Essays on forecasting and misreporting

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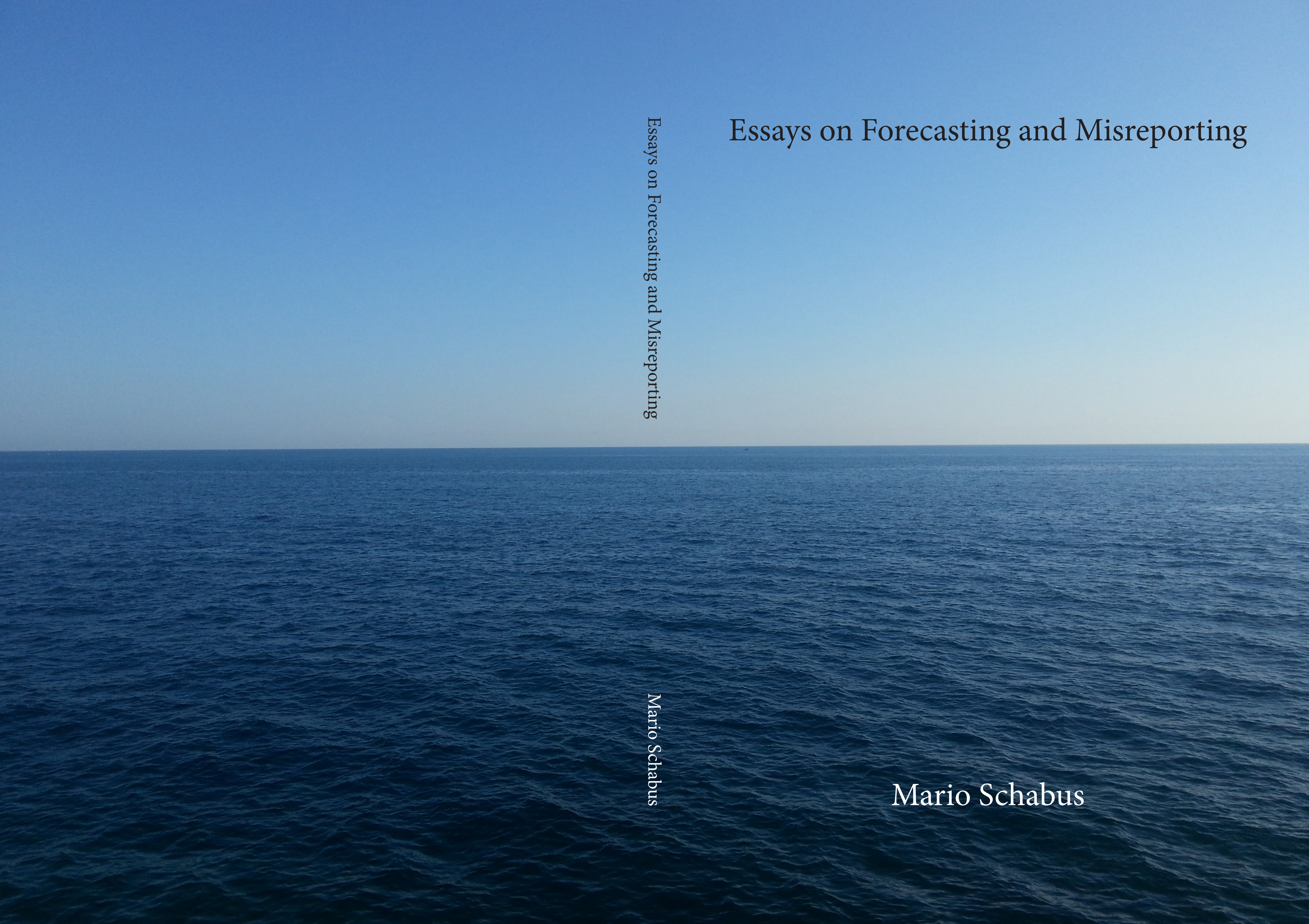

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"My best friend is the one who brings out the best in me" (Henry Ford). Let's say it takes quite a few best friends to bring out the best in myself. They make me feel comfortable with their affection, and at the same time challenge my thoughts and shed light from different angles in life. They distract me after work from lingering thoughts about research. They even tried, at times, to distract me from my persistent thoughts about working-out (unsuccessfully). They make fun of my dreary diet, but always have a second dinner ready when I underestimate my appetite. In short: They make my day, everyday. I owe so many rich experiences in Amsterdam to Alina, Camille, Daniele, Edgar, Gabriele, Kirstin, Sila, Silvia and Travers. Let's not forget the many more people who made me feel like a real Amsterdammer, and who grinded with me through mental (Tinbergen Institute) and physical (Squash City) workouts. In addition, Ann Arbor (and the gym at Ross) would never have been so much fun without my Michiganders Jason, Miranda, Prince and Tim. Go Blue!

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Co-author List

- Chapter 3, entitled *Voluntary Clawback Adoption and the Use of Financial Measures in CFO Bonus Plans* is joint work with my promotors Peter Kroos and Frank Verbeeten. This paper emerged from work I started in the first year of the Ph.D. program. Both co-authors were involved in developing the theoretical framework and positioning the paper, whereas solely I have been responsible for data collection and statistical analyses.

- Chapter 4, entitled *The Role of Internal Forecasting and Misreporting in Meeting Performance Benchmarks* is joint work with my promotors Peter Kroos and Frank Verbeeten. Similar to the work presented in chapter 3, both co-authors helped in the development of theory and contribution. In addition, they were involved in the data-collection process as we use proprietary data collected via a survey. I conducted all statistical analyses.

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Chapter 1

Introduction

This dissertation reflects my interest in research at the intersection between financial and managerial accounting. I enjoy working on topic matters from the two disciplines because I believe many issues are inherently intertwined. In the three studies that compose my dissertation, I examine topics related to managerial forecasting and misreporting. More precisely, in chapter 2, I investigate how board networks can facilitate firms' planning and forecasting, which mirrors my interest in managerial decision making, as well as corporate governance. Chapters 3 and 4 are coauthored with my supervisors Peter Kroos from the University of Amsterdam and Frank Verbeeten from Utrecht University and the VU Amsterdam. In chapter 3, we examine questions of incentive contracting and performance measurement for CFOs in lieu of potential misreporting. In chapter 4, we tied the topics of forecasting and misreporting together, by examining how firms' forecasting practices can inhibit managerial misreporting. The projects described in chapter 3 and 4 focus specifically on the role of CFOs and controllers in an organization.

Chapter 2 is single-authored and titled *Do Director Networks Help Managers Plan Better?* In this work I am interested in how directors, in their advisory role, can affect a firm's ability to plan operations. Research shows that board networks serve as a conduit for information about market developments. Well-connected directors can learn by assessing and evaluating strategy and decision making at multiple firms through the network, thus this broad-based knowledge may improve their ability to advise management. Their high-quality guidance can be useful to managers during the annual budgeting process, and help to increase the accuracy of annual predicted financials. Indeed, I find that firms with well-connected directors (as measured by boardroom centrality) provide a first annual earnings forecast that is closer to firms' realized earnings. In addition, central firms have better forecasts of sales and capital expenditures. The results are more pronounced in situations where management may benefit more from directors' advice. I hereby contribute to the literature by showing how directors' advisory responsibilities complement their monitoring role.

Chapter 3 is titled *Voluntary Clawback Adoption and the Use of Financial Measures in CFO Bonus Plans*. We examine the relation between CFO incentives and the adoption of voluntary clawback provisions. We are motivated by recent findings that CFOs have relatively muted incentives in comparison to CEOs, because they, as the main responsible employee for accounting and reporting, have the opportunity to manipulate financial reports. However, the muted incentives they receive may not stimulate their decision-making responsibility sufficiently. We find that clawback provisions allow firms to increase CFO incentives, as the adoption of clawbacks increases CFOs' misreporting costs. A particular timely aspect of this study is its implications. According to the Dodd-Frank Wall Street Reform and Consumer Protection Act of 2010 (Proposed Rule 10D-1), recoupment policies similar to the voluntary clawback policies we study will most likely become mandatory for U.S.-listed firms soon.

In chapter 4, titled *The Role of Internal Forecasting and Misreporting in Meeting Performance Benchmarks*, we explore the relation between firm's internal forecasting and misreporting. To gather information about firms' forecasting practices, we employ a survey of CFOs and controllers of Dutch corporations. We chose to conduct a survey because it allows us to gather information about internal decisions, which are not accessible to the average researcher as they are not publicly available. Prior literature emphasizes the importance of meeting external benchmarks. We build on this and examine whether the emphasis that firms put on their internal forecasts decreases the need to engage in misreporting later during the fiscal year. This hypothesis is confirmed, that is, the results indicate that firms with better internal forecasting processes engage in less (ex-post) misreporting. A particularly interesting aspect of this work is that much research has focused on management forecasts as a means to communicate with capital market participants. However, many public firms as well as large private firms primarily use forecasting initially to better plan and monitor operations.

Chapter 2, 3 and 4 tie together in several aspects. In chapter 2 and 4 management forecasts and forecasting processes are examined. The findings in chapter 2 reveal that directors, in their advisory function, can increase managers' ability to make high quality forecasts and plans, while the findings of chapter 4 show that high quality forecasting processes have effects on accounting and reporting choices. Chapter 3 and 4 are both concerned with managerial misreporting. In chapter 3, we find that the adoption of recoupment policies allows firms to increase CFO incentives without increasing their propensity to misreport. In chapter 4, instead of a moderator, we provide evidence of a specific determinant of misreporting (i.e., the quality of firms forecasting system). In chapter 3 and 4, specifically CFOs, controllers and finance directors are examined, actors who define firms' finance function and play a major role in the organisation. Finally, while we make use of microeconometric analyses throughout all studies, the studies in chapter 2 and 3 are based on public available data from U.S.-listed firms, unlike chapter 4, in which we conduct a survey on Dutch private and listed firms. Overall, because all three studies fall in the intersection of managerial and financial accounting the insights from this dissertation may be interesting to a broad audience within and outside the accounting research community.

Chapter 2

Do Director Networks Help Managers Plan Better?

2.1 Introduction

In their projections of future performance in competitive economies, managers have to assess the behavior of other firms. For example, since a firm shares the same input and product markets as its competitors, information about how competitors perceive and react to developments will also shape the firm's outlook. In this study, I assess whether greater access to information through director networks about the decision-making, strategies, and operations of other firms, helps managers to make better plans.[1] I focus on directors with large corporate networks, who are likely to have access to this information (Larcker et al., 2013).

Well-connected directors have access to decision making, strategies and operations of multiple firms, they can obtain insights into other managers' estimates of, and reactions to, external shocks, and can seek advice from highly competent and connected other directors. They are in an excellent position to learn from and about other market participants (Carpenter and Westphal, 2001,

[1] With respect to plans, I refer to one-year ahead planning that takes place in the course of firms' annual budgeting. The result is a one-year ahead prediction, which is publicly disclosed in the form of an annual management forecast. The quality of the plans is captured by the deviation between predicted and realized values.

Mizruchi, 1996). This knowledge may be used to support corporate decisions. While managers are likely to be well-informed about operations of the firm, due to limited attention, they may not always be able to absorb all relevant information about current market developments. In their advisory role, directors can provide external knowledge and help interpret information, and hence reduce managers' decision processing costs. In addition, well-connected directors can bring in outside knowledge to management via referrals, or can use numerous existing ties to establish complementary contacts to current business partnerships (Haunschild and Beckman, 1998).

I study the advisory function of directors specifically in the context of annual forecasts. High quality planning is a prerequisite for profitable investment decisions, and hence is important. For example, Goodman et al. (2013) find that higher quality management earnings forecasts are predictive of higher future investment efficiency and better mergers and acquisitions (M&A). This suggests that management earnings forecast accuracy captures a managerial ability that facilitates other corporate finance decisions. Second, directors' role in forecasting is more advisory in nature, because, on average, managers strive to forecast accurately (Lee et al., 2012, Trueman, 1986, Williams, 1996).[2] Managers can reap relatively higher personal benefits from opportunistic investments and M&As, which enhances the importance of directors' monitoring function.[3]

My initial sample contains all U.S.-listed companies covered by BoardEx, spanning the years 2002 to 2013, with management forecast data available in I/B/E/S, and non-missing data on firm fundamentals. To explore the impact of director networks, I build a yearly firm-to-firm network, where two firms are connected if, in a given year, they share at least one director. A firm's position within this network can be described in terms of its centrality: more central firms are linked via interlocking directorates to well-connected other firms. These firms have relatively more direct and indirect connections and thus have faster access to other firms in the network and hence, benefit the most from being part of the network. These firms may make better plans (i.e., under or over budget less), as reflected by the accuracy of their first annual earnings forecast.

[2] I discuss personal motivations for strategically biased forecasts in later sections.

[3] For example, managers may invest or acquire to build empires instead to maximize shareholder value [e.g., see El-Khatib et al. (2015), footnote 2].

Based on a final sample of 5,384 firm-year observations for 2002-2013, I find that an annual change in centrality is predictive of an annual change in management forecast accuracy. A one standard deviation increase in centrality enhances the accuracy of the first annual management earnings forecast by 14% (evaluated at the mean of absolute annual changes in forecast accuracy). Similarly, using firm fixed-effect analyses, I find that a one standard deviation increase in centrality relates to an 18% increase in management forecast accuracy (evaluated at the mean of forecast accuracy). I find that the positive network effect comes from reductions in both absolute positive and absolute negative management earnings forecast errors. The reduced positive forecast errors indicate that accuracy does not just capture firm performance, and that my findings are not driven by managers that strategically bias their forecast pessimistically (to increase the probability of beating their own forecast).

