performance are not better) due to an increased confidence.

6. CONCLUSION

This paper focuses on the level of individual confidence that a forecast is made with (reflected by the width of a confidence interval) and its relation to non-revision behaviors. Prior research has found that revisions in financial analysts' forecasts add informational value to the users of these forecasts under various circumstances. However, biases in financial analysts' forecasts are also observed. One bias previously observed is a general tendency to underreact to news. This paper uses the experimental method and relies on cognitive decision theory to explain one of many potential causes of why financial analysts sometimes hesitate to revise an existing forecast following new information and thus contributes to the general underreaction to news.

The first of two main results of this paper suggests that when individuals make financial forecasts with high confidence they are more likely to be hesitant to revise these forecasts after receiving new information. This is in line with theory of confirmation bias (Mahoney 1977; Edwards and Smith 1996) as a mechanism to reduce cognitive dissonance and with findings in a related experiment by Yaniv et al. (2009). The findings complement suggestions from Koonce and Mercer (2005) and findings from Friesen (2006) that confirmation bias, as a reaction to cognitive dissonance, drives non-revision behaviors in the perspective of financial forecasting and thus may lead to general underreactions. The findings can serve as inputs to when and how guidelines to revision requirements could reduce effects of cognitive biases on financial analysts' forecasts in the pursuit to make financial forecasts more accurate and informative to the users. Further, the finding might be important for future studies using archival data on financial analysts' forecast revisions as the finding highlights that non-revisions do not necessarily signal that the information is already incorporated in the current forecasts. Thus, future research may generally benefit from investigating when and why financial

analysts hesitate to revise a forecast following new information. Although most research assumes a non-revision following new information to be a reflection that the information has little or no new informational value or represents a way for analysts to minimize effort, little seems to be known about the internal requirements or norm in the firms in terms of forecast revisions. If we expand our knowledge on this issue we may be able to enlarge our understanding of observable biases in financial analysts' forecasts such as underreactions.

The second result of this paper is that the decision to not revise a forecast following new information affects the individual level of confidence in that forecast. The finding suggests that a non-revised forecast leads individuals to having an increased confidence in their own forecast compared to the confidence in revised forecasts. This is consistent with theory of cognitive dissonance reduction (Festinger 1957; Aronson 1968) and with prior findings by Plous (1991). The findings suggest that individuals, who stay devoted to their own beliefs by not revising their forecast, not only have more confidence in the first place but also enhance that confidence compared to individuals who revise their own beliefs. This is not necessarily in line with standard decision theory such as Bayesian updating of beliefs. These findings also contribute to the general literature on cognition in financial decision making by suggesting that individual confidence is an important factor to consider when investigating confirmation bias in different contexts. Although this paper focuses on individual confidence reflected by the size of a confidence interval in the context of forecasting, other dimensions of confidence may be applicable as well. Future research could address this in the context of financial analysts for example by following the method used in an experimental setting by Libby and Rennekamp (2012). Here they elicit managers' confidence in various dimensions including personal traits like miscalibration and optimism.

Further, analyzing the sensitivity of measuring individual confidence by confidence intervals I find indications that the participants' greater confidence following a non-revision compared to the confidence following a revision are not driven by actual performance. However, an additional analysis reveals that individuals with an increased confidence in this setting are more likely to choose a performance-based payment method at the end of the experiment (framed as a lottery choice). This may further indicate that this (unfounded) greater confidence for analysts that are hesitant to revise their forecasts, argued to occur as a result of cognitive dissonance reduction, results in a greater preference of performance based payment contracts compared to analysts that revise their forecasts. Thus, being more inclined to confirmation bias not only dilutes the individuals' information search and gives them a biased ground to base their forecasting on. It also seems to bias their view on their own performance. However, while this study is not designed to draw direct conclusions on this matter, future research could address this issue as it may contribute to important practical implications in the context of payment schemes and bonus structures.

The use of an experiment allows me to control the information flow available to the participants while at the same time capturing the individual confidence each forecast is made with. Both factors are impossible to control and observe directly from archival data. Holding the information flow constant across participants is important in order to eliminate possible confounding effects whereas directly measuring individual confidence is crucial in order to investigate its relation to non-revision behaviors. For these reasons the experimental method is found particularly applicable for the purpose of this paper although usual limitations of the experimental method such as generalizability also apply here. Thus, although the experimental design seeks to simulate a real-world setting e.g. by providing information to participants from various information sources, it may not be fully

generalizable. As an example, although all results persist when robustness checks are performed conditional on possible confounding factors, this study is not able to draw inferences about the magnitude of the effects on professional financial analysts in their natural environment.

APPENDIX A – Experimental Materials from the First Stage in the Forecasting Task

Forecasting Task

On the next page you are asked to state your **one-year-ahead earnings per share (EPS) forecast** for a particular company. Today is year 0 and you are asked to forecast EPS for year 1.

$$\text{EPS} = \text{Net Income} / \text{Number of Shares}$$

The company is an actual listed company but in this experiment you will just know it as “The Firm”.

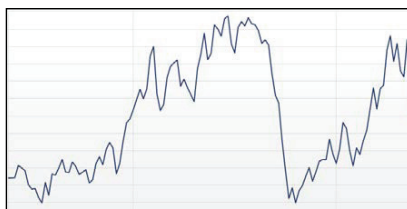
Company info:

The Firm was founded in 1892 and operates today through 842 stores in the United States, and 157 stores in Canada, Europe, Asia, and Australia. The Firm is within the retail industry with clothes as the main product line. The Firm’s products are considered to be medium-price. The sales are highly seasonal and usually peak in the spring and fall. Approximately 25 % of The Firm’s total revenue comes from online sales. According to The Firm: *“The brand is our lifestyle, our focus—the value of having a great brand is far-reaching and cannot be overstated—it’s a snowball effect”*.

Industry info:

The industry is known by its intense competition between its many players which is characterized by very volatile earnings and volatile stock prices. Within the last five years The Firm has experienced many new competitors which can be of future threat according to The Firm itself: *“In light of the competitive challenges we face, we may not be able to compete successfully in the future. Further increase in competition could reduce our sales and harm our operating results and business”*.

This figure illustrates the development in stock prices for The Firm in the last ten years:



The Firm's Income Statement from the annual report.

(year 0 = current, year -3 = three years ago)

(in thousand \$)	Year -3	Year -2	Year -1	Year 0
Revenue	3,468,777	4,158,058	4,510,805	4,116,897
<u>Cost of Revenue</u>	<u>-1,251,348</u>	<u>-1,607,834</u>	<u>-1,694,096</u>	<u>-1,541,462</u>
Gross Profit	2,217,429	2,550,224	2,816,709	2,575,435
Sales, General etc.	-1,980,249	-2,260,818	-2,435,069	-2,366,397
<u>Non-Recurring Items</u>	<u>0</u>	<u>-68,022</u>	<u>-7,407</u>	<u>-128,215</u>
Operating Income/EBIT	237,180	221,384	374,233	80,823
<u>Interest Expense</u>	<u>-3,362</u>	<u>-3,577</u>	<u>-7,288</u>	<u>-7,546</u>
Earnings Before Tax/EBT	233,818	217,807	366,945	73,277
<u>Income Tax</u>	<u>-78,109</u>	<u>-74,669</u>	<u>-129,934</u>	<u>-18,649</u>
Net Income	155,709	143,934	237,011	54,628
EPS (\$)	1.67	1.47	2.85	1.45
Stock price (\$)	45.64	58.70	49.61	46.20
Total Outstanding Shares (thousand, Year 0 and 1)	-----	-----	-----	37,693

Expectations for the industry:

The National Retail Foundation (NRF) says its retail sales forecast for year 1 predicts a growth of 4.1% (3.7 % year 0). Online sales are expected to increase between 9% and 12% this year. The NRF President and CEO said: "Improvements in economic growth combined with positive expectations for continued consumer spending will put the retail industry in a relatively good place in year 1. Though headwinds from the looming debates about the debt ceiling, increased health care costs, and regulatory concerns still pose a risk for both consumers and retailers".

Expectations of The Firm:

The Firm partly explains the EPS level at year 0 by unusual expenses due to restructuring costs as well as an ongoing lawsuit about management ethics. The Firm expects little or no restructuring costs and no impact from the lawsuit in year 1. The Firm forecasts EPS for year 1 to be in the range of \$2.25 to \$2.35.

Task:

I expect the EPS for The Firm for year 1 to be \$ _____. With a probability of 90% I believe the EPS will then lie between \$ _____ and \$ _____.

APPENDIX B – Experimental Materials from the Second Stage in the Forecasting Task

New information in the market

The first quarterly report for year 1 was roughly as expected. The second quarterly report for year 1, which just got released, reveals the following numbers.

Highlights from the second quarter report, year 0 and year 1, in thousand \$:

	Year 0, Q2	Year 1, Q2
Revenue	945,698	<u>890,605</u>
Gross profit	604,122	<u>552,956</u>
Operating income/EBIT	19,165	<u>17,493</u>
Net Income	11,371	<u>10,877</u>

After the release of the second quarterly report the CEO of The Firm said in a press release: “Because of a continued challenging environment, our sales for the second quarter were somewhat below plan.” However, The Firm does not revise their total expectations for year 1.

On the other hand, based on 14 estimates from your colleagues, expected EPS for The Firm at year 1 is downgraded to an average (consensus) of \$2.14.

Please revise your EPS forecast for The Firm for year 1 (If you do not deem a revision necessary, please write your forecast from the prior task again).

Task:

I now expect the EPS for The Firm for year 1 to be \$ _____. With a probability of 90% I believe the EPS will then lie between \$ _____ and \$ _____.

APPENDIX C – Experimental Materials Describing the Lottery Choice

You have now earned between 610 and 2000 coins from this experiment corresponding to between 61 and 200 tickets.