In an array of further tests, I establish that the relation between network centrality and the quality of a firm's forecasting is likely causal. First, I show that a firm's annual change in network centrality relates positively to its annual change in earnings forecast accuracy even if the firm's board composition does not change. Second, I continue to find a significant positive effect of annual change in network centrality if I allow neither the board composition of the focal firm nor of the interlocked firms, to change (in other words, only a firm's indirect connections change). For these subsamples, any annual change in a focal firm's centrality is likely not endogenous, and hence represents an external shock that affects its position in the board-network. Third, in placebo tests, I assess whether earnings forecast accuracy relates to future network centrality. I do not find significant results, which rules out potential reverse causality (i.e., unobserved firm-quality does not drive centrality). Finally, I examine whether a change in network centrality has an effect only on the accuracy of the subsequent earnings forecast, or whether it affects the accuracy of earnings forecasts relating to one-year/two-year ahead fiscal-years. I do not find support for the latter. This suggests that changes in network centrality have an immediate effect on firms' planning.

I then investigate the effect of director networks on non-earnings forecasts, as well as cross-sectional differences in the effect of director networks on management earnings forecast accuracy.

Both of these inquiries investigate potential mechanisms through which directors' advice may materialize in better plans. First, I show that more central firms not only have more accurate earnings forecasts, but are also better at planning their sales and capital expenditures (henceforth CapEx) (i.e., they have smaller absolute differences between forecasted and realized sales and CapEx). This suggests that networked directors provide knowledge about focal firms' customer and supplier industries. Second, I find that the positive impact of network centrality on earnings forecasts is larger when firm performance varies more with the performance of firms' industry and macroeconomy. This suggests that directors are able to bring industry and macroeconomic knowledge to the focal firm's management. Third, I find that the relation between centrality and earnings forecast accuracy varies predictably with firm and management characteristics that capture the level of difficulty to plan well. That is, network centrality affects forecast accuracy if CEOs/CFOs are relatively less experienced, and firm structure is relatively more complex (firms with high market-to-book values, more business and geographical segments, recent restructuring charges or M&As, and foreign investments). In these circumstances directors' advisory role may be more relevant.

My paper adds to existing literature in the following ways. First, I contribute to research on directors' advisory function. Directors play a role in safeguarding shareholders' assets (i.e., monitoring function), however, only recently has more attention been drawn to directors' role in productively supporting managerial decision making (i.e., advisory function) (Adams and Ferreira, 2007, Brickley and Zimmerman, 2010, Fama and Jensen, 1983, Hermalin and Weisbach, 1998, Schwartz-Ziv and Weisbach, 2013). This is somewhat puzzling, given descriptive evidence on the importance of boards' advisory role. For example, Schwartz-Ziv and Weisbach (2013) find that one-third of the issues boards discuss are of an advisory nature. Advice from directors may reduce managers' information uncertainty (Jung and Kwon, 1988), and thus positively affects firms' internal information environment (Gallemore and Labro, 2015). My results indicate that, in their advisory role, directors can facilitate managers' forecasting ability (Goodman et al., 2013). Hence, the paper adds to literature on firms' internal information environment, and more specifically on factors related to information uncertainty in firms' budgeting and forecasting processes (Cassar and Gibson, 2008, Ittner and Michels, 2016).

Second, this work extends the literature on the relevance of board networks. Recent work indicates that interlocking directorates with firms in related industries can affect management forecast accuracy (Ke et al., 2015), however considering first-degree connections provides an incomplete picture of aggregate network effects (Larcker et al., 2013). Prior literature on higher-degree connections shows that there is a positive relation between boardroom centrality and future firm performance (Horton et al., 2012, Larcker et al., 2013), but provides little insight into the specific channel underlying this relation. Third, I follow the call of Adams et al. (2010) to examine the networks of busy directors (Adams et al. (2010), p. 99). Core et al. (1999), Falato et al. (2014), Fich and Shivdasani (2006), and Perry and Peyer (2005), among others, argue that busy directors are too distracted to add value to each of their single employers. On the other hand, Fama and Jensen (1983), Ferris et al. (2003), and Field et al. (2013) suggest that multiple board assignments is a signal of quality. Whether the connections busy directors bring to the table outweigh the costs of them being active in several firms is an empirical question (Adams et al., 2010). My findings suggest that well-connected directors are not too distracted and hence positively affect firms operations.

2.2 Background and Hypothesis

2.2.1 Directors' Advisory Function and Board Networks

Functioning as advisers, directors counsel management on annual plans (Adams and Ferreira, 2007, Schwartz-Ziv and Weisbach, 2013) and work with executives on capital and resource allocation decisions (Charan et al., 2014). Indeed, during the annual planning period, executives and directors may discuss their concerns about the assumptions underlying important estimates (e.g., review assumptions about growth rates) (Brickley and Zimmerman, 2010, Sherin, 2010). For example, during the budgeting process at Johnson & Johnson, the corporate board requests updated budget projections several times a year, suggesting repeated manager-director interaction related to the budget (Simons, 2000). Useem and Zelleke (2006) report that operating budgets stimulate intense dialog and disputes between executives and outside directors. Directors have ratification duties over budgets and can withhold their approval of them, thus they play an important role in the planning process of firms (Brickley and Zimmerman, 2010).

Director networks built via their professional connections are critical for directors' effectiveness in their advisory role because they provide valuable access to knowledge (Charan et al., 2014, Coles et al., 2012). Well-connected directors are often directly involved in strategic decision-making. This provides management with timely and up-to-date information, as they learn from colleagues about practices on other boards, and observe adoptions and failures in other firms. The directors can apply this acquired knowledge or expertise in the context of their employer (Carpenter and Westphal, 2001, Useem, 1984), and communicate it to management (Li et al., 2014). Useem (1984) finds that executives and directors see board appointments as a way to scan the environment for timely and pertinent information. Specifically, one executive states: "Direct involvement in other companies' affairs replaces an awful lot of reading ... it's a hell of a tool for top management education" (pp. 209-210).

Knowledge of well-connected directors can be reflected in stock prices as indicated by recent insider trading literature. Akbas et al. (2016) find that sophisticated traders (short-sellers, institutional investors and option traders) exploit information transmitted by well-connected directors. Ahern (2016) studies illegal insider trading cases filed by the SEC and DOJ and shows that the most common occupations among people involved in illegal insider trading networks are corporate executives and directors. Berkman et al. (2016) show how effective board networks can be as an information conduit. They find that directors make above-average profitable trades in stocks of firms to which they are second-degree connected (and thus not an insider). Their trades convey information about the interlocked firms.

The labor market for directors recognizes the value of director networks. For example, Mace (1986) describes the contacts that board members bring to management as a main contribution for their advisory role. Following an appointment of a new director, a press release by Eli Lilly notes: "A successful business leader with experience on four continents, Sir Win Bischoff brings to our board his extensive global perspective, network and financial skills... Win will be an invaluable asset in helping us achieve global leadership."[4] Cashman et al. (2013) describe directors' networks as social capital, and find that directors' connections mitigate the negative labor market consequences of being affiliated with a firm that had to restate its financials.

Direct interlocking directorates provide a parsimonious indicator of interfirm network ties (Mizruchi, 1996). Network centrality extends this to indirect interlocking directorates (Borgatti, 2005, Jackson et al., 2008). A very central firm typically shares directors with several other firms, which are in turn, well-connected to other (well-connected) firms, while a less central firm has fewer connections. However, a firm has only limited control over its position in the network because its position depends on connections of other firms in the network.

Accounting and corporate finance literature argues that networks can be performance enhancing, especially for firms in adverse circumstances. Larcker et al. (2013) show that high growth firms that are more central have higher future returns, and Carney and Child (2015) find that central firms outperform less central firms during economic crises. However, there is little systematic evidence about the underlying mechanism. Fracassi (2016) finds that the most central firms make similar investment decisions, which can be interpreted as herd-behavior or higher investment efficiency of central firms. Omer et al. (2016) show central firms have fewer accounting restatements. I add by examining the effect of networked directors on managers' ability to plan/forecast.

2.2.2 Quality of Firms' Planning and Forecasting

The difference between forecasted and actual earnings is a measure of management forecast quality. The quality of firms' first annual forecast hinges on the quality of the planning during the annual budgeting cycle. Planning includes numerous actions during the budgeting process, spanning forecasts of sales, determining production capacity, R&D and labor expenses, as well as deciding

[4] "Lilly looks for added global perspective with board additions", Associated Business Wires, June 26, 2000.

upon investments and the financing of these investments. The aggregate effect of all these actions is reflected in planned profits. While individual actions are heterogeneous across firms, the difference between planned and actual profits homogeneously reflects the quality of firms' planning activities. As noted by Feng et al. (2009), sound planning is a prerequisite for high-quality forecasts, even if strategic considerations can influence whether real or distorted predictions are disclosed to capital markets.[5]

Prior work on managements' ability to produce high-quality forecasts examined the importance of firms' information environment. Goodman et al. (2013) argue that information about internal operations, such as cost structure, capacity constraints, margins, and personnel developments, is pivotal to forecasting accurately. This is corroborated by Feng et al. (2009), who find that firms with material weaknesses in their internal controls have higher forecast errors. The presence of budgets and internal reports per-se can facilitate planning for smaller firms (Cassar and Gibson, 2008). Ittner and Michels (2016) find that firms that employ more sophisticated risk-based forecasting have lower forecast errors, which indicates that taking environmental uncertainties into account facilitates planning. Uncertainty concerning events external to firms' information environment seems to be critical for planning. Chen et al. (2011) document that more than 25% of the managers cite "forecast predictability/uncertainty" as a factor changing guidance policies. I argue that this uncertainty may be reduced by well-connected directors.

2.2.3 Hypothesis Development

Planning can be facilitated through early identification of, and experiencing multiple firms' considerations about, industry developments in own and related industries, macroeconomic shocks, or technological innovations and applications. Knowledge about other market participants can alter

[5] The following strategic considerations stand out. First, management may communicate bad news to depress prices around stock option award periods (Aboody and Kasznik, 2000), or to benefit from insider trading (Rogers and Stocken, 2005). Second, firms may issue downward-biased forecasts to walk-down market expectations and increase the probability to beat their own forecast (Cotter et al., 2006, Matsumoto, 2002). These motives can only influence my inferences as far as they are correlated with network centrality. Importantly, an inverse relation of the positive forecast error with network centrality can not be explained by strategic considerations.

firms' actions. In particular, links to similar firms may be useful (Haunschild and Beckman, 1998), although firms operating in the same industry are in many cases prohibited from sharing directors [under Section 8 of the Clayton Antitrust Act of 1984 (LLP, 2010, Ropes and Gray, 2011)].[6] Nevertheless, second-degree (that is, indirect) within-industry linkages, as captured by network centrality, are not prohibited and may provide a competitive edge over less connected competitors.[7]

Firms can also benefit from interlocks with firms in related industries (i.e., customer or supplier industries)(Dass et al., 2014, Ke et al., 2015). The accuracy of a sales budget hinges on nuances about expected growth in target industries. This is important because the remaining budgeting process hinges on expected sales. Production plans can be refined and capacity updated, if supplier bottlenecks are identified early. Providing corroborating evidence, Ke et al. (2015) find that firms sharing a director with firms in related industries have smaller forecast errors. Having multiple direct and indirect connections to firms in related industries may increase the reliability of information and accuracy of estimates.

Relationships with firms in industries that are (at a first glance) unrelated can be advantageous. First, large listed firms are often conglomerates that operate offshore or earn revenues from operating in various industries. They may have interlocking directorates with firms operating in the same geographical areas. Alternatively, single divisions of conglomerates may operate in the same industry as an interlocked firm. In this case, Section 8 of the Clayton Act may not apply, because revenues or profits may not exceed the legally binding threshold.[8] Second, firms can learn from other firms' adoption of particular practices and by adaption of their decision-making processes, which can be applied to multiple domains (e.g., in multiple industries) (Westphal et al., 2001).[9] Third, directors are keenly aware of their economic environment (Davis, 1991), so they may be more

[6] For example, in 2009 FTC investigations lead to the resignations of Google Executive Chairman of the Board Eric Schmidt from the board of Apple and of former Genentech CEO Levinson from the board of Apple and Google.

[7] If firm A has an interlock with a supplier who is further interlocked with firm B, another customer that happens to compete in the same industry as firm A, A and B are second-degree connections.

[8] Two firms that have interlocked directorates, but competitive sales of under 3 million or undivided profits of under 30 million are exempted from this regulation (LLP, 2010, Ropes and Gray, 2011).

[9] Westphal et al. (2001) refer to this as second-order imitation. Contagion studies usually identify the spillover of a specific practice [e.g., related to accounting and disclosure practices and board interlocks see Cai et al. (2014), Chiu et al. (2012), and Reppenhagen (2010)], which is more likely first-order imitation.

likely than executives to recognize macroeconomic developments. This is relevant, since managers may decide to change forecast attributes in difficult-to-predict environments (Kim et al., 2016), and may have higher forecast errors than analysts (Hutton et al., 2012). While macroeconomic analysts typically employ sophisticated analyses, directors observe other firms' reactions to trends, providing them with informed insights that outside analysts do not have. Given all these advantages of director networks, I expect a positive relation between boardroom centrality and the quality of firms' planning, which motivates the following hypothesis:

H1: Boardroom centrality positively affects the accuracy of management forecasts.

However, this may as well not be the case. First, firms that are more central in a board network likely have more "distracted" directors. Research has indicated that this can lead to lower firm value and firm performance, potentially because directors have to focus on multiple assignments at the same time (Core et al., 1999, Falato et al., 2014, Perry and Peyer, 2005). Dedicating less attention to issues of a particular firm also inhibits the dissemination of valuable information, so network centrality may have little predictive power. Second, if directors concentrate their effort on high-level strategic tasks (Hermalin and Weisbach, 1998), they may only marginally participate in firms' decisions around annual budgets and plans.

2.3 Methodology

2.3.1 Sample Composition

My starting sample contains all U.S.-listed firms in the BoardEx database for the years 2002 to 2013, including all S&P 1500 firms for each year.[10] Limiting the sample to the years after 2000 has several advantages. First, there are selection issues with both BoardEx data (Engelberg et al., 2013, Fracassi and Tate, 2012) and I/B/E/S earnings guidance data (Chuk et al., 2013) in earlier time

[10] I thank Joseph Engelberg for providing the algorithm to match BoardEx data to Compustat, and as discussed in Engelberg et al. (2013). For the firm-years after their sample period, I create a matching algorithm based on CUSIP, company name, and ISIN.

periods. Second, I abstract from the impact of Regulation FD, which results in a more homogeneous institutional environment (Hutton et al., 2012).

I obtain data on annual management earnings forecasts from I/B/E/S. I focus only on annual forecasts, since quarterly reports do not have mandatory audits and hence are less reliable (Goodman et al., 2013). I delete all forecasts made more than one year in advance (at t-1) (Gong et al., 2009), made in the fourth quarter of year t, or after the end of the fiscal year t (Ajinkya et al., 2005).[11] I also drop all observations with missing data on earnings realizations and forecasts that are neither point nor range estimates. For range estimates, I assume that the midpoint of the range represents management expectations. I conduct my analysis on the first annual earnings forecast made after the prior year's fiscal year-end date and delete all subsequent annual forecasts in the same year because, compared to subsequent forecast revisions, this forecast is more likely to be the direct result of the annual planning and budgeting process.

I merge management forecast data with director data from BoardEx, and firm-level data from Compustat, I/B/E/S and Audit Analytics. I delete all duplicate firm-year observations. Requiring non-missing values for all variables used in the main analysis results in 7,523 unique firm-year observations. However, as I test my hypothesis with an annual change specification, data requirements reduce the final sample size to 5,384 observations.[12] To reduce the impact of outliers I winsorize all continuous variables at the 1st and 99th percentile.

2.3.2 Construction and Description of the Board Network

To calculate firm network centrality per firm-year, I first collect data on all director and executive positions reported in the Board-Ex database as of the end of 2013. To minimize the impact of self-reporting bias, I restrict the sample to listed firms in the U.S. I build a network of firms for each

[11] I do not delete management forecasts bundled with earnings announcements, as this would result in an unnecessary loss of observations. Following the guidance in Rogers and Van Buskirk (2013), I do not believe that this causes measurement problems or biases.

[12] The sample size deviates for other tests that require additional or less data. For the first stage test (probability of issuing a management forecast) the sample size is 19,889 because for this test firms without forecast are not excluded. The sample sizes in additional and robustness analyses vary according to the respective data requirements.

calendar year from 2002 to 2013. I define two firms as being connected in a given year if they share at least one executive or director at the beginning of the year, and being unconnected otherwise.[13] That results in an unweighted, symmetric, binary matrix (see example network in Appendix A for details of the network calculation).[14] I remove all isolated nodes, that is, firms that do not share any director with any other firm and are thus not part of the network.

Because I am interested in whether better connected directors cause managers to plan better, the sequence of events during (a representative) firms' annual budgeting cycle is important. Assume an annual budget preparation process for year t_1 of a sample firm whose fiscal and calendar year are aligned. This firm starts its planning during the middle of the prior year, that is, it initiates information collection as input for the budget in the third quarter of t_0 and finishes the budget at the beginning of the fiscal year t_1.[15] As result of the annual budget planning process, firms form expectations for t_1, which they may disclose in form of guidance. If they do so, at the end of t_1 one can determine the accuracy of this first annual earnings forecast, by estimating the difference between the predicted earnings and the realized earnings. The annual change in forecast accuracy is the difference between accuracy at t_1 and accuracy at t_0. I next define a network in which two firms are connected at year t_1 if they share a single director at the beginning of year t_1. That is, the director must have started to work at a given board at year t_0, or earlier. Director turnover can occur at any point in time during the year because it may be triggered by unexpected events or by director elections. However, director elections are the more frequent reason for turnover and they usually relate to firms annual meeting (Coles et al., 2014). Newly elected directors start their terms immediately, at the very next board meeting, or shortly afterwards, depending on the approval

[13] Note that I do not restrict the definition of connections to professional directors (i.e., directors that do not hold any position as executives). In untabulated analyses, I find that even after controlling for executive-interlocks (i.e., executives that serve as directors at other firms) the magnitude and significance of the effect of network centrality barely changes.

[14] In this parsimonious approach I ignore the presence of multiple directors forming an interlock between two firms. This choice is because no further assumptions about the network are necessary. In untabulated results I construct networks weighted by the amount of shared directors, and impose the restriction that director interlocks have to be in place for at least three years. Similar to findings of El-Khatib et al. (2015), results are consistent.

[15] This is in line with the standard practice of North American corporations surveyed by Libby and Lindsay (2010). Even though many firms supplement their annual budget with further planning (e.g., rolling forecasts) and update and re-calibrate their plans during the year, the annual budget serves as a benchmark for operational planning (Hansen and Van der Stede, 2004, Sivabalan et al., 2009).

process for new directors. This way an incoming director in t_0 technically has the opportunity to affect the annual planning process for t_1.[16]

I report descriptive statistics of the network in Table 2.1. A network component is defined as an entirely connected part of a network, that is, within each component, every node (here firm) can reach every other node. I target firms in the largest component because this allows comparison of network centrality of all firms. However, this constraint should not affect inferences as the percentage of firms in the largest component is around 90% of all non-isolated firms, while less than 1% of all firms belong to the second largest component. The largest component has on average a mean (median) degree of 5.2 (4). Reaching any firm along the shortest path in the network requires, passing around four to five nodes. Network statistics are similar to those of Larcker et al. (2013), which serves as validation for the network data.

2.3.3 Network Centrality

As outlined in more detail in Appendix A, the concept of network centrality is multidimensional in that each of the network measures employed, Degree, Eigenvector, and Closeness capture different aspects of access to information and resources (Freeman, 1979, Jackson et al., 2008).[17] [18] Degree (DEGREE) proxies for the number of direct connections. It is used to estimate the channels through which the network can be accessed and is equivalent to the number of board interlocks. Although widely used and advantageous due to its parsimony, its main drawback is that it only captures focal

[16] In employing network centrality measures, I assume that higher-degree connections can have relevance. Here, besides focal firms' directors, directors of interlocked firms (first-degree connections), and (at least) second-degree connections should matter for corporate planning. Interaction between linked firms in a network is naturally difficult to observe for the researcher; however, board-meetings are unarguably observable and interactive events (Larcker et al., 2013, Schwartz-Ziv and Weisbach, 2013). A typical board of a U.S.-listed firm meets seven or eight times a year (Falato et al., 2014, Karamanou and Vafeas, 2005) and meetings are distributed evenly throughout the year (Kim, 2016). This suggests that board meetings may provide a mechanism for the effects of director changes in a higher-degree connected firm.

[17] A fourth centrality measure frequently used in social network literature is Betweenness, which measures how often a firm falls on the shortest path between other pairs of nodes in the network. I do not include this measure based on conceptual grounds: According to social network theory, Betweenness captures focal firms' ability to withhold or distort information transmission between two other nodes (Freeman, 1979), but does not relate to focal firms' ability and speed to access information and resources in the network.

[18] See A.1 for an example Network.

Table 2.1: Description of the board network

Network by fiscal year	2002	2003	2004	2005	2006	2007
Number of unique directors	7,465	7,512	7,718	7,884	7,882	7,515
Number of non-isolated firms	5,978	5,912	5,886	5,863	5,754	5,455
Number of firms in largest component	5,450	5,357	5,351	5,394	5,253	4,907
Percentage of firms in largest component	91.1%	90.6%	90.9%	92.0%	91.2%	89.9%
Number of links	15,579	14,850	14,834	15,046	14,493	13,160
Largest component characteristics:						
Average Degree	5.71	5.54	5.54	5.57	5.51	5.36
Median Degree	4	4	4	4	4	4
Average path length	5.48	5.51	5.50	5.47	5.50	5.50
Network by fiscal year	2008	2009	2010	2011	2012	2013
Number of unique directors	7,403	7,198	6,876	6,734	6,704	7,432
Number of non-isolated firms	5,342	5,106	4,843	4,748	4,670	4,879
Number of firms in largest component	4,818	4,575	4,349	4,226	4,142	4,428
Percentage of firms in largest component	90.1%	89.6%	89.7%	89.8%	88.5%	90.4%
Number of links	12,624	11,904	11,178	10,822	10,613	12,089
Largest component characteristics:						
Average Degree	5.24	5.20	5.14	5.12	5.12	5.46
Median Degree	4	4	4	4	4	4
Average path length	5.56	5.50	5.52	5.52	5.58	5.33

Table 2.1 reports basic network characteristics of firm-to-firm networks for the years 2002 to 2013, where two firms are connected if they share at least one director in a given year. The sample described in Table 2.1 contains all U.S.-listed firms available in the BoardEx database (S&P 1500+), before requiring non-missing data on other variables used in this study. The largest component comprises the sample used for the analysis in this paper. Therefore, the final sample is a subset of all firm-years that belong to the largest component for which data on other required variables are available. A component is defined as the structure in which every node can reach any other in the component. In Appendix A, I provide an example network and discuss further network characteristics.

firms' directors' connections. Eigenvector (EIGENVECTOR) builds on Degree but takes n-degree connections into account. It counts the number of firms' direct connections and (discounts) the number of indirect connections. The idea is to capture increasing access to the network with not only more, but also better connections. Finally, centrality may be represented by firms' Closeness (CLOSENESS). This measure is defined as the inverse of the number of other firms that have to be passed to reach any other firm in the network, and measures how fast a firm can access information and resources.

Even though these dimensions of network centrality are to some extent distinct, it is ex-ante unclear which of the three measures influences firms' planning and forecasting. To address this lack of clarity, for each firm year, I conduct a factor analysis with DEGREE, EIGENVECTOR and CLOSENESS as input factors and define the factor with the largest eigenvalue (denoted as CENTRALITY) as the main independent variable of interest.[19] The annual Eigenvalue of this first factor ranges from 2.24 to 2.50 (and is in every year clearly the only factor with an Eigenvalue greater than 1). The average factor-loadings of DEGREE, CLOSENESS and EIGENVECTOR are all greater than 0.8 in each year. Due to these relatively high correlations, it is intuitive to use the largest factor during the main analysis. Subsequently, I build an annual change variable of the Eigenvalue-variable.

2.3.4 Measuring Management Earnings Forecast Accuracy

I proxy for annual planning and forecasting quality with annual earnings forecast accuracy (MFC_ACC). The accuracy of firms' externally reported forecasts serve as signal of managers' ability to plan corporate operations and anticipate future events (Goodman et al., 2013, Lee et al., 2012, Trueman, 1986), and broadly speaking, reflect firms' internal information environment (Gallemore and Labro, 2015). Following Feng et al. (2009), I calculate earnings forecast accuracy by taking the absolute difference between realized earnings per share and the first annual earnings per share estimate, scaled by assets per share. I multiply by minus one so that higher values of

[19] See El-Khatib et al. (2015), Larcker et al. (2013) and Omer et al. (2016) for similar approaches.

accuracy correspond to higher values of director connectedness. Following Hutton et al. (2012), I use firms' first disclosed annual earning forecast in each fiscal year. This should depict, as close as possible, the result of firms' annual budgeting process. I dedicate Section 2.4.6 to alternative measurement approaches.

2.3.5 Empirical Model and Control Variables

When measuring the characteristics of management forecasts, one has to be careful as firms self select into issuing a forecast. To the extent that one cannot control for drivers of this decision, conclusions drawn from later tests may be incorrect. To control for self-selection into issuing a forecast, I use the Heckman approach and calculate the inverse Mills ratio, to include it subsequently in my hypothesis test (Heckman, 1979). Following prior literature, I use as an instrument the number of analysts following a firm during the 30 days before the release of the earnings forecast. Ajinkya et al. (2005) and Feng et al. (2009), among others, find that this is associated with the decision to forecast, but not with forecast accuracy.[20] I employ a probit model regressing an indicator that equals one if a firm issues a forecast in a given year on the number of analysts following, the vector of controls used in the main model (as explained below), as well as network centrality. I construct the inverse Mills ratio (IMR) by dividing the probability density function by the cumulative distribution, and use ΔIMR as a covariate to test my main hypothesis.

I employ diagnostic tests following Larcker and Rusticus (2010) and Lennox et al. (2011) to confirm the validity of the Heckman approach. First, my instrument is bivariately correlated with the propensity to forecast but not with the dependent variable of interest in the main model ($p>0.1$). Second, the coefficient for the instrument is significantly positively related to the propensity to forecast (coefficient=0.0062, $p<0.01$) and has a partial pseudo R-squared of 2.10% (as compared

[20] As explained in Section 2.3.1, the sample I use to calculate the probability to forecast includes 19,889 observations. 67% of all firm years release an annual earnings forecast. The mean (median) number of analysts following is 9.07 (7) and has a standard deviation of 6.23.

to a total pseudo R-squared of 15.60%), suggesting that it has considerable relevance.[21] Third, including the IMR in the main model does not induce multicollinearity as indicated by variance inflation factors for the IMR of less than 10 in all analyses (Feng et al., 2009).