Even though your total number of tickets is not transparent to you, you now have to decide how you want to use your tickets. All the other participants are given the same options as you. The two options are explained in detail below.

Options:

- **The Blue Lottery** – Play the lottery by converting all your tickets from this experiment into one blue lottery ticket. Your chances in this lottery do not depend on your performance in the experiment or on the choices of other participants. Instead there is one winner for every blue ticket pile. A blue ticket pile always holds an amount of tickets corresponding to half the number of people in this classroom right now. Your chances in this lottery are therefore 1:60 if there is a total of 120 people, 1:40 if there is a total of 80 people, and so on. The winner is found by a random draw. If you win the blue lottery you earn DKK 2,000 before tax.
- **The Purple Lottery** – Play the lottery by converting all your tickets from this experiment into the same amount of purple tickets (the experimenter is able to calculate this from your answers). The more tickets you have the greater chances of winning. Your chances in this lottery depend on your performance in the experiment and depend on the choices of other participants. Your specific chances in this lottery are therefore unknown as they are influenced by the total pile of purple lottery tickets. The total pile consists of all purple lottery tickets from the people in this class room right now that choose to play this lottery. There is one winner of this lottery. The winner is found by a random draw. If you win the purple lottery you earn DKK 2,000 before tax.

Please tick off the box representing which lottery you want to play:

☐ The Blue Lottery

☐ The Purple Lottery

Your answer is binding and cannot be redone at any time!

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Using Feedback to Reduce the Cost of Information Intermediation: Experimental Evidence

Simone Staehr, Nigel J. Barradale, and Thomas Plenborg

ABSTRACT

Information intermediaries, including financial analysts and financial advisors, face incentives to produce biased recommendations and expend low effort. In an experiment with 344 finance masters students, we investigate the role of incentivized feedback in reducing these costs. Specifically, we have participants play analysts or investors, with the analysts making earnings recommendations for the investors in the presence of biased incentives. In the treatment condition, the investors provide incentivized feedback to the analysts. Consistent with educational learning and psychological theories, we find the presence of feedback reduces bias and increases effort among information intermediaries (financial analysts), while also enhancing information end-users' (investors) critical evaluation of recommendations. Hence the potential welfare gains from incentivized feedback-channels are large. This research is especially timely given the European Securities and Markets Authority's proposal in 2014 to abolish indirect payments to analysts including the broker votes system, since that system acts as an incentivized feedback-channel from institutional investors to financial analysts.

1. INTRODUCTION

The complexity of financial markets creates a pivotal role for information intermediaries, who process underlying data and make recommendations for information end-users. As examples, equity analysts process firm-specific data and make recommendations for institutional investors and financial advisors process market data and make recommendations for individual investors. However, as with all agency-type relationships there can be conflicts, with information intermediaries expending low effort or presenting biased information. This paper uses the experimental method to argue that incentivized feedback-channels can ameliorate this conflict. For the information intermediaries, the expectation of feedback increases effort and reduces bias. For the information end-users, providing feedback enhances the critical evaluation of recommendations. Both effects imply feedback-channels have a welfare-enhancing role to play in financial market design. The experiment, and much of the discussion, is framed in terms of financial analysts making earnings forecasts, but because the findings are argued to occur in line with social-psychological mechanisms results of this paper are also more broadly applicable within financial markets.

The bias in analyst forecasts is the subject of academic studies and regulatory oversight due to potential negative consequences for investors (Abarbanell et al. 1995). The main academic findings are a tendency of financial analysts to be overly optimistic (Rajan and Servaes, 1997; Lin and McNichols, 1998; Dechow et al., 2000; Chan et al., 2003; Bradshaw et al., 2006; Libby and Rennekamp 2012), have a desire to herd towards the consensus estimate (De Bondt, W. F. 1999; Hirshleifer and Hong 2003; Guedj and Bouchaud 2005; Jegadeesh, N., and Kim, W. 2009; Evgeniou et al. 2010; Jiang, H., and Verardo, M. 2013) or to stand out from the crowd (Hong et al. 2000; Hong and Kubik 2003; Clement and Tse 2005). Legislation that has strengthened the regulatory oversight includes Regulations

Fair Disclosure (2000), Regulation Analysts Certification (2002), the Sarbanes-Oxley Act (2002), and the Dodd-Frank Wall Street Reform and Consumer Protection Act (2010). Partly in response to regulation, a method of paying for research has developed that is known as “the broker vote system”. This system allows investors to apportion their overall trading activity and vote for analysts that provide good research so that sell-side departments supplying more valuable communications receive greater aggregate commission in subsequent periods (Goldstein et al. 2009; Groysberg et al. 2011; Brown et al. 2015; Maber et al. 2014).

While less studied in the finance and accounting literatures, theories in educational learning and psychology argue that providing as well as receiving feedback causes increased cognitive reflection, referred to as metacognition (Garner 1987; Falchikov 2004). Those receiving feedback tend to feel more responsible and motivated to adapt their output to the feedback provider (see e.g., Berkowitz et al. 1963; Butler and Winne 1995; Topping 1998; Black et al. 1998; Pope 2001; Atkins 2002; Brown et al. 2013). In line with social comparison theory (Festinger 1954), reactions due to the expectations of feedback are expected to occur not only for monetary reasons but also to maintain a positive self-image. Meanwhile, those providing feedback process information more thoroughly, with enhanced reflection and increased insight into task performance (see e.g., Stefani 1994; Van Lehn et al. 1995; Topping 1998; Cheng and Warren, 1999; Topping 1998; Davies 2000; Althausen and Darnall 2001; Venables and Summit 2003; Li and Steckelberg 2006). This research implies that feedback-channels may enhance the alignment between the behaviors of a feedback receiver and the goals of a feedback provider, while simultaneously providing the feedback provider with enhanced insight into those behaviors. In the setting of the current paper, the agency cost of information

intermediaries is reduced while the critical evaluation by the information end-users is enhanced.

We rely on an experimental setting with a relevant subject pool of 344 master students in finance. In a 2x2x2 between-subject design, we test how the implementation of a feedback-channel affects forecasting behaviors from the analyst's and the investor's perspective, respectively. Participants are randomly assigned the role of an analyst or an investor, and each analyst is randomly matched one-to-one with an investor to simulate an information cascade. All participants are monetarily incentivized and a post-experiment questionnaire including check-questions is implemented. Since the broker votes determine trading commissions and thereby part of the professional financial analyst's compensation (Maber et al. 2014), it is analogous to the incentivized feedback system of the current experiment.

We find empirical support for the hypothesis that implementing a feedback channel reduces analysts' response to bias incentives and increases their effort towards the investors' needs. Without feedback, analysts with a diverging incentive forecast significantly further away from consensus than those with a converge incentive, but in the presence of feedback there is no significant difference between the two groups. This is argued to be a combined reaction to a reduction in the monetary benefits of following a private incentive and a cognitive encouragement to maintain a positive self-image by receiving good feedback from the investor in line with psychological theory. Further, included in the robustness checks, the feedback channel increases the number of words analysts' disclose in their written justifications to the investors also reflecting an enhanced effort.

We also find empirical support for the hypothesis that implementing a feedback-channel makes the investors more critical of the analysts' forecast. In particular, the feedback-channel results in the investors' forecasts moving towards the

consensus and away from the analysts' recommendations both in the case where the analysts were facing an incentive to diverge from the consensus but also when the analysts were incentivized to converge towards the consensus. This is consistent with the feedback-channel increasing the investors' evaluation of alternate information sources. Answers from the check-questions support this interpretation: when a feedback channel exists, significantly more investors answer that moving away from the analyst's biased forecast and towards the consensus forecast is the best strategy to apply. Further, those investors matched with analysts with a diverging incentive report that they trust the analysts significantly less when a feedback-channel exists indicating a more critical and less naïve approach. Additionally, when a feedback-channel exists, investors assess their own performance as being better (as opposed to when no feedback-channel exists) suggesting an increased confidence in their forecasts. When we ask the analysts the same question their confidence in their own forecasts is unaffected by the feedback-channel. Thus, investors' enhanced attention in the task due to the feedback-channel seems to additionally increase their self-reliance whereas analysts' does not feel either better or worse of.

Our findings are of specific relevance to the broker votes system. As an incentivized feedback channel, this system will reduce the bias and increase the effort of equity analysts while enhancing the institutional investors' critical evaluation of recommendations by making them less naïve towards the analysts' inputs and rely more on alternate information sources. This is an extension to the existing academic research which primarily documents and describes the commission-allocation system (e.g. Maber et al. 2014) and moves the literature towards an evaluation of its institutional and psychological impacts. Also, to the extent that we find positive impacts of the system, we highlight some unintended consequences of the European Securities and Markets Authority's proposed

prohibition of indirect payments (ESMA 2014, Section 2.15), which would effectively prohibit the broker votes system in the Europe.

The reminder of this paper is organized as follows. In Section 2, background research, theory and hypotheses development are included. Section 3 describes our method, measurements and includes descriptive statistics. In Section 4, our results including robustness checks are presented. Section 5 concludes.

2. BACKGROUND, THEORY AND HYPOTHESIS DEVELOPMENT

2.1. Background

Financial analysts provide guidance to institutional investors in various forms, including earnings forecasts and recommendations, by mainly using information from firms such as quarterly reports and management forecasts (Lees 1981). Since analysts analyze and interpret complex information, they are often referred to as information-intermediaries i.e. between firm management and investors (e.g. Lang and Lundholm 1996). Due to this agency-type relationship, there can be conflict with analysts expending low effort or presenting biased information. Amongst many examples research finds financial analysts to obtain private information from management and respond with overly optimistic forecasts in exchange (e.g. Francis and Philbrick 1993; Cheng et al. 2013). Research also documents that analysts may provide biased forecasts as a result of a desire to stand out from the crowd due to career concerns (Hong et al. 2000; Hong and Kubik 2003; Clement and Tse 2005), or a desire hide in the crowd due to uncertainty (Hirshleifer and Hong 2003; Guedj and Bouchaud 2005; Evgeniou et al. 2010). Analysts' biasing incentives may result in investors making suboptimal investment decisions (e.g. Abarbanell et al. 1995).

A typical response to these constraints has been to increase regulation in order to protect investors. Regulation Analysts Certification (2002) requires financial analysts to disclose payments received in connection with their reports and moreover to make a written statement that their reports truly reflect their personal beliefs. In the same year, strict rules about disclosure of any affiliations or ownership between the analysts and the investment banks to the covered security (among many other requirements) were imposed. The Sarbanes-Oxley Act of 2002 added control over analysts' contracts by implementing so-called Chinese walls and further limiting ties between analysts' compensation and investment banking

earnings in the attempt to reduce analysts' conflicts of interest. Further, proposals on educating the investors or more paternalistic approaches such as limiting their trading opportunities have been developed e.g. by requiring investors to own a certain amount of wealth or to obtain a license before trading. However, critics highlight potential drawbacks of these regulations and proposals. For example, Fisch (2005) argues that requiring too much independence of the analysts will eventually make them add a fee to their reports to avoid public dissemination of their analyses in order to maintain the value to institutional clients. Thus, mandated independence of financial analysts potentially reduces investors' access to information. Further, evidence suggests that investors are not capable of making sufficient use of the extensive disclosure on analysts' conflict of interest (e.g. Alexander et al., 1998; Barber and Odean, 2001; Kelly et al., 2012; Firth et al., 2013). Thus investors are claimed to be generally too naïve towards the information provided by analysts and prior interventions has failed to sufficiently enhance their critical assessment of the analysts work. Critics also claim that regulators go too far in their effort of de-biasing investors. For example, limiting investors' trading opportunities does not necessarily make them better off, if the alternative is that investors have to invest in asset classes where the risk-reward relation is not as attractive as the stock market.

Broker Votes

The broker vote system is a process whereby institutional investors vote to assess the value of research services from analysts and to determine how to allocate research commissions (Brown et al., 2015). As part of the broker vote process, sell-side brokers request that larger clients communicate the rationale for their decisions, including voting outcomes for the broker's analysts. The signals from this reporting system are used to credit analysts for their contributions to investors' trading revenues and thus encourage the production of valuable

analyses to investors (Maber et al. 2014). As such, the feedback channel from investors to analysts serves as a way to mitigate some of the perverse incentives that analysts have from direct trading commissions (Hayes et al. 1998; Irvine 2004; Jackson 2005; Irvine et al. 2007; Juergens and Linsey 2009; Groysberg et al. 2011; Beyer and Guttman 2011). The broker vote system may also mitigate intra-firm contracting frictions such as allocation of bonuses among analysts (Maber et al. 2014).

Maber et al. (2014) document that broker votes reflect a reward from investors to analysts for providing valuable fundamental research. They also find that sell-side brokers use the votes as an allocation method to indirectly reward individual analysts for contributions to brokerage-wide commission payments. Thus, the broker vote system seems to reward analysts' expertise and is not biased towards trading volumes or relationship interest between the agents. In a survey, Brown et al (2015) find that broker votes are very important to the analysts. For example, most analysts state that their bonuses are directly affected by broker votes. Further, 83% of analysts indicate that broker votes are very important to their career advancement.

2.2. Theory and Hypothesis Development

Theory generally suggests that people respond to feedback by enhancing their performance (Cyert and March 1963). The need of feedback in order reflect on and judge one's own performance is often a central mechanism used as a tool to increase motivation in different contexts e.g. incitement- and bonus contracts (O'Reilly et al. 1988). Further, the need to focus on social factors and not solely monetary motivations in order to understand mechanisms of feedback is important (Panadero 2016). In this paper, we use the term *feedback* in a broader sense whereas other papers may refer to it as *evaluation* or *assessment* (of others work).

Although it is generally accepted that both receiving and providing feedback can be an important learning tool (e.g. Van Gennip et al. 2009), which enhances the capability of self-assessment (Mason and Reinholtz 2015), it can be important to distinguish between the role of receiving and the role of providing feedback since it sometimes demands different cognitive mechanisms (Topping 1998; van Zundert 2010). Therefore, in cases where the goals of the feedback receiver and feedback provider differ it is relevant to focus on the two agents separately (Panadero 2016). Whereas financial analysts are generally found to also have other incentives than providing accurate earnings estimates the investors are generally assumed to strive for accuracy. Thus, in the context of the broker vote system, where financial analysts receive feedback from the investors, this separation between providing and receiving feedback is potentially important.

Thus, we draw attention to analysts' behavior when they *expect* feedback and to investors' behavior when they must *provide* feedback. Below we develop hypotheses for analysts, as feedback receivers, and investors, as feedback providers, separately.

2.2.1. Receiving Feedback (The Analysts' Role)

One aspect of receiving feedback is concentrated on the ability to compare one's own performance with the performance of others in order to relatively assess one's own performance more objectively. According to social comparison theory (Festinger 1954) the tendency of comparing one's own performance against others, has been suggested as an important input for humans self-feelings at least since humans became social animals (Rousseau 1754/1984) and can be observed even in small children (Butler 1992) as well as in other species (Gilbert et al. 1995).

When people seek to evaluate their own performance they do so to assess themselves precisely (*self-assessment*, Trope 1986), confirm their own sense of

self (*self-verification*, Swann 1983) and keep a positive self-image (*self-enhancement* or *self-affirmation*, Pyszczynski and Greenberg 1987; Steele 1988; Suls and Wheeler 2000). According to Jordan and Audia (2012 p. 214) the latter point about self-affirmation is especially important to consider in settings with feedback since it may (unconsciously) influence the cognitive perception of received feedback and consequently provoke behaviors inconsistent with otherwise assumed by performance theories.

Self-affirmation theory, originally proposed by Steele (1988), posits that people have a general drive to maintain self-integrity. Consequently, people seek to avoid threats to their image of themselves (Sherman and Cohen 2006). Because people generally seek to develop and sustain a positive self-image (Beach and Tesser 1995) they pursue an opportunity to evaluate their performance against others. This drives a general competitive behavior where ability and effort in a task are central (Garcia and Tor 2007). Therefore, the existence of feedback in tasks have for long been argued and proved to be an effective tool to increase motivation, effort and performance not only in order to achieve monetary gain but also to enhance a positive self-image (Pyszczynski and Greenberg 1987; Smith 2000; Greenberg et al. 2007).

In line with the self-affirmation theory, and not only because of monetary incitements, we find it likely that the build-in feedback channel in the broker vote system affects analysts' forecasts and written reports due to a desire to maintain a positive self-image.

Relying on self-affirmation theory Salovey and Rodin (1984) provided experimental evidence that people get negative emotions (more anxiety, depression and a bad mood) from receiving negative feedback in a dimension that is important to their self-image. Further, literature in educational learning has for

long been studying the effects of feedback (e.g. Butler and Winne 1995; Kluger and DeNisi's 1996; Topping 1998; Black et al. 1998; Pope 2001; Hanrahan and Isaacs 2001; Atkins 2002; van den Boom et al. 2007; Brown et al. 2013). Although most of these studies has investigated the effects of receiving feedback on *future* performance (Topping 1998), the *expectation* of feedback itself may in fact also improve the feedback receiver's *current* performance. In an experimental study Berkowitz et al. (1963) find that performance increases when the feedback receivers are informed that the feedback providers have access to their productivity data. This is the case even in conditions where the feedback receivers are explicitly informed that their evaluation will not be affected by their individual productivity data. Berkowitz et al. (1963) explain this with the feedback receiver's feeling a sense of responsibility to the feedback provider and respond by increased effort towards the feedback provider's expected needs. More recently, Vollmeyer and Rheinberg (2005) (unexpectedly) conclude from an experiment that when people expect feedback after a task they use better strategies from the beginning of the task and argue this to be a result of increased motivation. Thus, expecting feedback seems to change how people generally approach the task and their considerations of how the provider of the feedback will value their performance.

The need for people to be evaluated by others (Baumeister 1982; Brown and Gallagher 1992) and hence strive for positive feelings in order to retain or improve their self-image (Lazarus 1991; Smith 2000) makes the existence of feedback an important driver to complete a task for the receiver of the feedback. Since expecting feedback increases motivation in the task and the feedback receiver's responsibility toward the feedback provider we conjecture that when analysts expect feedback from investors they will approach the task differently. We find it likely that analysts will make an increased effort when evaluated by investors

through mechanisms like the broker vote system in order to maximize the chance of receiving positive feedback and thus minimize the risk of harming their positive self-image. Because analysts generally consider broker votes as important to receive (Brown et al 2015) we expect that analysts engage in cognitive processes in line with social comparison theory in order to maintain a positive self-image by receiving votes from the investors as a reflection of a reward for doing a good job. More specifically, we expect analysts to react less to other biasing incentives and disclose forecasts more in line with investors' requests compared to analysts that do not expect to receive feedback. This leads to our first hypotheses.

H1: The feedback-channel induces a reduced reaction to private incentives in analysts' forecasts.

2.1.2. Providing Feedback (The Investors' Role)

Bangert-Drowns et al. (1991) argues that it is important to focus on what people can gain from providing feedback instead of solely focusing on the receivers of feedback. In the case of the broker vote system, investors are able to provide feedback to analysts about their investment advice. Because a broad stream of research in educational literature agrees that a requirement of providing feedback increases the need for cognitive regulations, this opportunity for investors to allocate broker votes is likely to affect how the investors approach and perceive the outputs from the analysts. As examples, regulating cognition in the context of providing feedback is basically metacognitive activities that control our thinking and learning (Brown 1987; Schraw and Moshman 1995). This is said to increase people's *awareness of comprehension breakdowns and use of attentional resources* (Schraw 1998) in tasks. It includes enhanced planning prior to a task (Miller 1985), increased thinking (Stefani 1994), a greater ability to diagnose misconceived knowledge (Van Lehn et al. 1995), more constructive reflection

(Topping 1998; Cheng and Warren, 1999), increased attention (Topping 1998), better self-performance (Davies 2000; Althausser and Darnall 2001), enhanced knowledge of the subject (Venables and Summit 2003) and more inspiration (Li and Steckelberg 2006).