To test my main hypothesis, I use a first-differences specification to account for the proposed timing of events. The vector of controls used contains determinants of management forecast accuracy related to firm structure and board structure variables, as well as the IMR, Fama-French 17 industry indicators (δ_j), and year indicators (γ_t). Unless specified otherwise, this vector of controls is consistently applied throughout all regressions. I test my hypothesis using the following OLS estimation with robust standard errors, where all time variant variables are measured in annual changes:

$$\begin{aligned}\Delta MFC\_ACC_{it} = {} & \alpha_0 + \alpha_1 \Delta CENTRALITY_{it} + \alpha_2 \Delta AN\_FC\_DISP_{it} + \alpha_3 \Delta MFC\_TIME_{it} \\ & + \alpha_4 FIRM\_AGE_{it} + \alpha_5 \Delta R\&D_{it} + \alpha_6 \Delta SIZE_{it} + \alpha_7 \Delta MTB_{it} \\ & + \alpha_8 \Delta REL\_IND\_DIR_{it} + \alpha_9 \Delta SALES\_VOL_{it} + \alpha_{10} \Delta EARN\_VOL_{it} \\ & + \alpha_{11} \Delta LEVERAGE_{it} + \alpha_{12} LITIGATION_i + \alpha_{13} \Delta BOARD\_SIZE_{it} \\ & + \alpha_{14} \Delta BUSY\_DIR_{it} + \alpha_{15} \Delta PER\_OUT\_DIR_{it} + \alpha_{16} \Delta DISAG_{it} \\ & + \alpha_{17} \Delta ICMWD_{it} + \alpha_{18} \Delta ERROR_{it} + \alpha_{19} \Delta ROA_{it} + \alpha_{20} \Delta IMR_{it} \\ & + \gamma_t + \delta_j + \epsilon_{it}\end{aligned} \tag{2.1}$$

Variable definitions are in Appendix B. Based on my hypothesis, I expect network centrality (ΔCENTRALITY) to be positively related to management forecast accuracy (ΔMFC_ACC). To establish that network centrality has an effect over and above commonly-used board structure variables, I control for board size (ΔBOARD_SIZE), director business (ΔBUSY_DIR), percentage of outside directors (ΔPER_OUT_DIR), and interlocking directorates in related industries (ΔREL_IND_DIR)[22] (Ajinkya et al., 2005, Karamanou and Vafeas, 2005, Ke et al., 2015). I con-

[21] I find that network centrality is positively related to the probability of observing a management forecast (coefficient=0.16, p<0.01). I do not hypothesize whether network centrality relates to management's decision to issue forecasts because the decision to issue a forecast is, as opposed to forecast accuracy, clearly firm's choice.

[22] To calculate connections to firms in related industries, I collect data from the Input-Output table provided online by the Bureau of Economic Analysis, and follow closely the procedure explained in detail in Dass et al. (2014), p. 1544.

trol for firms' information environment in various ways. First, accurate forecasting is harder in volatile environments and for growth firms, so I control for sales volatility (ΔSALES_VOL), earnings volatility (ΔEARN_VOL), analyst forecast dispersion (ΔAN_FC_DISP), and growth (ΔMTB) (Waymire, 1984). Second, other aspects of firms' internal information environment can influence forecasting, which I proxy for with an indicator variable for internal control material weaknesses (ICMWD), an indicator variable for accounting restatements due to errors (ERROR), and R&D expenses (ΔR&D) (Feng et al., 2009). Forecasts released earlier during the fiscal year are likely to be less accurate than those released later (ΔMFC_TIME).

The financial condition of a firm may affect forecast accuracy, therefore I control for accounting performance and leverage (ΔROA, ΔLEVERAGE) (Miller, 2002). I expect managers to provide more accurate management forecasts in highly litigious industries (LITIGATION) (Rogers and Stocken, 2005). Supplementary information may be an important remedy to increase market confidence after inaccurate forecasts (ΔDISAG) (Lansford et al., 2013). I add the firm structure variables size (ΔSIZE) and firm age (FIRM_AGE), because larger firms may have more resources to invest in forecasting and older firms may have more experience (Lang and Lundholm, 1996).

2.4 Results

2.4.1 Descriptive Statistics

I report univariate statistics for all variables used in the model for testing my main hypothesis in Table 2.2.[23] In Table 2.3, I present the Pearson correlations for variables more likely to be related to management forecast accuracy and network centrality. Some firm characteristics are significantly correlated with network centrality. For example, more central firms tend to be larger, have higher sales volatility and higher analyst forecast dispersion, they have less debt, and tend to be older than less central firms. More central firms have larger boards, busier directors, and are more likely to

[23] I report the levels of all variables even if annual changes are used to test the hypothesis as they might be more comparable to other studies than changes.

have an interlock with a firm operating in a related industry. The correlation between the annual change in network centrality and annual changes in other independent variables does not seem to be a major concern as untabulated bivariate correlations show that annual changes in network centrality is not highly correlated with any of the annual changes in other independent variables (Pearson correlation coefficients are all smaller than 0.15).[24] Importantly, bivariate results indicate that central firms tend to have significantly more accurate forecasts.

[24] The exception is annual changes in board size and director busyness, which is correlated to changes in network centrality by construction. Excluding the board-structure variables from the set of controls does not affect my inferences (see Table 2.4).

Table 2.2: Summary statistics of variables included in the main analysis

Variable	N	Mean	Std. Dev.	P10	P25	Median	P75	P90
MFC_ACC	5,384	-0.012	0.028	-0.024	-0.011	-0.004	-0.002	-0.001
ΔMFC_ACC	5,384	-0.002	0.018	-0.013	-0.004	0	0.003	0.011
CENTRALITY	5,384	0.634	1.088	-0.533	-0.144	0.428	1.143	2.061
ΔCENTRALITY	5,384	0.015	0.327	-0.37	-0.141	0.004	0.175	0.404
ΔDEGREE	5,384	0.010	0.397	-0.377	-0.188	0	0.188	0.377
ΔCLOSENESS	5,384	0.028	0.36	-0.30	-0.11	0.017	0.162	0.364
ΔEIGENVECTOR	5,384	-0.052	0.38	-0.359	-0.104	-0.006	0.039	0.188
AN_FC_DISP	5,384	0.075	0.151	0.01	0.02	0.04	0.08	0.14
BOARD_SIZE	5,384	11.68	5.09	7	8	10	13	18
BUSY_DIR	5,384	1.81	0.396	1.33	1.5	1.77	2.05	2.33
DISAG	5,384	1.95	1.04	1	1	2	2	3
EARN_VOL	5,384	58.5	107.4	3.67	7.65	20.6	56.7	146.4
ERROR	5,384	0.146	0.353	0	0	0	0	1
FIRM_AGE	5,384	20.66	2.95	16	21	22	22	23
ICMWD	5,384	0.135	0.342	0	0	0	0	1
IMR	5,384	0.38	0.23	0.12	0.19	0.33	0.52	0.70
LEVERAGE	5,384	0.255	0.212	0	0.095	0.238	0.366	0.502
LITIGATION_D_FPS	5,384	0.27	0.44	0	0	0	1	1
MFC_TIME	5,384	246	32	233	241	249	256	288
MTB	5,384	1.78	1.38	0.593	0.893	1.44	2.19	3.34
PER_OUT_DIR	5,384	0.65	0.15	0.44	0.55	0.66	0.77	0.85
REL_IND_DIR	5,384	0.78	0.41	0	1	1	1	1
R&D	5,384	0.029	0.056	0	0	0	0.035	0.09
ROA	5,384	0.69	1.33	0.007	0.06	0.223	0.78	1.88
SALES_VOL	5,384	224	395	13	28	78	229	557
SIZE	5,384	7.58	1.52	5.66	6.53	7.54	8.63	9.57

Table 2.2 reports descriptive statistics of the variables used in the main analyses. The main sample consists of all U.S.-listed firms available in BoardEx from 2002 to 2013 with management forecast data available in I/B/E/S, and data for control variables in Compustat, I/B/E/S and Audit Analytics, which are part of the largest component of the board network. The sample to test the main model comprises 5,384 observations. Variable definitions are reported in Appendix B.

Table 2.3: Pearson correlations of selected variables used in the main analysis, based on the main sample, which comprises all U.S.-listed firms available in BoardEx from 2002 to 2013 with non-missing data on management forecasts and control variables, which are part of the largest component of the board network. Variable definitions are reported in Appendix B.

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
(1) MFC_ACC	1.00												
(2) ΔMFC_ACC	0.65	1.00											
	(0.00)												
(3) CENTRALITY	0.12	0.05	1.00										
	(0.00)	(0.00)											
(4) ΔCENTRALITY	0.01	0.03	0.12	1.00									
	(0.35)	(0.02)	(0.00)										
(5) AN_FC_DISP	-0.45	-0.13	0.04	0.01	1.00								
	(0.00)	(0.00)	(0.01)	(0.37)									
(6) BOARD_SIZE	0.14	0.05	0.77	0.04	0.04	1.00							
	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)								
(7) BUSY_DIR	0.05	0.02	0.63	0.13	0.01	0.20	1.00						
	(0.00)	(0.07)	(0.00)	(0.00)	(0.35)	(0.00)							
(8) FIRM_AGE	0.11	0.02	0.21	-0.04	0.01	0.26	0.08	1.00					

Continued on next page...

... table 2.3 continued

	(0.00)	(0.23)	(0.00)	(0.01)	(0.38)	(0.00)	(0.00)						
(9) LEVERAGE	0.08	0.04	0.09	-0.01	0.10	0.10	0.08	0.03	1.00				
	(0.00)	(0.00)	(0.00)	(0.68)	(0.00)	(0.00)	(0.00)	(0.04)					
(10) MTB	0.01	0.05	-0.00	0.06	-0.10	-0.03	-0.02	-0.14	-0.01	1.00			
	(0.66)	(0.00)	(0.96)	(0.00)	(0.00)	(0.05)	(0.15)	(0.00)	(0.53)				
(11) REL_IND_DIR	-0.02	-0.01	0.16	0.01	0.03	0.12	0.15	0.07	-0.02	-0.02	1.00		
	(0.08)	(0.40)	(0.00)	(0.35)	(0.02)	(0.00)	(0.00)	(0.00)	(0.07)	(0.08)			
(12) SALES_VOL	0.08	0.02	0.50	-0.02	0.07	0.58	0.14	0.17	0.06	-0.12	0.06	1.00	
	(0.00)	(0.23)	(0.00)	(0.24)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)		
(13) SIZE	0.20	0.05	0.64	-0.02	0.10	0.69	0.26	0.32	0.20	-0.191	0.06	0.68	1.00
	(0.00)	(0.00)	(0.00)	(0.11)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	

2.4.2 The Effect of Network Centrality on Management Earnings Forecast Accuracy

The Results in Table 2.4 indicate that network centrality is consistently positively related to management forecast accuracy. Column (1) provides the results of the main model outlined in Section 2.3.5. ΔCENTRALITY is positive and significant (coefficient=0.37, $p < 0.01$), indicating that firms with better-connected directors have more accurate plans/forecasts. Coefficients are multiplied by 100 for presentation. The economic significance is non-negligible: A one standard deviation change in ΔCENTRALITY changes ΔMFC_ACC (evaluated at the mean of the absolute annual change in management forecast accuracy) by 14%.[25] Most of the control variables relate to forecast accuracy as expected. To confirm the robustness of the documented economic effect of centrality, I rerun model 1 as a level-specification (that is, all variables previously measured in annual changes are measured in levels), and in addition to all controls used in model 1, I control for firm fixed-effects (untabulated). The results indicate similar economic significance as documented in the annual changes regression. More specifically, a one standard deviation increase in centrality increases forecast accuracy by 18%.[26]

Next, I re-estimate model 1, and results in columns (2) and (3) suggest that findings are robust to excluding the IMR, or board variables, respectively. As pointed out by Lennox et al. (2011), a Heckman selection model that is not correctly applied may induce multicollinearity and produces biased coefficients. Multicollinearity concerns may also arise due to correlation between various board variables.[27] The results reported in Table 2.4, columns (2) and (3) suggest that the effect

[25] The mean absolute value of ΔMFC_ACC is 0.0088 and one standard deviation of ΔCENTRALITY is 0.327. The magnitude is the result of the following calculation: ((0.37/100)*0.327)/0.0088=0.137. I evaluate results at the *absolute value* of ΔMFC_ACC, because the mean of ΔMFC_ACC is very close to zero, which makes it difficult to interpret its economic significance.

[26] The mean absolute value of MFC_ACC is -0.012, the coefficient for CENTRALITY is 0.002 [p-value=0.027], and a one standard deviation of CENTRALITY is 1.088. The magnitude documented is the result of the following calculation: (0.002*1.088)/0.012=0.181.

[27] Untabulated results show that the average variance inflation factor (VIF) of the main model is 2.17 and no VIF for one variable is greater than 10, hence lower than the commonly applied critical value for multicollinearity (Feng et al., 2009).

of network centrality is significantly positive, but of slightly smaller magnitude than reported in column (1).

Table 2.4: Annual changes in management forecast accuracy as a function of annual changes in centrality and annual changes in controls

DV = ΔMFC_ACC	Predicted sign	(1)	(2)	(3)	(4)	(5)	(6)
ΔCENTRALITY	+	0.37***	0.21**	0.25***			
		(0.006)	(0.034)	(0.000)			
ΔDEGREE	+				0.13*		
					(0.051)		
ΔEIGENVECTOR	+					0.08*	
						(0.09)	
ΔCLOSENESS	+						0.27***
							(0.00)
ΔBOARD_SIZE		-0.01	0.00				
		(0.67)	(0.94)				
ΔBUSY_DIR		-0.29	-0.13				
		(0.25)	(0.60)				
ΔPER_OUT_DIR		-0.61	-1.26**				
		(0.33)	(0.013)				
ΔIMR		2.43		2.64**	2.16*	2.06	2.83**
		(0.11)		(0.04)	(0.08)	(0.11)	(0.03)
ΔREL_IND_DIR		0.18*	0.16	0.16	0.16	0.18*	0.16
		(0.09)	(0.12)	(0.12)	(0.12)	(0.09)	(0.14)
ΔAN_FC_DISP		-1.87**	-1.28**	-1.91**	-1.79**	-1.77**	-1.95**
		(0.02)	(0.05)	(0.02)	(0.02)	(0.03)	(0.01)
ΔDISAG		-0.07*	-0.08**	-0.06*	-0.06*	-0.07*	-0.06*
		(0.09)	(0.05)	(0.09)	(0.09)	(0.09)	(0.09)
ΔEARN_VOL		-0.00	-0.00	-0.00	-0.00	-0.00	-0.00
		(0.13)	(0.13)	(0.12)	(0.14)	(0.16)	(0.13)
ΔERROR		-0.08	-0.08	-0.08	-0.08	-0.08	-0.08
		(0.37)	(0.33)	(0.35)	(0.34)	(0.36)	(0.35)
FIRM_AGE		0.02*	0.02**	0.02*	0.02*	0.02*	0.02*
		(0.07)	(0.04)	(0.07)	(0.07)	(0.07)	(0.07)
ΔICMWD		-0.14*	-0.15*	-0.14*	-0.14*	-0.14*	-0.14*
		(0.08)	(0.06)	(0.08)	(0.08)	(0.08)	(0.07)
ΔLEVERAGE		0.63***	0.52**	0.62***	0.60***	0.60***	0.63***
		(0.00)	(0.01)	(0.00)	(0.00)	(0.00)	(0.00)