Thus, this evidence supports that providing feedback stimulates the cognitive activities. For example, Falchikov (1995) and Freeman (1995) find that providing feedback enhances the awareness and attentional resources. Panadero (2016) also finds that providing feedback creates a setting where people learn about their own strengths and weaknesses. Thus, being required to provide feedback strengthens peoples' abilities to understand the task and how the person, to whom feedback must be provided, solved the task including an increased understanding of the persons' strategies and motives. Because the broker vote system requires investors to provide feedback to analysts it is likely that this feedback process will regulate investors' cognition and thereby increase their awareness and attentional resources. We therefore conjecture that investors, who provide feedback to analysts, will increase their awareness and attention towards the analyst's work including a more careful consideration of the analyst's incentives and an improved ability to diagnose biased information. This will impose a more skeptical use of an analyst's biased earnings forecasts when investors make trading decisions and a greater reliance on other sources of information. Thus, in a setting where the consensus forecast serves as the other source of information we expect that investors giving feedback to analysts will provide forecasts closer to the consensus forecasts than investors who are not required to provide feedback to analysts. This leads us to the second hypothesis.

H2: The feedback-channel decreases investors' weighting of the analyst's forecast and increases the weighting of the consensus forecast.

3. METHOD, MEASUREMENTS AND DESCRIPTIVE STATISTICS

3.1. Task and Design

This paper-based experiment follows a 2x2x2 between-subjects design. In the main task participants are asked to conduct an earnings forecast for a given firm, either as an analyst or as an investor. Creating an information cascade, each analyst is matched with an investor who has access to the analyst's forecast and justification. Based on hard and soft information the analysts (investors) state an earnings forecast (prediction) for a given company and write a justification for their forecast. Although similar, we refer to the analysts' estimates as a *forecast* and to the investors' estimates as a *prediction* for simplification. The investors participate in the experiment at a later time than the analysts and the written form ensures that communication is anonymous. This anonymity is important since some studies, although providing scared results, suggest that friendships might interact with how people conduct and perceive feedback (Falchikov 1995; Hunter and Russ 1996; Corgnet 2012). In order to further minimize the risk that some participants recognize the matched fellow student, e.g. by the handwriting, we make sure that no matches are done within the same class. Thus, we expect that no participants in our study are able to recognize who they are matched with. An example of the experimental materials available to analysts and investors respectfully is provided in the appendices. After the main task, check-questions and a short questionnaire are completed.

Participants and Procedure

The participants are 344 finance Master Students all assigned the course *Financial Statement Analysis and Valuation*. On average participants are 25 years old and 27 % are female. Participants have on average completed five courses within finance and accounting, 44 % invest in stocks, and 73 % have relevant part-time employment (51 % directly related to finance or accounting).

The experiment was conducted at the end of the lecture on financial forecasting in five different programs. All experiments were conducted by the same experimenter and the experimenter was present in the room during the experiment. The experiment lasted approximately 25 minutes. Students had the option not to participate in the experiment.

A written introduction on the front page of the experimental materials was read out loud by the experimenter and participants were then encouraged to ask clarifying questions before the experiment began. In the introduction, participants were given standard experimental information including that all their belongings must be put away, that their answers are treated anonymously, that they must remain seated during the entire experiment and that all communication during the experiment is prohibited. We describe the topic of the experiment as “*this experiment is related to the reports of financial analysts and how investors use those reports*” and the participants are shortly introduced to the construction of the forecasting task (e.g. we explain that they will be assigned one of two roles and also that answers from analysts are matched up with investors). Different versions are included (known to the participants) in order to avoid possible benefits of copying answers from the person next to them and to allow us to identify participants that may do so (Table 1 illustrates the different versions disguised as three different companies). Feedback on individual performances was available online to all participants within one week after the experiment was executed.

Forecasting Task

For the forecasting task, the analysts are given “hard” and “soft” information. The hard information includes last quarter’s earnings, an earnings range (uniformly distributed) in which this quarter’s earnings will be, and information about ten competing analysts (their average and the standard deviation of their forecasts). The soft information concerns a recent private conversation the analyst had with

the company CFO implying a decrease in this quarter's earnings compared to last quarter. Here the CFO expresses concern about the performance of a division that makes around 60 % of the total profit. Based on this, we told the analysts that given the phone call "*the consensus forecast is probably too optimistic about the dairies division*". Since the ten competing analysts are not aware of the private phone conversation, the soft information provides a plausible scenario for the analyst's superior knowledge (i.e., the true earnings range).

All investors receive the same hard information as the analysts excluding the earnings range and its distribution (unless their matched analyst chooses to disclose this information in the written justification). However, the investors have information corresponding to the upper point of the true earnings range because they are informed that this quarter's earnings will not exceed last quarter's earnings. Further, investors have access to their matched analyst's forecast and written justification. They are also informed about the analyst's phone call with the CFO but do not receive any details about it (unless their matched analyst chooses to disclose this information in the written justification).

Treatments

Following a 2x2x2 between-subjects design, besides assigning each participant the role as an analysts or an investor, we randomly manipulate the information in two ways: First, we incentivized analysts to either diverge from or converge towards the consensus estimate referred to as the incentive-treatment. And second, we included an incentivized feedback-channel where the quality of the analysts' answers was rated by the investors referred to as the feedback-treatment.

Incentive-treatment

The analysts face one of two private incentives to either diverge from- or converge to the consensus. For the *diverge* incentive, the analysts are informed that they will

be promoted (and earn more money) if they “stand out from the crowd” so that their forecast is more accurate than any forecast provided by the ten other analysts. For the *converge* incentive, the analysts are informed that they will avoid being fired (and earn more money) if they “hide in the crowd” and their forecast is not the most inaccurate compared to the other ten analysts’.

The investors are truthfully told about the analyst’s financial incentive and the analysts are aware of this shared information with the investors.

Feedback-treatment

Half the analysts will receive further earnings (framed as a bonus) if their matched investor rates them 4 or 5 on a scale from 1 to 5, with 5 being the best rating. Their matched investor is given the same information about the analysts’ rating. However, the investors are told that their own earnings from the experiment are not affected by the rating they choose to give their matched analyst. Further, investors are informed that the analysts are aware of the investors control over their earnings.

TABLE 1
Hard information distributed to analysts and investors for each company.

Company	n	Role	Last Quarter's Earnings	Analysts' Consensus			Next Quarter's Earnings Range		
				Estimate	Distribution	SD	Lower	Upper	Distribution
ABC	63	Analyst	2.40	2.40	normal	0.05	2.20	2.40	uniform
	48	Investor	2.40	2.40	normal	0.05	N/A	2.40	N/A
GHJ	65	Analyst	3.84	3.84	normal	0.08	3.52	3.84	uniform
	52	Investor	3.84	3.84	normal	0.08	N/A	3.84	N/A
MNO	67	Analyst	1.92	1.92	normal	0.04	1.76	1.92	uniform
	49	Investor	1.92	1.92	normal	0.04	N/A	1.92	N/A

Table 1 reveals the hard information available to analysts and investors respectively in the experimental materials. Three different versions exist referred to with different company names. The number of observations (n) are also included for each of the three versions for analysts and investors respectively.

Compensation

Following Davis and Holt (1993, Chap. 2) the experiment is monetarily incentivized. Approximately 10 % of the participants are paid according to their performance. Hence, all participants are expected to make an effort in the experiment in order to receive the highest possible payments. This determination is conducted by rolling a ten-sided die at the end of each session and paying the participants with a matching last digit of their identification number.³² The payments are made in local currency, but for presentation purposes we convert the amounts in the text to USD. Across the sessions, the total payment of \$2,495 was distributed between 43 winners equivalent to average earnings per winner of \$58. For all participants this corresponds to an average hourly wage of \$17.³³

The analysts with an incentive to diverge (converge) in the non-feedback treatment are paid \$75 if they are promoted (not fired) and \$15 if they are not promoted (are fired). The analysts in the feedback treatment are paid \$45 if they are promoted (not fired) and \$15 if they are not promoted (are fired), plus a bonus of \$30 if the investors rate analysts' performance as 4 or 5. Thus, the payment difference according to the incentives is reduced in the feedback-treatment (from \$75 to \$45) but the total maximum and minimum payment for all participants playing analysts are the same across treatments.

The investors are paid \$75 less an amount due to the absolute distance of their prediction from the true earnings, calibrated such that the payment is reduced to \$15 if their deviation from true earnings equals the range provided to the analyst.

³² All answers are treated anonymously and we therefore identify participants by an identification number. This number consists of six digits where the first two represent the month of birth and the other four digits are equal to the last four digits of their phone number. Participants are asked to write this six-digit number on the front page of the experiment before the experiment starts. All experiments are handed in to the experimenter before a die decides the winning number.

³³ The payments were made approximately a week after the session to allow for matching of analysts and investors. The check-questions and questionnaire are also incentivized by small amounts (i.e. 30 cents for every correctly answered check-question).

After the experiment, the true quarterly earnings from the firm are randomly drawn from the range provided to the analysts.

3.2. Exclusion Criteria and Manipulation Checks

We drop three analysts whose forecasts are outside the range provided (having been informed of the true range) and three investors whose forecast is above last quarter’s earnings (having been informed that this quarter’s earnings will not exceed last quarter’s earnings). Since the investors are not informed of a lower bound, we do not impose that as an exclusion criterion. Thus, we perceive these six dropped participants as having misunderstood the central task of the experiment. The remaining sample is 338 participants who are distributed between treatments as illustrated by Table 2³⁴.