LITIGATION	0.08	0.07	0.08	0.08	0.08	0.08
	(0.26)	(0.35)	(0.26)	(0.27)	(0.27)	(0.25)
ΔMFC_TIME	-0.01***	-0.00***	-0.01***	-0.01***	-0.01***	-0.01***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
ΔMTB	0.18***	0.15***	0.18***	0.18***	0.18***	0.18***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
ΔR&D	-2.53*	-1.80	-2.61*	-2.48*	-2.42*	-2.70**
	(0.06)	(0.14)	(0.05)	(0.06)	(0.07)	(0.04)
ΔROA	0.04*	0.00	0.05**	0.04*	0.04*	0.05**
	(0.10)	(0.78)	(0.04)	(0.08)	(0.09)	(0.03)
ΔSALES_VOL	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00
	(0.41)	(1.00)	(0.36)	(0.44)	(0.45)	(0.35)
ΔSIZE	1.41***	1.16***	1.44***	1.40***	1.40***	1.45***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Year effects	Yes	Yes	Yes	Yes	Yes	Yes
Industry effects	Yes	Yes	Yes	Yes	Yes	Yes
N	5,384	5,484	5,384	5,384	5,384	5,384
Adjusted R-squared	0.060	0.058	0.059	0.058	0.058	0.060

Table 2.4 reports estimates of an OLS regression with Huber-White standard errors of the following model:

$$\Delta MFC\_ACC_{it} = \alpha_0 + \alpha_1 \Delta CENTRALITY_{it} + \sum \alpha_k \Delta CONTROLS_{it} + \gamma_t + \delta_j + \epsilon_{it}$$

This models an annual change in annual earnings forecast accuracy (ΔMFC_ACC) as a function of an annual change in centrality (ΔCENTRALITY) and a set of control variables. The sample consists of all U.S.-listed firms available in BoardEx from 2002 to 2013 with management forecast data available in I/B/E/S, and data for control variables in Compustat, I/B/E/S and Audit Analytics, which are part of the largest component of the board network. Appendix B provides the variable definitions. ***,**,* corresponds to 1%, 5%, and 10% significance levels (one-tailed when the coefficient sign is predicted, two-tailed otherwise). Due to small values for the dependent variable the coefficients are multiplied by 100 for presentation.

I also employ each network centrality measure separately, and find that coefficients of all network centrality measures are positive and significant (columns (4)-(6)). This indicates that the quality of directors well-connectedness, even if defined in different ways, facilitates planning and forecasting. In addition to firms' local network (DEGREE), their position in a global network (EIGENVECTOR, CLOSENESS) seems to matter.

In untabulated analysis, I analyze the relation between signed forecast errors and network centrality. I rerun model 1 in subsamples of firm-years that have in at least two consecutive years either positive (2,227 firm-years) or negative (1,101 firm-years) forecast errors. I find that network centrality is inversely related to annual changes in both, absolute positive as well as absolute negative forecast errors ($p<0.05$). This indicates that in firms where managers over- or under-predict profits, they do so by a smaller amount when their board is composed of well-networked directors. Due to these results, it is unlikely that changes in strategic bias, that may correlate with changes in director connectedness, drive management forecast accuracy. In addition, the results for less positive forecast errors confirm that accuracy does not simply reflect firm performance.

2.4.3 Endogeneity

I next examine whether network centrality causally relates to management forecast quality. Specifically, I examine whether the positive coefficient on network centrality (reported in Table 2.4) is driven by self-selection, reverse causality, director-firm matching or omitted variable bias. The results are reported in Table 2.5.

An unobserved component in the regression error may relate to directors joining or leaving a focal firm's board, as well as to changes in forecast accuracy. For example, innate director quality may drive self-selection of high-quality directors to firms with high-quality planning practices. To avoid spurious inferences, I rerun the main model for firm-years only in which a focal firm does not experience any director turnover, but still moves within the global network (i.e., focal firm's network centrality changes). The change in network centrality in these years is likely to be exogenous to factors related to the focal firm, but can be attributed to external developments in the network. For this subsample of firm-years I do not allow any unobserved firm-specific component in the error term to drive network centrality. In 27.2% of all firm-years in my sample, board composition does not change.[28] As reported in column (1) of Table 2.5, the coefficient for centrality is 0.861 (p=0.014). This result implies that latent director characteristics that are potentially correlated with centrality do not drive the positive coefficient on centrality.

Even if the focal firm's board composition does not change, it may still be that its network centrality changes due to self-selection of focal firms' directors into other boards. In other words, high-quality directors may self-select into taking on additional board assignments. In addition, other directors may want to join the boards of the latter firms. Both expands a focal firm's network, and may be driven by an omitted variable that drives as well forecast accuracy. To rule this out, I restrict director turnover at the focal firm to zero, as well as at all interlocked firms (Table 2.5 column (2)). This specification makes it implausible that any characteristic of directors at the focal firm affects the deliberate decision of others to join the focal firm's local network. As shown in column (2), network centrality remains significantly positive (coefficient=0.001 and p=0.081). These results suggest that it is unlikely that any firm-specific unmeasured component in the error term biases the findings.

Next, I examine whether firms that plan better attract higher quality directors (i.e., reverse causality). I examine changes in network centrality after the annual planning is concluded and a forecast is issued. I test for this possibility by substituting centrality with one-year (two-year) ahead centrality (LEAD_ΔCENTRALITY and LEAD_ΔCENTRALITY, respectively). The results in column (5) and (6) of Table 2.5 show that these coefficients are insignificant. This suggests that current forecast accuracy does not lead to future changes in centrality, and therefore does not point towards reverse causality. In addition, the results of the analysis in which I measure changes in network centrality after earnings forecasts are issued but before earnings are realized (reported in Table 2.5, column (5)), indicate that director networks impact plans, rather than operational adjustments between forecast release and earnings realization date (that would be made in order to minimize forecast errors).

[28] The variation in changes in network centrality for this subsample is still considerable: The values for the 10th (90th) percentile for this subsample are -0.22 (0.22), as compared to -0.37 (0.40) in the full sample. The standard deviation is with 0.19 slightly lower than in the full sample (0.32).

Finally, I examine whether changes in director networks that occur one or two years before the current planning period matter. I replace centrality with one-year lagged (LAG_ΔCENTRALITY) and two-years lagged (LAG2_ΔCENTRALITY) network centrality and report the results in columns (3) and (4), respectively, in Table 2.5. A significant coefficient for network centrality indicates that changes in the network structure take longer than one year to be reflected in firms' planning. This may be intuitive under the assumption that incoming directors need time to gain firm-specific knowledge and understand how to effectively add value to firms' operations. Findings do not support the latter; neither lagged centrality nor two-year lagged centrality are significant.

Taken together, the results in Table 2.5 increase confidence in causal inferences from the main results (reported in Table 2.4).

Table 2.5: Annual changes in management forecast accuracy as a function of annual changes in centrality, estimated in subsamples of no director changes (columns (1) & (2)), and lag and lead annual changes in centrality (columns (3)-(6)).

DV = ΔMFC_ACC	Predicted sign	(1)	(2)	(3)	(4)	(5)	(6)
ΔCENTRALITY	+	0.861**					
		(0.014)					
ΔCENTRALITY	+		0.001*				
			(0.081)				
LAG_ΔCENTRALITY				-0.076			
				(0.328)			
LAG2_ΔCENTRALITY					-0.024		
					(0.723)		
LEAD_ΔCENTRALITY						-0.071	
						(0.325)	
LEAD2_ΔCENTRALITY							-0.089
							(0.208)
Controls		Yes	Yes	Yes	Yes	Yes	Yes
Year effects		Yes	Yes	Yes	Yes	Yes	Yes
Industry effects		Yes	Yes	Yes	Yes	Yes	Yes
Allow for changes in board composition of firm (i)		No	No	Yes	Yes	Yes	Yes
Allow for changes in # outside directorships of directors of firm (i)		Yes	No	Yes	Yes	Yes	Yes
N		1,455	688	4,906	4,322	4,663	3,997
Adjusted R-squared		0.095	0.074	0.056	0.052	0.062	0.06

Table 2.5, columns (1) and (2) report estimates of an OLS regression with Huber-White standard errors of the following model, where only the subset of observations without changes in board composition (column (1)) and without changes in outside directorships (column (2)) is used:

$$\Delta MFC\_ACC_{it} = \alpha_0 + \alpha_1 \Delta CENTRALITY_{it} + \sum \alpha_k \Delta CONTROLS_{it} + \gamma_t + \delta_j + \epsilon_{it}$$

Table 2.5, columns (3) to (6) report estimates of an OLS regression with Huber-White standard errors of the main model, where the independent variable ΔCENTRALITY is replaced by one year lag ΔCENTRALITY (column (3)), two year lag ΔCENTRALITY (column (4)), one year lead ΔCENTRALITY (column (5)) and two year lead ΔCENTRALITY (column (6)):

$$\Delta MFC\_ACC_{it} = \alpha_0 + \alpha_1 LAG\_\Delta CENTRALITY_{it} + \sum \alpha_k \Delta CONTROLS_{it} + \gamma_t + \delta_j + \epsilon_{it}$$

$$\Delta MFC\_ACC_{it} = \alpha_0 + \alpha_1 LAG2\_\Delta CENTRALITY_{it} + \sum \alpha_k \Delta CONTROLS_{it} + \gamma_t + \delta_j + \epsilon_{it}$$

$$\Delta MFC\_ACC_{it} = \alpha_0 + \alpha_1 LEAD\_\Delta CENTRALITY_{it} + \sum \alpha_k \Delta CONTROLS_{it} + \gamma_t + \delta_j + \epsilon_{it}$$

$$\Delta MFC\_ACC_{it} = \alpha_0 + \alpha_1 LEAD2\_\Delta CENTRALITY_{it} + \sum \alpha_k \Delta CONTROLS_{it} + \gamma_t + \delta_j + \epsilon_{it}$$

Where the vector ΔCONTROLS contains the conventional control variables used throughout the paper. The sample consists of all U.S.-listed firms available in BoardEx from 2002 to 2013 with management forecast data available in I/B/E/S, and data for control variables in Compustat, I/B/E/S and Audit Analytics, which are part of the largest component of the board network. Appendix B provides the variable definitions. ***,**,* corresponds to 1%, 5%, and 10% significance levels (one-tailed when the coefficient sign is predicted, two-tailed otherwise). The coefficients are multiplied by 100 for presentation.

2.4.4 Accuracy of Revenue and CapEx Forecasts

The analyses throughout the paper focus on the accuracy of earnings forecasts, based on the intuition that accounting earnings indicate the quality of aggregate plans concerning revenues and expenses. This is reasonable as most corporate activities affect the income statement either directly (e.g., sales, labor costs or R&D), or indirectly (e.g., asset purchases/disposals or change in assets' value affect depreciation expenses and impairment charges), therefore the ability to plan operations will be reflected in earnings. To provide more direct evidence that networked directors provide knowledge about firms' supplier/customer industries, I examine the accuracy of management forecasts of sales and CapEx. The quality of firms' sales prediction varies with knowledge about actual demand for a focal firm's product. Further, as a firm's planned CapEx outlays follow from expectations about future demand, CapEx will also vary with projected developments in customer industries. However, to predict most profitable future investments, managers benefit from knowledge about developments in the firm's supplier industries.

In 60% (33%) of my sample firm-years, firms disclose annual revenue (CapEx) predictions at the beginning of their fiscal year.[29] This is similar to findings in prior studies on disaggragated management earnings forecasts (Lansford et al., 2013) and investment guidance (Bae et al., 2016, Lu and Tucker, 2012, Luo, 2016), that consider time periods that are different or partly overlapping to the one I consider.[30] To be consistent with the earnings forecast accuracy estimation, I use the first annual revenue and CapEx forecasts, scaled by total assets (Luo, 2016). The accuracy of revenue (CapEx) forecasts is the absolute difference between the first annual revenue (capital expenditure) forecast and realized revenue (capital expenditure) at the end of the year, scaled by total assets. Mean (median) revenue forecast accuracy is 0.076 (0.038), with a standard deviation of 0.19; the mean (median) capital expenditure forecast accuracy is 0.015 (0.007), with a standard deviation of 0.025. I use the same estimation procedure as in the main model and outlined in Section

[29] In order to be consistent with the sample of firms providing earnings forecasts, I only include firm-years for which revenue (CapEx) forecasts in dollar amounts (instead of percentage growth, percentage of last year, etc.) are available.

[30] Guidance on CapEx has been available in I/B/E/S since 2008, hence the firm years with observable CapEx guidance is a subset of my entire sample. For the sample years since 2008, 63% of my sample firm-years disclose their expectations of annual CapEx.

2.3.5, except that I substitute earnings forecast accuracy with revenue (capex) forecast accuracy, and employ the respective IMR.[31] I use the common vector of controls in constructing separate prediction models because similar antecedents appear in the existing literature. Inferences do not change when I exclude the IMR from the estimation.

Results in Table 2.6 indicate that network centrality is significantly related to revenue and CapEx forecast accuracy at the 10% level of significance. Finding a significant coefficient for the revenue forecast accuracy regression suggests that directors access information relevant for sales planning (which comes potentially from superior knowledge about demand from customer industries). The impact of director networks on investment plans indicates that these managers can plan production better, which implies knowledge about demand as well as supply (i.e., customer and supplier industries).

2.4.5 Comparative Statics

Synchronicity of Firm Performance with Industry and Macroeconomy

In cross-sectional analyses, I aim to show more directly that well-connected directors can support management by providing industry and macro-economic knowledge. I exploit cross-sectional variation in movements of firm-fundamentals with the industry and the macroeconomy. I expect managers of firms whose fundamentals move strongly with the industry and macroeconomy (i.e., industry or macroeconomic synchronicity is high), to benefit more from directors' industry and macroeconomic knowledge.