TABLE 2
Observation distributions

Role	No Feedback		Feedback		Total
	<u>Converge</u>	<u>Diverge</u>	<u>Converge</u>	<u>Diverge</u>	
Analyst	49	49	46	48	192
Investor	32	30	44	40	146
Total	192		146		338

The number of observations from the total sample assigned to one of two roles (analyst or investor) and two treatments (diverge vs. converge incentive and no-feedback vs. feedback).

³⁴ Note that scheduling conflicts, with the investors participating in later sessions than the analysts, resulted in fewer investors than analysts.

3.3. Measurements and descriptive statistics

Because the experiments have different versions (see e.g. Table 1 above or Table 1A in appendix G for a more detailed view) the main variables are calculated relatively according to the disclosed consensus estimate/the upper point of the true earnings range. Hence, the participants' reported forecasts and predictions in the experiment are used as inputs to construct our main variables which are described in further detail below.

Dependent Variables

For the analysts, we measure their individual deviation from their forecast to the consensus estimate which corresponds to the last quarter's earnings and the upper point of the true earnings range, scaled according to the true earnings range. We refer to this continuous variable as *Devcon* and measure it as:

$$Devcon = (Consensus Estimate - Analyst Forecast) / Length Range$$

I.e., 0 is an analyst's forecast at the consensus, while 1 is a forecast at the lower bound. The expected earnings value is the center of the true earnings range, taking a value of 0.5, and we expect this to act as an anchor for analysts (along with the consensus).

The investors do not receive the true earnings range but are instead provided with the consensus and the analyst's forecast. To construct a variable analogous to *Devcon*, we use the matched analyst's forecast as a center point, since this obviates the need to use the true earnings range that the investors do not possess. We refer to this continuous variable as *Devana* and measure it as:

$$Devana = (Consensus Estimate - Investor Forecast) / (2 \times (Consensus Estimate - Analyst Forecast))$$

We scale the investors forecasts with a value of 0 being at the consensus, 0.5 being at the matched analyst's forecast³⁵, and 1 being twice (or more) as far from consensus as the matched analyst's forecast.³⁶

Independent Variables

We include the two treatments as dichotomous independent variables. We refer to the incentive-treatment as *incentive*. Here, the analysts are given an incentive to converge to (framed as a nearly firing in the firm of the analyst) - or to diverge from (framed as a nearly promotion in the firm of the analyst) the consensus estimate. We assign the *incentive* variable a value of 1 (0) if analysts are given an incentive to diverge from (converge to) the consensus estimate. Further, we refer to the feedback-treatment as *feedback*. Here, the investors rate the advice of their matched analysts on a scale from 1 to 5 (with 5 being the best rating). We assign the feedback variable a value of 1 for the group of analysts and investors with feedback, 0 otherwise. Because of randomization, we expect no correlations between our two treatments. Descriptive statistics for all main variables are found in Table 3.

³⁵ Where the analyst and investor both forecast at the consensus, then a value of 0.5 is taken.

³⁶ We cap this measure at 1. This implies that in cases where investors are even further away from their matched analysts' forecasts than twice the distance *devana* equals 1.

TABLE 3
Descriptive statistics and correlations of main variables.

<u>Variable</u>	<u>Mean</u>	<u>Median</u>	<u>SD</u>	<u>Min</u>	<u>Max</u>	<u>n</u>	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>
1. <i>devcon</i>	0.485	0.500	0.243	0	1	192				
2. <i>devana</i>	0.445	0.382	0.243	0	1	146	N/A			
3. <i>incentive</i>	0.574	1.00	0.243	0	1	338	0.117	-0.237***		
4. <i>feedback</i>	0.527	1.00	0.243	0	1	338	0.086	-0.260***	0.001	
5. <i>effortwords</i>	34.16	32.50	0.243	0	105	192	0.038	N/A	-0.144***	0.194***

Descriptive statistics and pairwise correlations for the six main variables.

Stars indicate significance on level. ***= $p<0.001$, **= $p<0.05$, *= $p<0.1$.

As expected our two treatments are not correlated (a correlation of 0.001) suggesting a successful randomization of the experiments. Our measure of analysts' deviations from the consensus estimate, *devcon*, is not correlated with any of our treatments whereas our measure of investors' adjustments to analysts' forecasts, *devana*, is moderately negatively correlated with both treatments. The latter suggests that investors adjust more towards consensus when analysts have an incentive to diverge and when a feedback-channel exists. The variable *effortwords* lastly included in Table 3 reflects the number of words analysts disclose in their written justifications to investors as a proxy of effort. This variable is used as a robustness check of H1.

4. RESULTS AND ROBUSTNESS CHECKS

4.1. The impact of a feedback-channel on analysts as feedback receivers (H1)

To test our first hypothesis, we include the distance between analysts' forecasts and the consensus estimate (*devcon*) as the primary variable. To test the effect of our two treatments, we use t-tests and support the results with non-parametric tests. Results are reported in Table 4. We report only two-tailed tests. Appendix F includes an illustration (Figure 1) of the test results for H1.

H1 predicts that participants playing the role as analysts in the experiment will disclose more honest forecasts if a feedback-channel exists, and thus react less to their biasing incentives. Results in Table 4 show that the analysts in the control group (no feedback) provide significantly different forecasts according to their incentive (t-stat of -2.01). These analysts with a converge incentive forecast on average 41.5 % below consensus, while the ones with a diverge incentive forecast on average 51.4 % below consensus. On the other hand, for the analysts in the treatment group (with feedback) there is no effect (t-stat. of -0.24). With feedback, these analysts with a converge incentive forecast 50 % below consensus, while the ones with a diverge incentive forecast 51.2 % below consensus. These results support H1; i.e. the introduction of a feedback-channel reduces analysts' reactions to the incentives which results in less biased forecasts according to the investors' desires (the middle of the range). We interpret this reduced reaction to private incentive as if the analysts are more concerned about the investors' needs. In line with social comparison theory, analysts do so in order to maintain a positive self-image reflected by a wish to receive a better rating from the investors and thus not only for monetary reasons.

TABLE 4
T-test results of analysts' deviations from consensus (devcon)

	Total Sample	Feedback		Difference	T-tests (t-stat.)	Wilcoxon tests (z-stat.)
		No Feedback	Treatment Feedback			
Total Sample		0.465	0.506		-1.19	-0.95
Incentive						
Converge	0.456	0.415	0.500	-0.085	-1.74*	-1.30
Treatment						
Diverge	0.513	0.514	0.512	0.002	0.05	-0.04
Difference		-0.099	-0.012			
T-tests (t-stat.)	-1.63	-2.01**	-0.24			
Wilcoxon tests (z-stat.)	-1.69*	-1.80*	-0.68			

Means of analysts' deviations from consensus (devcon) tested on total sample and for the two treatments respectively.
T-statistics and z-statistics are reported for two-tailed tests of difference in means.
Stars indicate significance on level: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

4.2. The impact of a feedback-channel on investors as feedback providers (H2)

To test our second hypothesis, we use the measure of investors' directional adjustments to the analysts' forecasts (*devana*) as the primary variable.

We conjecture in H2 that the feedback-channel will increase investors' awareness and attention towards the analyst's work. This will impose a more skeptical use of an analyst's earnings forecasts when investors make trading decisions and a greater reliance on other sources of information which in this experiment is the consensus estimate. To test the effect of our two treatments on the investors' adjustment behaviors we use t-tests and support the results with non-parametric tests. Results are reported in Table 5. We report only two-tailed tests. Appendix F includes an illustration (Figure 2) of the test results for H2.

In line with H2, investors with a feedback-channel adjust their forecasts more towards consensus (0.381 vs. 0.533) with the difference of 0.152 being strongly significant (t-stat of 3.23). This effect remains robust across the converge- and diverge-incentive groups, with investors with a feedback-channel moving closer to consensus by 0.141 and 0.167, respectively (t-stats of 2.06 and 2.74). Although counterintuitive at first sight, these results show that implementing a feedback-channel makes the investors more critical of the analysts' forecast. In particular, the feedback-channel results in the investors' forecasts moving away from analysts' recommendations and towards the other information anchor which in this experiment is the consensus forecast. This is consistent with the feedback-channel increasing the investors' evaluation of the analysts' forecasts and their attention towards alternative sources of information. Thus, this supports the theoretical prediction that providing feedback enhances people's cognitive ability to understand the task from the perspective of others; in this case, investors' enhanced understanding of analysts' biasing incentives.

TABLE 5
T-test results of investors' adjustment to analysts' forecasts (devana)

	Total Sample	Feedback Treatment		Difference	T-tests (t-stat.)	Wilcoxon tests (z-stat.)
		No Feedback	Feedback			
Total Sample		0.533	0.381		3.23***	3.32***
Incentive	Converge	0.511	0.452	0.141	2.06**	2.11**
Treatment	Diverge	0.374	0.302	0.167	2.74***	2.99***
Difference		0.124	0.150			
T-tests (t-stat.)	2.93***	1.78*	2.49**			
Wilcoxon tests (z-stat.)	2.66***	1.83*	3.30**			

Means of investors' adjustment to analysts' forecasts (devana) tested on total sample and for the two treatments respectively.

T-statistics and z-statistics are reported for two-tailed tests of difference in means.

Stars indicate significance levels: ***-p<0.001, **-p<0.05, *-p<0.1.

Although not a hypothesis, we also test whether investors adjust analysts' forecasts differently for the incentive treatment. Intuitively, investors should recognize the analysts' confronting incentives in the groups where the feedback-channel are present and respond by adjusting their forecasts less compared to the groups without the feedback-channel. On the other hand, the task of providing feedback to the analysts makes investors more aware of analysts' biasing incentives and their consequences. Hence, according to this it is equally likely that investors will make greater adjustments to analysts' forecasts when a feedback-channel exists compared to when there is no feedback-channel. In the control group (no feedback-channel) the difference between the converge- and diverge incentive is 0.124 (t-stat of 1.78), while in the treatment group (with feedback) the difference is 0.150 (t-stat of 2.49). Hence, the difference in investors' magnitude of adjustments to the incentives is not affected by the feedback-treatment (only the direction of this adjustment is). We perceive this indifference as a result of the two counteracting mechanisms discussed above. Consequently these two opposing effects plausibly resolve in no difference between the magnitude of investors adjustment to analysts' incentives according to the feedback-treatment.

4.3. Robustness Checks

4.3.1. Analysts' Increased Effort in Feedback Treatment

To measure the effort analysts make in their written justification to investors we make the variable *effortwords* which is a continuous variable referring to the number of words that an analyst chooses to write in the justification to the investor (descriptive statistics of this variable are included in Table 3). We perceive more words in the written justification as that the analysts making a greater effort to explain the reasoning behind their forecasts to the investors. Using the number of words as a proxy of effort has previously been done by other studies in different fields (Pieterman et al. 1993; Gatewood et al. 2002; Blumenstock 2008). We

predict that analysts receiving feedback disclose more words in their written justification to investors in order to increase their chances of receiving positive feedback.

The results, reported in Table 6, reveal a significant difference in the number of words disclosed by analysts across the two feedback treatments (t-stat. of -2.19). Analysts in the control group (no feedback) disclose 31 words as compared to 37 words in the treatment group (with feedback). In summary, the number of words improves significantly when investors provide feedback to analysts supporting that a feedback-channel has a positive impact on analysts’ effort in line with predictions from theory.

<div>TABLE 6</div> <div>T-test results of analysts’ effort in their justification to investors</div>					
	Feedback Treatment		Difference	T-tests (t-stat.)	Wilcoxon tests (z-stat.)
	No Feedback	Feedback			
Number of Words (<i>effortwords</i>)	31.14	37.30	-6.155	-2.19**	-2.13**

Means of analysts’ effort (*effortwords*) tested on the feedback-treatment.
T-statistics and z-statistics are reported for two-tailed tests of difference in means.
Stars indicate level of significance: ***=p<0.01, **=p<0.05, *=p<0.1.

4.3.2. Check Questions

To enlarge our understanding of the considerations participants had when performing the experiment, the participants were asked to answer a number of check-questions after they completed the forecasting task. Some of the check-questions were given in order to make manipulation checks e.g. questions like “*Were you playing the role as an analyst or an investor?*” or “*How much could you at maximum earn from this task?*”. Others were conducted to deepen our understanding of the participants’ behavior in the forecasting task e.g. questions like “*What strategy would be best in order to earn the greatest expected amount?*”.

Rerun H1 and H2 on a subsample

We found that 13 analysts' provided incorrect responses to the question of the maximum earnings from the experiment. We therefore drop these analysts³⁷. Further, one analyst wrongly reported the assigned role and is therefore also dropped. We rerun tests of H1 with a reduced sample of 178 analysts (14 dropped). Results (not tabulated) remain similar to the ones reported based on the full sample. We also drop 14 investors who provided incorrect answers to some of the check-questions (6) or who were matched-up with the 14 analysts that we dropped above (8). We rerun tests of H2 with a reduced sample of 132 investors (14 dropped). Results (not tabulated) based on the reduced sample remain similar to the ones reported above. These robustness tests confirm that our results are not driven by the analysts or investors providing incorrect answers to the check-questions.³⁸

Indications from Check-Questions Supporting the Results

We ask all participants which strategy they think would be better to follow in order to receive most earnings from the forecasting task (the two options they may choose between differs between analysts and investors). We also ask the analysts if helping the investors was important to them (1 = yes, 2 = no) and correspondingly we ask the investors if they trusted the analyst to make an honest forecast (1 = yes, 2 = no). Finally, we ask all participants to assess their own performance in the forecasting task, relative to how they think the others participating in the experiment has performed, on a three point scale (1 = above average, 2 = around average and 3 = below average). Table 7 reports how analysts answered in panel A and how investors answered in panel B. All answers are

³⁷ The 14 analysts are evenly represented in the treatment groups.

³⁸ Untabulated results are available upon request.

provided for the total sample and for each treatment group. T-tests (supported by non-parametric tests) are reported two-tailed.

The answers by analysts about which strategy would be better to apply in order to earn more are significantly different (t-stat. of -8.42) according to their given incentives to either diverge or converge. This supports our design that analysts respond as intended to our manipulation of biasing incentives. Further, more analysts without a feedback-channel than analysts with a feedback-channel believe that following the incentives is the best strategy. This supports that analysts receiving feedback from investors reflect more carefully about their incentive and the forecast they provide in line with the prediction of H1. Further, (insignificantly) more analysts answer 'yes' to the question if helping the investor was important to them when a feedback-channel exists. Indications from analysts' answers to the check-questions supports our results of H1 that introducing a feedback-channel decreases analysts' reactions to other incentives and increases their responsibility to investors resolving in more honest forecasts.

When investors are asked which strategy would be better to apply in order to increase earnings, the group without the feedback-channel more often answers that following the analysts' forecasts is a better strategy than does the group including a feedback-channel (t-stat. of -1.85). Further, (insignificantly) less investors trust the analysts to make honest forecasts when a feedback-channel exists. However, this difference is highly significant when looking isolated on the diverge incentive group (t-stat. of -2.68). This supports that investors providing feedback to analysts pay greater attention to analysts' biasing incentives, decreasing investors' naïveté in line with H2. Finally, we find evidence that the investors, who trust analysts to provide honest forecasts, respond by giving significantly higher ratings than the investors who do not trust their matched analyst (t-stat. of 2.461, results not tabulated).

Table 7
Descriptive statistics and t-tests of analysts' and investors answers to three check-questions

PANEL A - ANALYSTS						
		Incentive			T-tests	Wilcoxon tests
		Average	Converge	Diverge	(t-stat.)	(z-stat.)
Best Strategy	Average		1.33	1.90	-8.42***	-7.13***
	No Feedback	1.57	1.25	1.91	-8.80***	-6.54***
	Feedback	1.63	1.44	1.80	-3.60***	-3.40***
	T-tests (t-stat.)	-0.78	-1.91*	1.59		
	Wilcoxon tests (z-stat.)	-0.79	-1.88*	1.58		
1 = towards consensus 2 = away from consensus						
Help Investor	Average		1.36	1.35	0.06	0.06
	No Feedback	1.37	1.36	1.38	-0.21	-0.21
	Feedback	1.33	1.35	1.32	0.30	-0.30
	T-tests (t-stat.)	0.23	0.13	0.64		
	Wilcoxon tests (z-stat.)	0.35	0.13	0.65		
1 = yes 2 = no						
Own Performance	Average		1.83	1.95	-1.56	-1.58
	No Feedback	1.90	1.78	1.96	-1.59	-1.55
	Feedback	1.91	1.89	1.94	-0.50	-0.55
	T-tests (t-stat.)	-0.61	-0.98	0.20		
	Wilcoxon tests (z-stat.)	-0.68	-0.98	0.16		
1 = above avg. 2 = around avg. 3 = below avg.						
PANEL B - INVESTORS						
		Incentive			T-tests	Wilcoxon tests
		Average	Converge	Diverge	(t-stat.)	(z-stat.)
Best Strategy	Average		1.67	1.79	-1.31	-1.31
	No Feedback	1.67	1.64	1.69	-0.37	-0.37
	Feedback	1.81	1.74	1.87	-1.48	-1.47
	T-tests (t-stat.)	-1.85*	-0.78	-1.86*		
	Wilcoxon tests (z-stat.)	-1.83*	-0.78	-1.82*		
1 = follow analyst 2 = follow consensus						
Trust Analyst	Average		1.49	1.33	1.90*	1.88*
	No Feedback	1.37	1.58	1.14	3.83***	3.44***
	Feedback	1.44	1.41	1.46	-0.42	-0.42
	T-tests (t-stat.)	-0.71	1.40	-2.86***		
	Wilcoxon tests (z-stat.)	-0.75	1.39	-2.72***		
1 = yes 2 = no						
Own Performance	Average		1.95	1.99	-0.48	-0.49
	No Feedback	2.05	2.00	2.10	-0.78	-0.78
	Feedback	1.90	1.91	1.90	0.09	0.05
	T-tests (t-stat.)	1.77*	0.76	1.86*		
	Wilcoxon tests (z-stat.)	1.75*	0.76	1.77*		
1 = above avg. 2 = around avg. 3 = below avg.						

Means of analysts' (Panel A) and investors' (Panel B) answers to check-questions tested on the two treatments respectively.
T-statistics and z-statistics are reported for two-tailed tests of difference in means.
Stars indicate significance on level: ***=p<0.001, **=p<0.05, *=p<0.1.

When asking our participants to assess their performance in the forecasting compared to others the average assessment is 1.90 for analysts with a feedback-channel and 1.91 for analysts without a feedback (t-stat. of -0.61). Correspondingly, investors' average assessment is 1.90 for the group with a feedback-channel and 2.05 for the group without a feedback (t-stat. of 1.77). Thus,

while analysts have a constant assessment of their own performance across the feedback-treatment, investors with a feedback-channel seem to assess their performance above investors without a feedback-channel. This finding suggests that the feedback-channel increases investors' confidence in their own estimate plausibly derived from applying meta-cognitive processes when solving the task.

Finally, to make sure analysts understand that investors are better off at the middle point of the range (due the way we designed the payment-structure) we run a t-test to check the difference between the forecasts of those analysts declaring in the check-questions that helping the investors was important to them and those that did not find it important. We expect that the analysts who want to help the investors forecast closer to the middle point of the range. However, this analysis is only done for analysts with an incentive to converge since those having a diverge incentive forecast around the middle to follow the incentive and hence we cannot infer that they do so because of considerations of the investors intentions. Results of the test support our expectations. The group of analysts that did not find it important to help the investor has a mean forecast at 0.42 at the range compared to the group of analysts that did find it important to help the investor who has a mean forecast at 0.50 (t-stat. = 1.78, significant at the 10 %-level). We interpret these results as evidence that analysts are aware of the investors' optimal position in order to maximize their potential payoff. This is important since the experimental design reveals to the analysts that the true earnings are randomly decided.