The reasons for these expectations are two-fold. First, well-connected directors observe how other firms' anticipate or react to industry and macroeconomic shocks, and can subsequently supply managers with this knowledge. Second, well-connected directors are in an excellent position to learn from analysts about industry or macroeconomic developments. Indeed, Hutton et al. (2012)

[31] Specifically, I estimate a Heckman selection model to construct the IMR for each dependent variable separately. I employ the same vector of controls that I used in the main model and use the number of analysts following as instrument. Results of untabulated diagnostic tests indicate that the instruments are valid and relevant based on the same criteria outlined in Section 2.3.5. I find VIFs of around 25 for the year indicators in the estimation of CapEx forecast accuracy on network centrality, hence I exclude year effects from the estimation.

Table 2.6: Annual changes in revenue and CapEx forecast accuracy as a function of annual changes in centrality and annual changes in controls.

	Predicted sign	DV = ΔRevenue FC-Accuracy	p-value	DV = ΔCapEx FC-Accuracy	p-value
ΔCENTRALITY	+	1.58*	(0.09)	0.25*	(0.08)
ΔBOARD_SIZE		0.55	(0.11)	-0.04	(0.33)
ΔBUSY_DIR		2.94	(0.32)	-0.19	(0.62)
ΔPER_OUT_DIR		0.00	(1.00)	1.05	(0.37)
ΔIMR		5.90	(0.67)	-2.19*	(0.08)
ΔREL_IND_DIR		-1.40	(0.11)	0.35	(0.19)
ΔAN_FC_DISP		0.63	(0.93)	-0.01	(0.99)
ΔDISAG		0.33	(0.35)	0.05	(0.16)
ΔEARN_VOL		0.03	(0.49)	0.00	(0.23)
ΔERROR		-1.59	(0.22)	-0.026	(0.83)
FIRM_AGE		0.25**	(0.03)	0.01	(0.43)
ΔICMWD		-0.90	(0.35)	-0.006	(0.93)
ΔLEVERAGE		-3.13	(0.18)	-0.14	(0.76)
LITIGATION		-0.27	(0.63)	-0.02	(0.84)
ΔMFC_TIME		-0.03***	(0.00)	-0.001***	(0.00)
ΔMTB		0.59	(0.23)	0.06	(0.48)
ΔROA		0.33	(0.44)	0.10***	(0.01)
ΔR&D		2.61	(0.72)	2.36	(0.53)
ΔSALES_VOL		-0.03*	(0.09)	-0.00	(0.50)
ΔSIZE		21.9***	(0.00)	0.86	(0.07)
Industry effects		Yes		Yes	
Year effects		Yes		No	
N		2,778		1,222	
Adjusted R-squared		0.038		0.048	

Table 2.6 reports estimates of an OLS regression with Huber-White standard errors of the following models:

$$\Delta RevenueFC - ACCit = \alpha_1 \Delta CENTRALITY_{it} + \alpha_2 \Delta CONTROLS_{it} + \gamma_t + \delta_j + \epsilon_{it}$$

$$\Delta CapExFC - ACCit = \alpha_0 + \alpha_1 \Delta CENTRALITY_{it} + \sum \alpha_k \Delta CONTROLS_{it} + \delta_j + \epsilon_{it}$$

This models an annual change in annual revenue (ΔRevenue FC-ACC) and capital expenditure (ΔCapEx FC-ACC) forecast accuracy as a function of an annual change in centrality (ΔCENTRALITY) and a set of control variables. The sample consists of all U.S.-listed firms available in BoardEx from 2002 to 2013 with revenue and CapEx forecast data available in I/B/E/S, and data for control variables in Compustat, I/B/E/S and Audit Analytics, which are part of the largest component of the board network. Revenue FC-ACC (CapEx FC-ACC) denotes the absolute difference between forecasted revenue (CapEx) and realized revenue (CapEx), scaled by total assets. Appendix B provides the remaining variable definitions. ***,**,* corresponds to 1%, 5%, and 10% significance levels (one-tailed when the coefficient sign is predicted, two-tailed otherwise). The coefficients are multiplied by 100 for presentation.

find that analyst earnings forecasts are more accurate if industry or macroeconomic synchronicity is high.[32] If some of analysts' information is disseminated to the market, well-connected directors will, on average, receive this information faster than less connected counterparts.

I measure industry as well as macroeconomic synchronicity as explained in Hutton et al. (2012), pages 1224 - 1226. In brief, industry synchronicity is defined as the R-square from firm level estimation of the model over the prior 12 quarters:

$$REV_{i,t} = \alpha_0 + \alpha_1 INDREV_{i,t} + \epsilon_{i,t},$$

where REV denotes firm's quarterly revenue over its quarterly revenue in quarter t-4, and INDREV is the industry-revenue (minus the revenue of firm(i)), scaled by the same measure in quarter t-4. Firms with above median R-square are defined as HIGH INDUSTRY SYNCHRONICITY firms. The mean (median) industry synchronicity is 0.24 (0.15), and the std. dev. is 0.24. Next I define macroeconomic synchronicity following Hutton et al. (2012). Analogous, I calculate the R-square from firm level estimation of the model over the prior 12 quarters:

$$EARN_{i,t} = \alpha_0 + \alpha_1 FACTOR_t + \epsilon_{i,t},$$

where EARN is income before extraordinary items and FACTOR either the nominal quarterly GDP, energy costs, or the spread between the 30-year mortgage rate and the t-bill rate. High R-square indicates that firms earnings move in cyclical fashion with the overall economy (i.e., GDP), economic indicators like energy costs, or interest rates, respectively. Mean and median values for the R-square variables are similar to Hutton et al. (2012). To build a single variable that captures firms' macroeconomic synchronicity, I run a factor analysis with the three R-square variables as inputs. The first factor has an eigenvalue of 1.49, is the only that is larger than one, and each factor

[32] As argued and found by Hutton et al. (2012), analysts' expertise about the macroeconomy allows them to make more accurate earnings forecasts than management if firms' profits vary with the marcroeconomy. Along similar lines, the authors argue and find that some analysts are industry specialists (i.e., have a deep understanding of industry demand and dynamics), leading to better forecasts if firms' sales vary with industry-sales.

loading is higher than 0.6. I call the factor MACRO SYNCHRONICITY and firms with above median values, HIGH MACRO SYNCHRONICITY firms.

Results are reported in Table 2.7, and I find that firms' INDUSTRY and MACRO SYNCHRONICITY moderates the effect of centrality on earnings forecast accuracy. The results indicate that in particular, managers of firms whose fortunes are more sensitive to industry and macroeconomic developments can benefit from well-connected directors. They further suggest that director networks facilitate the flow of industry specific and macroeconomic information, and that managers can take advantage of this information in the annual planning process.

Organizational Complexity

In complex organizations it may be more difficult, time consuming, and hence costly for managers to make high quality plans. Managers may need more information in order to plan. Gathering and aggregating the information may take longer, and information may be less readily available. In other words, in complex organizations limited attention may impact managerial decisions.

First, growth firms and firms that undergo major organizational changes are more complex than stable firms. Complications that arise with changes in the operational landscape make planning more costly. Directors can add value to managements' planning by providing operational and strategic advise during times managers are challenged by major organizational changes. I define growth firms as firms with above median market-to-book values (MTB) (Larcker et al., 2013), and firms that undergo organizational changes as firms that recognize restructuring charges or recently undertook mergers or acquisitions (RESTRUCT or M&A) (Feng et al., 2009). In my sample, the mean (median) market-to-book is 1.44 (1.78) (std. dev.= 1.38). In 70.5% of all firm-years some restructuring charges were recognized, or a firm was involved in mergers or acquisitions.

Organizations can also be characterized as complex if they operate in more business and geographical segments, or if they engage in foreign operations (Feng et al., 2009, Gallemore and Labro, 2015, Jennings et al., 2015). Directors' advisory role gains relevance for these firms because it is more difficult for managers to stay well-informed in a larger set of product and geographical

Table 2.7: The moderating effect of the synchronicity of firm fundamental with the industry (columns (1) & (2)), or macroeconomy (columns (3) & (4)), on the relation between annual changes in management forecast accuracy and annual changes in centrality

DV = ΔMFC_ACC	(1) INDUSTRY SYNC.	(2) INDUSTRY SYNC.	(3) MACRO SYNC.	(4) MACRO SYNC.
Predicted sign	HIGH	LOW	HIGH	LOW
for ΔCENTRALITY	+	/	+	/
ΔCENTRALITY	0.46***	0.22	0.29**	0.11
	(0.005)	(0.304)	(0.042)	(0.460)
Controls	Yes	Yes	Yes	Yes
Industry effects	Yes	Yes	Yes	Yes
Year effects	Yes	Yes	Yes	Yes
N	2,679	2,680	2,692	2,692
Adjusted R-squared	0.087	0.062	0.067	0.083

Table 2.7 reports estimates of the following OLS regression with Huber-White standard errors (which equals the estimation of the main model, in subsamples):

$$\Delta MFC\_ACC_{it} = \alpha_0 + \alpha_1 \Delta CENTRALITY_{it} + \sum \alpha_k \Delta CONTROLS_{it} + \gamma_t + \delta_j + \epsilon_{it}$$

In Table 2.7 the relation between management earnings forecast accuracy and network centrality is reported in estimations of subsamples of the following firms. Firms whose revenue growth is relatively more/less explained by industry revenue growth (column (1)/(2)) and firms whose earnings vary relatively more/less with macroeconomic indicators (column (3)/(4)). The specific variables for these tests are defined in Section 2.4.5. Appendix B provides the remaining variable definitions. The vector ΔCONTROLS contains the same control variables that are used throughout the main analysis. The sample consists of all U.S.-listed firms available in BoardEx from 2002 to 2013 with management forecast data available in I/B/E/S, and data for control variables in Compustat, I/B/E/S, Execucomp and Audit Analytics, which are part of the largest component of the board network. ***,**,* corresponds to 1%, 5%, and 10% significance levels (one-tailed when the coefficient sign is predicted, two-tailed otherwise). The coefficients are multiplied by 100 for presentation.

markets. To measure firms' segments, I add up the number of business segments and geographic segments in which a firm operates. The mean (median) firm operates in 6.5 (6) segments, and most of the sample firms operate in 2 (10th percentile) to 11 segments (90th percentile). In addition, I construct an indicator that takes the value of one if a firm has a non-zero currency transaction, indicating foreign operations. I find that 42% of my sample-firms have foreign operations during my sample period.

In line with my expectations, and reported in Table 2.8, I find that network centrality is positively related to management earnings forecast accuracy when organizational complexity is relatively high (as measured by market-to-book, restructuring or mergers and acquisitions activities, the amount of geographic and business segments a firm operates in, and corporate foreign operations). This suggests that directors' advice can be specifically valuable when planning is more difficult due to relatively more complex firm structures and growth.

Table 2.8: The moderating effect of organizational complexity on the relation between annual changes in management forecast accuracy and annual changes in centrality.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
DV = ΔMFC_ACC	MTB	MTB	RESTRUCT. or M&A	RESTRUCT. or M&A	NUMBER of SEGMENTS	NUMBER of SEGMENTS	FOREIGN OPERATIONS	FOREIGN OPERATIONS
Predicted sign	HIGH	LOW	HIGH	LOW	HIGH	LOW	HIGH	LOW
for ΔCENTRALITY	+	/	+	/	+	/	+	/
ΔCENTRALITY	0.36**	0.27	0.41**	0.16	0.46***	0.16	0.61**	0.25
	(0.024)	(0.238)	(0.015)	(0.344)	(0.007)	(0.517)	(0.011)	(0.162)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	2,692	2,692	3,796	1,588	2,925	2,448	1,974	3,410
Adjusted R-squared	0.048	0.103	0.070	0.064	0.066	0.060	0.093	0.063

Table 2.8 reports estimates of the following OLS regression with Huber-White standard errors (which equals the estimation of the main model, in subsamples):

$$\Delta MFC\_ACC_{it} = \alpha_0 + \alpha_1 \Delta CENTRALITY_{it} + \sum \alpha_k \Delta CONTROLS_{it} + \gamma_t + \delta_j + \epsilon_{it}$$

In Table 2.8 results of an analysis of the moderating effect of firm complexity on the relation between network centrality and forecast accuracy are presented. The main model has been re-estimated in subsamples (median splits) of HIGH vs. LOW market-to-book values (column (1) and (2)), restructuring or M&A activities (column (3) and (4)), number of business and geographic segments (column (5) and (6)), and foreign operations (column (7) and (8)). Restructuring or M&A is an indicator variable that takes the value 1 if a firm reports restructuring charges (Compustat item RCP is non-zero) or M&As (Compustat item AQI is non-zero), 0 otherwise. NUMBER of SEGMENTS is defined as the sum of the business and geographic segments a firm operates in, as reported in Compustat. FOREIGN OPERATIONS takes the value 1 if Compustat item FCA is non-zero, 0 otherwise. The vector ΔCONTROLS contains the same control variables that are used throughout the main analysis. The sample consists of all U.S.-listed firms available in BoardEx from 2002 to 2013 with management forecast data available in I/B/E/S, and data for control variables in Compustat, I/B/E/S, Execucomp and Audit Analytics, which are part of the largest component of the board network. Appendix B provides the remaining variable definitions. ***,**,* corresponds to 1%, 5%, and 10% significance levels (one-tailed when the coefficient sign is predicted, two-tailed otherwise). The coefficients are multiplied by 100 for presentation.

CEO/CFO Firm-Specific Knowledge and Ability

I next examine whether relatively inexperienced CEOs/CFOs, and CEOs/CFOs that supposedly have lower forecasting ability benefit more from boards' advice. First, short-tenured management may not have sufficient firm-specific knowledge to be able to estimate the implications of external shocks and developments for their employers. Second, some managers may simply lack the ability required to process large amount of information (Lee et al., 2012). These managers' limited attention may be mitigated by advising directors.