5. CONCLUSION AND DISCUSSIONS

In this study, we investigate the effect of having information end-users (e.g., institutional investors, individual investors) provide performance feedback to information intermediaries (e.g., financial analysts, financial advisors). Relying on theories from psychology and educational research, we predict that information intermediaries will increase effort and reduce bias, while information end-users will be more critical of advice and consider alternate information. We test these predictions in an experiment that replicates the information transmission from financial analysts to institutional investors, but our findings are equally applicable to the analogous setting of financial advisors and individual investors. Consistent with the predictions, the information intermediaries become less biased (no longer responding to incentives to converge or diverge from consensus) while the information end-users become more critical (increasing the weight given to the consensus over the analyst's recommendation).

To our knowledge, this is the first paper to use the experimental method to test the possible effects of the broker vote system on both the role of the analysts and investors. By adding an additional incentive system (broker votes, or bonus payment) then the relative magnitude of the biased incentive will be reduced (from \$60 to \$30 in our case, career concerns for analysts) and the amount of bias will fall. We find evidence consistent with this, although the reduction close to zero that we observe is also consistent with the psychological theories. The experimental results imply that the broker vote system not only reduces the bias and increases the effort of analysts, it simultaneously enhances investors' critical evaluation of available sources of information. Hence, we extend current academic research on the broker votes system (e.g. Maber et al. 2014) by investigating the psychological and behavioral effects of the system on both parties. The analysts are argued to increase their effort not only for monetary reasons but also in order

to maintain a positive self-image. Further, requiring investors to provide ratings like broker votes increases their understanding of the analysts' role and other incentives because it demands more cognition at a higher level than performing the task without a requirement of feedback. This decreases the naivety of the investors towards analysts' outputs which has otherwise been a challenge to affect without too much regulatory intervention. We also highlight some unintended consequences of the European Securities and Markets Authority's proposed prohibition of indirect payments (ESMA 2014, Section 2.15), which would effectively prohibit the broker vote system in Europe. Such a prohibition would harm the information efficiency of the market unless the replacement system had similarly benefits.

The findings of this paper are also more broadly relevant to the design of financial markets. Given the extreme complexity of modern markets, information intermediaries will always have a critical role to play. Incorporating feedback-processes can ameliorate the agency cost of these intermediaries by increasing their effort and reducing bias, while improving the end-users' engagement. For example, in a setting with a financial advisor proposing products to a retail investor, having a feedback channel would reduce the likelihood of the advisor proposing non-suitable products (complex, high fees, etc.) while also increasing the likelihood of the investor considering competing products. But while these benefits are welfare enhancing overall, they may only be sub-optimal for the financial advisors, suggesting a possible role for regulation in implementing feedback-channels as best practice.

As with all experimental studies the world is rather simplified and consequently limits the generalizability. By running an experiment, we create an idealized world that allows us to easily manipulate the information space of each participant. But clearly some aspects of the design are less realistic and so less generalizable. In

particular, we draw the reader's attention to the transparent incentives, with the investors receiving full information about the biased incentives of the analysts. In practice, this would never be the case. Hence we do not argue that investors should be given more information in order to de-bias the recommendations. Rather, we argue that feedback-channels should be used to reduce the bias at source and simultaneously enhance the investors' critical evaluation. This implies the use of feedback-channels as a policy tool that is both more realistic and more powerful than full disclosure of biased incentives.

This study does not take into account analysts-client communication which has been argued to play an important role in analysts' decision process (Abhayawansa et al. 2015). Consequently, we cannot predict if a long term relationship between analysts and investors moderates the results of this paper. However, in the literature on feedback the results are rather scared from studies that investigate the role of friendship (e.g. Falchikov 1995; Hunter and Russ 1996; Corgnet 2012; Panadero 2016). Further, Maber et al. (2014) find the allocation of broker votes to be independent of established relationship between analysts'- and investment firms. Thus, we do not expect this simplification in our experimental design (excluding possible relationship establishments between the receiver and provider of feedback) to be a concern of the implications of this paper.

In the present experiment we also highly constrain the role of the analysts' forecasts by disclosing information that the realized earnings outcome is based on a random draw. Thus, otherwise relevant inputs to analysts' forecast decisions such as accounting based information i.e. from fundamental analyses (Barker and Imam 2008) becomes less important in this setting. Consequently, possible moderating effects such as analytical skill, forecast experience and understanding of the valuation process are not directly included in this study. Thus, the effects found by this experiment might be enlarged or weakened in a real-world setting

which future research could investigate but it is out of the scope of this paper. However, since this study is the first to experimentally investigate the effects of incorporated feedback in a system comparable to the broker vote system we consider the benefits of a clear and controlled setting to outweigh the potential drawbacks of a simplified world. Further, limiting the need for sophisticated knowledge and skills in conducting financial forecasts creates a setting where graduate students in finance are well-suited participants. And finally, because other studies generally agree that feedback influences effects of self-image to a larger degree when the feedback is made public as oppose to private (e.g. Taftkov 2012, p.333), we find it likely that effects of feedback found in this paper might be even more pronounced in the real-world to the extent that the allocation of broker votes are made publicly available.

APPENDIX A

EXPERIMENTAL MATERIALS FOR ANALYSTS WITH CONVERGE INCENTIVE AND NO FEEDBACK

Forecasting earnings as an analyst

Background

In this experiment, you will play the role of a *financial analyst* making an earnings forecast about ABC Company's quarterly earnings. Your forecast may help other CBS students (*the investors*) in later experiments. The *investors* will have access to the (consensus) forecast of other analysts, your forecast and justification, and may have access to your compensation scheme. The *investors* will make an investment decision that may result in their making or losing money depending on the actual earnings that the company announces (this will be announced sometime after the experiment is finished). You will forecast what the actual quarterly earnings will be for ABC based on the information below.

ABC Company

The company makes machines used in the food processing industry. Their quarterly earnings are generally quite stable. Last quarter the earnings were \$2.40.

Your Phone Call with the CFO

Yesterday, you had a private phone conversation with the CFO of ABC about the dairies (milk processing) division and the snacks division. The dairies division makes about 60 % of the profits of the company and it has been under pressure from a new entrant into the market. While the profit of the dairies division has been falling slightly, the profit at the snacks division has been increasing modestly. When the phone conversation turned to the performance of the dairies division, the CFO seemed very nervous and defensive.

Your Earnings View

For this quarter, recent forecasts of the 10 other analysts are normally distributed (with a standard deviation of 0.05) around an average (consensus) of \$2.40 that is identical to last quarter's earnings. The other analysts are not aware of your phone call and will not be talking to the CFO themselves. Therefore, you decide the consensus forecast is probably too optimistic about the dairies division. You (correctly) believe the earnings could be anywhere between \$2.20 and \$2.40 (uniformly distributed).

Your Compensation

One analyst is expected to be fired at your firm. You probably won't be fired if you act strategically with your forecast and hide in the crowd of the other analysts' forecasts (consensus). If you avoid being fired you will earn your regular amount of DKK 500. But you will be fired and earn only DKK 100 if your forecast is the most inaccurate compared to the other 10 analysts (who have already made their forecasts).

Your Forecast

You must now provide a forecast (a single number) using the attached sheet and a written justification that may help the *investors* make an investment decision. Please only write your input in the section called 'to be completed by the financial analyst'.

APPENDIX B

EXPERIMENTAL MATERIALS FOR ANALYSTS WITH DIVERGE INCENTIVE AND FEEDBACK

Forecasting earnings as an analyst

Background

In this experiment, you will play the role of a *financial analyst* making an earnings forecast about ABC Company's quarterly earnings. Your forecast may help other CBS students (*the investors*) in later experiments. The *investors* will have access to the (consensus) forecast of other analysts, your forecast and justification, and may have access to your compensation scheme. The *investors* will make an investment decision that may result in their making or losing money depending on the actual earnings that the company announces (this will be announced sometime after the experiment is finished). You will forecast what the actual quarterly earnings will be for ABC based on the information below.

ABC Company

The company makes machines used in the food processing industry. Their quarterly earnings are generally quite stable. Last quarter the earnings were \$2.40.

Your Phone Call with the CFO

Yesterday, you had a private phone conversation with the CFO of ABC about the dairies (milk processing) division and the snacks division. The dairies division makes about 60 % of the profits of the company and it has been under pressure from a new entrant into the market. While the profit of the dairies division has been falling slightly, the profit at the snacks division has been increasing modestly. When the phone conversation turned to the performance of the dairies division, the CFO seemed very nervous and defensive.

Your Earnings View

For this quarter, recent forecasts of the 10 other analysts are normally distributed (with a standard deviation of 0.05) around an average (consensus) of \$2.40 that is identical to last quarter's earnings. The other analysts are not aware of your phone call and will not be talking to the CFO themselves. Therefore, you decide the consensus forecast is probably too optimistic about the dairies division. You (correctly) believe the earnings could be anywhere between \$2.20 and \$2.40 (uniformly distributed).

Your Compensation

One analyst is expected to be promoted at your firm. You probably will be promoted you if you act strategically with your forecast and stand out from the other analysts' forecasts (consensus). If your forecast is the most accurate compared to the other 10 analysts (who have already made their forecasts), then you will be promoted and earn DKK 300. Otherwise you will earn your regular amount of only DKK 100.

In addition, *investors* (who earn money according to the accuracy of their own forecast) will rate your help from 1-5 (where 5 is the highest rating). You will receive a bonus of DKK 200 if your help is rated 4 or 5 (this is paid whether you are promoted or not).