To test the moderating effect of managers characteristics on the relation between network centrality and earnings forecast accuracy, I recalculate the main model using subsamples of long and short CEO and CFO tenure (TENURE), and high and low total compensation (TOT_COMP), respectively. I measure manager characteristics of CEOs and CFOs because these are the two executives who are mainly involved in operational planning and forecasting (Bamber et al., 2010, Brochet et al., 2011, Lee et al., 2012). To measure CEOs' and CFOs' combined firm-specific knowledge, I calculate the sum of CEO and CFO tenure. To measure combined ability, I sum their annual compensation (Gabaix and Landier, 2008) (Execucomp data item TDC1).

The mean (median) combined CEO and CFO tenure is 13 (14.5) years (std. dev.= 6.35), and mean (median) total annual compensation amounts to 7,4 (5.0) million dollar (std. dev.= 6,37). Results of the subsample analyses are reported in Table 2.9, and indicate that the relation between network centrality and earnings forecast accuracy is moderated by CEO and CFO tenure and their total compensation. Network centrality is positive and significant when tenure is low (coefficient=0.48, p=0.013) or if total compensation is low (coefficient=0.52, p=0.035), but insignificant when CEO/CFO tenure or their total compensation is high. These results provide support for the conjecture that directors' advice may be valuable to managers if they are deficient in the knowledge and/or skills required to provide high quality plans.

Table 2.9: The moderating effect of CEO and CFO tenure and ability on the relation between annual changes in management forecast accuracy and annual changes in centrality

	(1)	(2)	(3)	(4)
DV = ΔMFC_ACC	TENURE	TENURE	TOT_COMP	TOT_COMP
Predicted sign	HIGH	LOW	HIGH	LOW
for ΔCENTRALITY	/	+	/	+
ΔCENTRALITY	0.20	0.48**	0.18	0.52**
	(0.315)	(0.013)	(0.223)	(0.035)
Controls	Yes	Yes	Yes	Yes
Industry effects	Yes	Yes	Yes	Yes
Year effects	Yes	Yes	Yes	Yes
N	2,442	2,942	2,692	2,692
Adjusted R-squared	0.038	0.059	0.041	0.065

Table 2.9 reports estimates of the following OLS regression with Huber-White standard errors (which equals the estimation of the main model, in subsamples):

$$\Delta MFC\_ACC_{it} = \alpha_0 \alpha_1 \Delta CENTRALITY_{it} + \sum \alpha_k \Delta CONTROLS_{it} + \gamma_t + \delta_j + \epsilon_{it}$$

In Table 2.9 results of an analysis of the moderating effect of managements' demand for advisory on the relation between network centrality and forecast accuracy are presented. The main model has been re-estimated in subsamples of HIGH vs. LOW TENURE (column (1) and (2)), where TENURE is defined as the sum of CEO and CFO tenure as reported in Execucomp. Analogous, column (3) and (4) reports results of a subsample analysis based on the sum of CEO and CFO total compensation (TOT_COMP; Execucomp item TDC1). The vector ΔCONTROLS contains the same control variables that are used throughout the main analysis. The sample consists of all U.S.-listed firms available in BoardEx from 2002 to 2013 with management forecast data available in I/B/E/S, and data for control variables in Compustat, I/B/E/S, Execucomp and Audit Analytics, which are part of the largest component of the board network. Appendix B provides the remaining variable definitions. ***,**,* corresponds to 1%, 5%, and 10% significance levels (one-tailed when the coefficient sign is predicted, two-tailed otherwise). The coefficients are multiplied by 100 for presentation.

2.4.6 Robustness Analyses

Director Networks and Director Quality

In this analysis, I examine how director quality relates to management forecast accuracy. As discussed in Section 2.4.3, director networks have a significant impact on management earnings forecast accuracy, holding director ability constant. In this section, I assess director quality along several dimensions, by including controls for tenure, age, the number of past directorships and past industry experience.

I build each director quality variable at the board-level. Director tenure is defined as the average tenure of the board (mean=8.67, median=8.22, std. dev.=3.6), and measures firm-specific knowledge (Brickley and Zimmerman, 2010, Kim et al., 2014). Director age is defined as the average age of the board (mean=60, median=61, std. dev.=3.8), where older directors are supposedly (even though more experienced) less effective because they may see directorships as lucrative part-time jobs (Ferris et al., 2003). Directors' past directorships measures general board experience and is the total number of board assignments all current directors had in the past at other firms, divided by board size (mean=13.9, median=2.63, std. dev.=23) (Gray and Nowland, 2013). Directors' past industry experience is an indicator variable with value one if a firm has at least one director who worked in the past at another firm in the same industry, as defined by firms' four-digit SIC code (mean=0.14, std. dev.=0.34), zero otherwise (Faleye et al., 2014).[33]

The magnitude of the effect of network centrality on management forecast accuracy is slightly smaller after controlling for director quality but does not vary much, independent of the quality measure included (i.e., centrality ranges from 0.28 to 0.31 and is significant on conventional levels) (untabulated). This does not suggest that director quality and networks are substitutes (i.e., industry experience may not substitute for access to resources and knowledge from current director networks).

[33] I control for annual changes and levels in director quality because changes capture largely the difference in director quality after turnover, while levels of director quality capture for the quality of incumbent directors.

Director Networks and CEO Connections

In a concurrent working paper, Hong et al. (2016) find that CEOs' acquaintances from current and past employments influence management forecast accuracy. The authors define CEO network size as the total number of past and current colleagues at a firm; therefore, the size of CEOs' network is driven more by the amount of connections from past employers than the current. Hong et al. (2016) find that most of the variation in CEO network size is driven by CEO turnover and not by director and other executive turnover (i.e., CEO network size stays relatively stable for a given CEO). Given this finding, I can use the empirical setting of CEO-turnover to examine whether the network size of an incoming CEO drives my results. If annual changes in director networks are driven by incoming/outgoing CEOs, then I expect annual changes in director networks (i.e. ΔCENTRALITY) to lose significance after considering CEO-turnover.

I construct an indicator variable equal to one for the first year of every CEO's tenure and zero otherwise. This way, I allow forecast accuracy to vary with CEO turnover. In addition, I let the relation between forecast accuracy and centrality vary with CEO turnover by interacting CEO turnover with centrality. This interaction is significant only if network centrality picks up the incoming CEOs' network size. I find that centrality is positive and significant (coefficient=0.41, p<0.01), the interaction is insignificant (p=0.299), and the turnover indicator variable is insignificant (p=0.506) (untabulated). Alternatively, I exclude all firm-years when CEO turnover occurred. This leads to an exclusion of 516 observations. The results hold, that is, the coefficient on network centrality is positive and significant (coefficient=0.40, p=0.012) (untabulated). Overall, these analyses do not indicate that CEO network size drives the relation between network centrality and earnings forecast accuracy.

Earnings Management and Forecast Accuracy

In this subsection, I examine whether firms with well-connected directors engage in earnings management to increase earnings forecast accuracy. Inaccurate forecasts can be costly to firms and management (Kasznik, 1999, Lee et al., 2012, Matsumoto, 2002), however, recent network centrality literature finds that director connectedness actually relates negatively to earnings management (Omer et al., 2016).

I address whether earnings management drives results in two ways. First, I re-estimate my main model adding additional controls for earnings management.[34] I add performance matched discretionary accruals (alternatively performance matched absolute discretionary accruals) (Kothari et al., 2005) as control variables, and find that the coefficient for network centrality is similar compared to the estimation for the main model. Specifically, the coefficient for network centrality is 0.42 (0.39), $p<0.01$, when I add (absolute) discretionary accruals (untabulated).

Second, I split the full sample into subsamples around the zero forecast-error threshold, and examine whether centrality has a steeper slope in these subsamples. I follow the intuition that only firms with prospects to meet their own forecast through the use of accounting discretion will manage earnings, and hence have a forecast error close to zero. I re-examine the main model three times, letting the slope for centrality vary in the following ways. I interact centrality with an indicator variable being one if a firm is in the (1) small-miss sample (has a positive forecast error below the 25th percentile of the positive forecast error subsample), (2) small-beat sample (has a negative forecast error above the 75th percentile of the negative forecast error subsample), (3) or is in the small-miss or small-beat sample. Within these subsamples, firms close to zero forecast errors are assumed to have managed earnings, while the others have not. Earnings management facilitated by director networks will be reflected in a higher coefficient for centrality in these subsamples. In untabulated analyses, I do not find a significantly different coefficient for centrality in the small-miss ($p=0.431$), small-beat ($p=0.417$), or small-miss/small-beat ($p=0.281$) sample. Overall, these findings do not suggest that the relation between forecast accuracy and centrality is driven by an increased propensity to minimize forecast errors through earnings management.

[34] The standard vector of controls includes indicator variables for restatements due to errors and internal control material weaknesses, which proxies for the susceptibility of the accounting system to misreporting. Excluding them does not affect the inferences.

Alternative Measurement Approaches to Earnings Forecast Accuracy

In this subsection, I discuss the robustness of findings to different measurement approaches to earnings forecast accuracy. First, in a placebo test, I re-examine my main model with earnings forecasts measured at other points in time, during the same year. Throughout the paper, I assume the first annual management forecast is a close approximation of managers' actual expectation, because it results directly from the annual planning and budgeting process (while later forecasts are more likely to reflect earnings guidance revisions). Given this, I do not posit that network centrality is a determinant of the quality of earnings forecasts that are provided later in the fiscal year. I re-estimate model 1, using the accuracy of the last annual earnings forecast as the dependent variable, and do not find a significant coefficient for centrality (coefficient=0.15, p>0.1).

Second, I also follow the convention that midpoints of range forecasts constitute managements earnings expectations (Feng et al., 2009, Karamanou and Vafeas, 2005). However, I address whether midpoints or upper bounds in range estimates represent managers' expectations by examining the actual EPS distribution (Ciconte III et al., 2014). Of all range estimates in my sample, 44% (34%) of actual EPS fall above (below) the higher bound (lower bound) estimate, and 10% (12%) fall between the lower (higher) bound estimate and the midpoint estimate. Due to this relatively normal distribution of estimates around the midpoint (as opposed to the upper bound or lower bound), I interpret the mid-point as managers' expected EPS. However, assuming the upper or lower bound reflects managements' expectations and rerunning the main model provides similar results (untabulated).[35]

Third, I examine annual earnings forecast accuracy using different scalars identified in the management forecast literature, to show that the results do not depend on the choice of the scalar. I use the following alternative scalars: absolute forecast value, log of total assets, total assets, or standard deviation of EPS, and re-estimate the main model. Network centrality is significantly positive at the 10% level in all estimations (untabulated), hence results are not sensitive to the

[35] Re-estimating model 1 assuming the upper (lower) bound is the actual expectations provides a coefficient for centrality of 0.43 (0.33), and p-values <0.01.

construction of the management earnings forecast variable. Specifically, due to the robustness of the findings to the use of the absolute earnings forecast as scalar, it is unlikely that variation in the denominator (i.e., asset per share) drives my results.

Correcting for the Correlation between Network Centrality and further Firm Characteristics

I employ two variants of the main model to address potential multicollinearity concerns that may arise from the correlation of network centrality with firm characteristics (Akbas et al., 2016, Larcker et al., 2013). I first account specifically for the correlation of network centrality with firm size (and, secondarily, employ a non-parametric approach to network centrality). Therefore, similar to Larcker et al. (2013), I construct size-quartiles based on the natural logarithm of total revenues, to account for the tendency of larger firms to have larger boards, and hence to be better connected. Within each size quartile I construct quartiles for network centrality and rerun the main model, and substitute centrality with its quartile measure.[36] Untabulated results show a significantly positive coefficient for annual changes in quartile-centrality (coefficient=2.13, p=0.016). This implies that network centrality corrected for firm size has a positive effect on accuracy.

In a second approach I control for the correlation of network centrality with several firm characteristics. I orthogonalize centrality to a set of firm characteristics found to be related to network centrality (Akbas et al., 2016, Larcker et al., 2013). I run annual regressions of network centrality on size, firm age, board size, market-to-book, ROA, and changes in ROA, and use the change in the residual value as an alternative centrality measure. The coefficient for changes in residual network centrality is 4.11 and significant ($p<0.01$). Both approaches indicate that the results are not driven by firm characteristics that correlate with a firm's connectedness. Specifically, neither changes nor levels in firm performance affect the relation between annual changes in network centrality and annual changes in management forecast accuracy.

[36] In this non-parametric approach, finding hypothesized results in an annual change specification implies that changes in network centrality have to be large enough that a firm-year will be classified in a different centrality-quartile; which biases against finding significant results. In an alternative non-parametric approach, I rerun model 1 with quantile regressions and continue to find a significantly positive effect of centrality (coefficient=1.44, p=0.075)

2.5 Conclusion

In this study, I shed light on the advisory role of directors. I investigate whether directors' current professional connections facilitate firms' annual planning. I examine firms' direct as well as indirect board networks, which allows for a wider range of influential connections than only interlocking directorates. Results indicate that a well-connected board of directors matters for corporate decisions, as it can be valuable in providing widespread access to network information and resources. I employ a U.S. sample of 5,384 firm-year observations, spanning the years 2002 to 2013. I find that an increase in centrality relates positively to annual changes in earnings forecast accuracy. In addition, more central firms are better able to predict sales and create more accurate capital expenditure plans. Comparative statics analyses indicate that CEOs and CFOs with shorter tenure, lower ability, and managers of more complex firms especially benefit from the support of well-connected directors. In addition, I find that directors' connections increase forecast quality more if firm-performance is more sensitive to the macroeconomy or the industry. Taken together, the results suggest that directors facilitate access to external information (i.e., information about focal firms' industry, related industries or the macroeconomy), and directors' advisory function plays out particularly when managers have difficulties in creating high quality forecasts.

The study has implications for work on the advisory role of directors, because it points towards a particular mechanism through which directors support managerial decision making. This is the first study to show that directors' access to multiple firms can be beneficial because their connections have the potential to increase the quality of firms' planning process and the subsequent forecast. This implies that indirect connections should not be ignored to understand directors' advisory role. Another implication is that busy directors can play an active role in corporate decision making, as opposed to being too distracted to add value.