Your Forecast

You must now provide a forecast (a single number) using the attached sheet and a written justification that may help the *investors* make an investment decision. Please only write your input in the section called 'to be completed by the financial analyst'.

APPENDIX C

EXPERIMENTAL MATERIALS FOR INVESTORS MATCHED WITH AN ANALYST WITH CONVERGE INCENTIVE AND NO FEEDBACK

Predicting earnings as an investor

Background

In this experiment, you will play the role of an *investor* making an investment decision by predicting ABC Company's quarterly earnings. The outcome of that investment (reflecting your payment for this task) depends on your accuracy (the actual quarterly earnings will be announced sometime after the experiment is finished). Another CBS student (the *financial analyst*) has already made an earnings forecast that may help you. *The financial analyst* had a recent private phone conversation with the CFO of ABC. You will predict what the actual quarterly earnings will be for ABC, based on the *financial analyst's* forecast and justification (see the attached sheet on the following page), together with the (consensus) forecast of 10 other analysts (more information below).

ABC Company

The company makes machines used in the food processing industry. Their quarterly earnings are generally quite stable. Last quarter the earnings were \$2.40. For this quarter, recent forecasts of 10 other analysts are normally distributed around an average (consensus) of \$2.40 (and a standard deviation of 0.05). These analysts are not aware of the *financial analyst's* private phone call with the CFO and will not be talking to the CFO themselves.

Financial Analyst Compensation

The firm that employs the *financial analyst* has announced that one analyst is expected to be fired. The *financial analyst* (correctly) believes he is less likely to

be fired if he acts strategically with his forecast and hides in the crowd of the other 10 analysts (consensus). If he avoids being fired he will earn the regular amount of DKK 500. But he will be fired and earn only DKK 100 if his forecast is the most inaccurate compared to the other analysts (who already made their forecasts).

Your Compensation

Reflecting the importance of earnings announcements for investment performance, you will “trade the announcement”. That is, you will write down your prediction of the earnings on the attached sheet. If you are exactly correct, you will earn DKK 500. For every \$0.01 that the actual earnings are away from your forecast, the payment will reduce by DKK 20 (i.e., you will earn DKK 460 if the actual earnings are \$0.02 higher or lower than your forecast).

Your Prediction

You must now provide a prediction (a single number) and a written justification of your prediction using the attached sheet.

APPENDIX D

EXPERIMENTAL MATERIALS FOR INVESTORS MATCHED WITH AN ANALYST WITH DIVERGE INCENTIVE AND FEEDBACK

Predicting earnings as an investor

Background

In this experiment, you will play the role of an *investor* making an investment decision by predicting ABC Company's quarterly earnings. The outcome of that investment (reflecting your payment for this task) depends on your accuracy (the actual quarterly earnings will be announced sometime after the experiment is finished). Another CBS student (the *financial analyst*) has already made an earnings forecast that may help you. *The financial analyst* had a recent private phone conversation with the CFO of ABC. You will predict what the actual quarterly earnings will be for ABC, based on the *financial analyst's* forecast and justification (see the attached sheet on the following page), together with the (consensus) forecast of 10 other analysts (more information below).

ABC Company

The company makes machines used in the food processing industry. Their quarterly earnings are generally quite stable. Last quarter the earnings were \$2.40. For this quarter, recent forecasts of 10 other analysts are normally distributed around an average (consensus) of \$2.40 (and a standard deviation of 0.05). These analysts are not aware of the *financial analyst's* private phone call with the CFO and will not be talking to the CFO themselves.

Financial Analyst Compensation

One analyst is expected to be promoted at the *financial analyst's* firm. The *financial analyst* (correctly) believes he is more likely to be promoted if he acts

strategically with his forecast and stands out from the crowd of the other 10 analysts (consensus). If his forecast is the most accurate compared to the other analysts (who already made their forecasts), then he will be promoted and earn DKK 300. Otherwise he will not be promoted and earn the regular amount of only DKK 100.

In addition, you (as an investor) will be able to rate the help of the *financial analyst* on a scale of 1-5 (where 5 is the highest rating). If the help is rated as 4 or 5, then the *financial analyst* will earn an additional DKK 200 payment (this is paid whether he is promoted or not). The *financial analyst* is aware of your control over this payment.

Your Compensation

Reflecting the importance of earnings announcements for investment performance, you will “trade the announcement”. That is, you will write down your prediction of the earnings on the attached sheet. If you are exactly correct, you will earn DKK 500. For every \$0.01 that the actual earnings are away from your forecast, the payment will reduce by DKK 20 (i.e., you will earn DKK 460 if the actual earnings are \$0.02 higher or lower than your forecast).

Your Prediction

You must now provide a prediction (a single number), a written justification of your prediction and a rating of the *financial analyst's* help using the attached sheet.

APPENDIX E

THE ATTACHED SHEET

TO BE COMPLETED BY THE *FINANCIAL ANALYST*

Enter your earnings forecast:

(this quarter's earnings will not exceed last quarter's earnings)

Enter a justification of your forecast to help the *Investor*:

TO BE COMPLETED BY THE *INVESTOR*

Enter your earnings prediction:

(this quarter's earnings will not exceed last quarter's earnings)

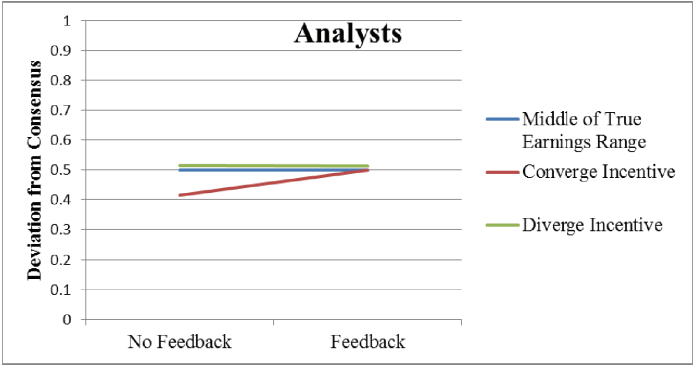
Enter a justification of your prediction:

Rate the *Financial Analyst's* help on a 1-5 scale (5 being the best rating):

APPENDIX F

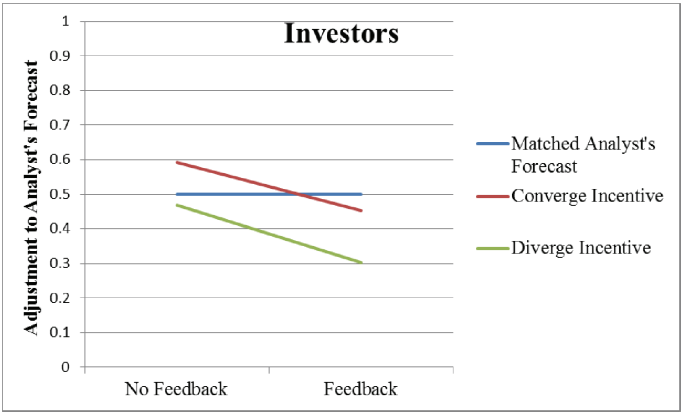
ILLUSTRATIONS OF RESULTS FOR H1 (FIGURE 1) AND H2 (FIGURE 2)

Figure 1 – Illustration of analysts’ forecasting behavior according to the treatments the middle of the true earnings range



Means of analysts’ forecasts measured by *devcon* for the two treatments (converge vs. diverge incentive and no feedback vs. feedback) compared to the middle of the true earnings range. The horizontal axis includes the none-feedback and feedback group respectively. The vertical axis takes numbers between 0 (the consensus estimate) and 1 (the lower point of the true earnings range) illustrating the deviation of analysts’ forecasts from the consensus estimate.

Figure 2 – Illustration of investors’ forecasting behavior according to the treatments and their matched analyst’s forecast



Means of investors’ adjustments of their matched analyst’s forecast measured by *devana* for the two treatments (converge vs. diverge incentive and no feedback vs. feedback) compared to the matched analysts forecast (0.5). The horizontal axis includes the none-feedback and feedback group respectively. The vertical axis takes numbers between 0 (the consensus estimate) and 1 (the lower point of the true earnings range) illustrating the adjustment investors make according to their matched analyst’s forecast and the consensus estimate.

APPENDIX G

DESCRIPTIVE STATISTICS FOR ALL TREATMENT GROUPS

TABLE A1							
Descriptives of participants' forecast/prediction by company, role and treatments							
<u>Company</u>	<u>Role</u>	<u>Incentive</u>	<u>Feedback</u>	<u>n</u>	<u>Mean</u>	<u>Median</u>	<u>SD</u>
ABC	Analyst	Diverge	No	17	2.30	2.30	0.05
			Yes	14	2.30	2.30	0.04
		Converge	No	17	2.30	2.30	0.06
			Yes	15	2.29	2.30	0.04
	Investor	Diverge	No	10	2.32	2.35	0.08
			Yes	11	2.35	2.35	0.05
		Converge	No	12	2.28	2.28	0.10
			Yes	15	2.36	2.35	0.19
GHJ	Analyst	Diverge	No	16	3.64	3.66	0.07
			Yes	18	3.69	3.60	0.05
		Converge	No	16	3.72	3.75	0.08
			Yes	14	3.70	3.71	0.09
	Investor	Diverge	No	10	3.68	3.68	0.06
			Yes	17	3.74	3.76	0.10
		Converge	No	10	3.75	3.77	0.13
			Yes	14	3.66	3.71	0.15
MNO	Analyst	Diverge	No	16	1.85	1.85	0.04
			Yes	16	1.83	1.83	0.05
		Converge	No	16	1.86	1.84	0.03
			Yes	17	1.84	1.85	0.04
	Investor	Diverge	No	10	1.86	1.86	0.03
			Yes	12	1.87	1.87	0.04
		Converge	No	10	1.84	1.86	0.06
			Yes	15	1.86	1.88	0.04

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