The results do not imply that every firm should (or can) strive for a more central position in a board network. Building such a network may not always be cost effective, or even possible. There are costs associated with the search process for new directors, hiring and firing directors, and overly large boards. Further, a firm has only limited control over its position in a network.

Network centrality is a relational concept, which implies that the position of a firm in the network is determined by the board structure of other firms. Additionally, there are contractual impediments to building interlocking directorates.

This study has several limitations. First, even though I employ an extensive research design to address endogeneity concerns it is difficult to make strong causal claims in social network research. Second, given that it costs more resources and effort to investigate a global as compared to a local network, one has to trade-off the costs and benefits of each empirical approach. Conditional on these caveats, I believe this work provides a valuable contribution to the corporate governance literature, and more specifically to work on the advisory function of directors.

Appendix A

Calculation of Centrality Measures and Example Network

A.1 Centrality Measures

The main measure employed, CENTRALITY, is the first eigenvalue from a factor analysis with the three input variables Degree, Closeness and Eigenvector (for a detailed discussion see Freeman (1979), Jackson et al. (2008) pp. 37). I first build a symmetric binary matrix (called adjacency matrix), with each row and column representing a different firm in the network. Each entry in the matrix is set to one if two firms share a director in a given year. That is, the network is calculated for each year that belongs to the sample period. Based on this, I calculate centrality measures that are commonly applied in finance and accounting research (El-Khatib et al., 2015, Fracassi, 2016, Larcker et al., 2013).

Degree, as the simplest of the four measures, is an ex-post multiplication of the adjacency matrix (A) with the unit vector. The unit vector includes all nodes (=firms) of the network. The result indicates the amount of direct connections of each node. In my setting, Degree equals the amount of firms a given firm is connected to through at least one shared director. Common alternative expressions for the same measure are *number of interlocks* or *interlock centrality* (Davis, 1991).

Freeman Closeness measures how easy a node can reach every other node in the network. It is defined as the inverse of the average distance between one node to any other node in the network. The numerator is multiplied by n-1, while the average distance is defined as the average number of steps firm (i) has to take to reach every other firm in the network on the shortest path. Let l(i,j) be the number of links in the shortest path between (i) and (j), then closeness is calculated as

$$\frac{n-1}{\sum_{j \neq i} l(i,j)}$$

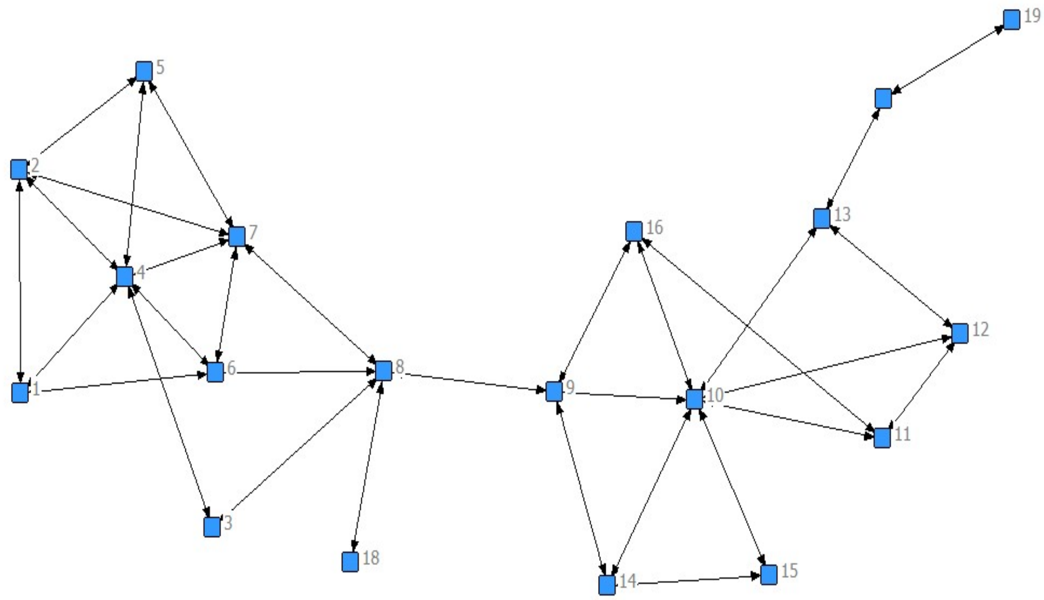
Closeness captures the inverse of the average time it takes a signal, sent by the focal firm, to arrive at any other firm in the network.

Eigenvector considers not only first-degree connections but as well higher-degree connections, accounting therefore for the number of direct and indirect connections of each node. A firm with higher Eigenvector does not necessarily have more direct connections, but the connections the firm has, are well-connected. Because this is a self-referring calculation with x unknown and x equations, it can be solved by calculating an Eigenvector of the adjacency matrix $E_{(A)}$ related to the largest eigenvalue θ. In matrix notation, $\theta E_{(A)} = AE_{(A)}$ gives the Eigenvector $E_{(A)}$. I use a modification to this measure, which is referred to as Katz-Bonacich centrality, because it discounts higher degree connections with a decay parameter. The intuition is that, as connections increase in distance, they are assigned smaller weights, captured by the decay parameter. Further, only board connections up to the sixth degree are factored in the calculation because including more distant connections is not compelling from both an intuitive and theoretical standpoint.

A.2 Example Network

The purpose of the example network (presented below) is to exhibit that centrality is a multifaceted concept, i.e., different firms are most central depending on which of the centrality-measures are used. As an example, I focus on nodes with many connections and compare their local and global network position. Node 10 has the highest Degree (7) but low Eigenvector (0.117), while node 4

Figure A.1: Graphical presentation of an Example Network: The most central nodes as evaluated on their Degree centrality are 10 and 4. Based on Closeness centrality, the nodes 9 and 8 are most central, and when evaluated on Eigenvector centrality the nodes 4 and 7 are most central.



has the highest Eigenvector (0.465) even though it only has the second highest Degree (6). That indicates that the connections of node 4 are better connected than the connections of node 10, putting node 4 in a more central position in a global network. However, node 4 is less central if only the local network ties are considered. As another example, Closeness captures how fast a firm can reach any other node in the network. According to this criterion node 9 and 8 are the most central ones, but both score relatively low on Degree and Eigenvector.

Example Network: Calculation of Degree centrality, Closeness centrality and Eigenvector centrality

Node	Degree	Closeness	Eigenvector
1	3	0.290	0.286
2	4	0.295	0.360
3	2	0.346	0.181
4	6	0.305	0.465
5	3	0.291	0.304
6	4	0.360	0.355
7	5	0.367	0.429
8	5	0.450	0.283
9	4	0.462	0.133
10	7	0.428	0.117
11	3	0.316	0.060
12	3	0.327	0.054
13	3	0.333	0.044
14	3	0.375	0.072
15	2	0.310	0.046
16	3	0.375	0.075
17	2	0.260	0.011
18	1	0.316	0.069
19	1	0.209	0.003

Appendix B

Variable Description

Variables are constructed as follows:

CENTRALITY	Largest factor of an annual factor analysis of Closeness, Eigenvector and Degree centrality (Board-Ex)
DEGREE	Standardized number of first-degree links to outside boards (Board-Ex)
CLOSENESS	Standardized number of firms that lie on the shortest path between firm (i) and any other firm in the network (Board-Ex)
EIGENVECTOR	Standardized number of nth-degree links to outside boards (Board-Ex)
MFC_ACC	Absolute difference between the first management EPS forecast for year t issued after the announcement of earnings for year t-1, minus the actual EPS for year t, deflated by total assets per share, and multiplied by (-1) (I/B/E/S)
AN_FC_DISP	Standard deviation of analyst forecasts (I/B/E/S)
BOARD_SIZE	Number of directors (BoardEx)
BUSY_DIR	Number of average outside director positions (BoardEx)
DISAG	Number of items a firm forecasts in addition to EPS (I/B/E/S)
EARN_VOL	Standard deviation of quarterly operating income over the last 20 quarters (Compustat)

ERROR	Indicator variable that is 1 if a firm has a restatement due to errors in the current year, and 0 otherwise (Audit Analytics)
FIRM_AGE	Years firms are listed on a stock exchange in the US (Compustat)
ICMWD	Indicator variable that is 1 if a firm has material weaknesses in its internal controls in the current year, and 0 otherwise (Audit Analytics)
IMR	Inverse Mills ratio from the first stage selection model
LEVERAGE	Total debt over total assets (Compustat)
LITIGATION	Indicator variable that is 1 if a firm operates in a highly litigious industry as defined by Francis et al. (1994), 0 otherwise (Compustat)
MFC_TIME	Days between FY-end date and managements EPS forecast (I/B/E/S)
MTB	Market value of equity scaled by book value of assets (Compustat)
PER_OUT_DIR	Percentage of outside directors (BoardEx)
REL_IND_DIR	Indicator being 1 if a firm has a board interlock with a firm in a related industry, 0 otherwise (BoardEx and Bureau of Economic Analysis)
R&D	Research and development expenses deflated by lagged assets (Compustat)
ROA	Industry adjusted net income scaled by lagged total assets (Compustat)
SALES_VOL	Standard deviation of quarterly sales over the last 20 quarters (Compustat)
SIZE	Natural logarithm of total revenues (Compustat)

Chapter 3

Voluntary Clawback Adoption and the Use of Financial Measures in CFO Bonus Plans

3.1 Introduction

We study how the adoption of clawback policies affects the design of CFO bonus plans. We focus on CFOs given that they are the top executives who are primarily responsible for the preparation and filing of the financial reports (Mian, 2001). CFOs monitor the process of preparing financial reports and are viewed as watchdogs for financial reporting integrity. They must safeguard the quality of internal controls to reasonably assure that financial statements are reliable and free of material mistakes. This implies that, relative to other executives, CFOs are in a unique position to engage in accounting manipulations (Feng et al., 2011). Jiang et al. (2010) examine both CEO and CFO incentives and find that especially CFO incentives are associated with accrual-based earnings management. CFOs may also be pressured by CEOs to manipulate accounting reports (Friedman, 2014). To strengthen the role of the CFO as gatekeeper for financial reporting integrity, firms can deemphasize accounting measures in CFO bonus plans.[1] In this way, financial

[1] We use 'financial measures' and 'accounting measures' interchangeably. Accounting measures are the most often used financial measures in CFO bonus plans (Hoitash et al., 2012). In our analyses, we also include market performance as a proxy for alternative measures used in CFO bonus plans.

reporting is reinforced given CFOs' influence over reported numbers (Indjejikian and Matějka, 2009). But providing less financial bonus incentives to support their fiduciary role comes at the expense of incentivizing CFOs' decision-making duties. In general, firms trade-off CFOs' fiduciary responsibilities against their decision-making duties.

Clawbacks can allow firms to more fully incentivize CFOs' decision-making duties without instantly compromising their fiduciary responsibilities. Clawback provisions allow firms to ex-post recoup compensation from executives after the occurrence of a specific trigger event (e.g., an accounting restatement due to a material noncompliance with a financial reporting requirement). Clawbacks were initiated by the Sarbanes-Oxley Act (SOX), and the Securities and Exchange Committee (SEC) was authorized to recover incentive pay awarded to CEOs and CFOs in the case of restatements. The Dodd-Frank Wall Street Reform and Consumer Protection Act (DFA) will require listed firms to adopt a policy to recapture excess incentive compensation paid on the basis of erroneous financial statements. Different from SOX is that the firm's board of directors rather than the SEC enforces these clawbacks. Many firms have already adopted clawback provisions on a voluntary basis. If executives understand that after clawback adoption, publishing misstated accounting information will be penalized ex-post through the loss of compensation, they have less incentives to engage in accounting manipulation ex-ante (Chan et al., 2012).

The purpose of this study is to examine whether clawback adoption is associated with greater bonus incentives tied to accounting measures for CFOs. We expect that clawbacks increase CFOs' personal misreporting costs because of the recovery of previously awarded compensation. Given that the propensity to misreport is a function of the financial incentives that CFOs face as well as the personal misreporting costs that they incur (Friedman, 2014, Indjejikian and Matějka, 2009), an increase in CFOs' misreporting costs may allow firms to more fully incentivize CFOs' decision making duties without increasing their propensity to misreport. We test the joint hypothesis that clawbacks lead to an increase in misreporting costs for CFOs and that this allows firms to increase incentives on financial measures in CFO bonus contracts. The maintained assumption here is that clawbacks lead to an increase in personal misreporting costs. Prior studies document significant effects associated with the adoption of clawbacks such as fewer restatements, higher earnings response coefficients, and a decrease in accrual-based earnings management, indicative of increased misreporting costs after the adoption of clawbacks (Chan et al., 2012, 2015, deHaan et al., 2013, Iskandar-Datta and Jia, 2013). For example, deHaan et al. (2013) state that a "clawback provision increases the cost of being caught by increasing the likelihood that the firm's shareholders and board of directors will be able to recapture erroneously awarded performance-based compensation" (1030).[2]

Our study is focused on CFO bonus plans and in particular how bonuses are tied to financial performance, as this reflects how firms trade-off the provision of incentives to motivate productive effort against the potential for misreporting. This trade-off may affect CFO incentives differently from the incentives of other executives as CFOs are the executive officers with unique responsibilities for financial reporting (Friedman, 2014, Indjejikian and Matějka, 2009, Mian, 2001). Firms that adopt clawbacks and intend to emphasize their financial reporting integrity[3] may not want to counteract that effect by increasing bonus incentives of CFOs. On the other hand, the monetary penalty associated with clawbacks may have a more marked effect on the propensity to misreport for CFOs as they also face a greater threat of dismissal in the case of accounting irregularities. That is, the recoupment of prior compensation may have a large incremental effect on CFOs as with dismissal they will be less able to generate future income. Lastly, given that CFO effort is recognized as a main determinant of the integrity of financial reports, firms have been underincentivizing CFOs' decision making duties prior to clawback adoption (Indjejikian and Matějka, 2009). The implementation of clawbacks may enable firms to more properly incentivize CFOs' decision making duties by increasing their bonus incentives.

[2] Even in the presence of SOX, we do not expect that the effect of clawbacks on the propensity to misreport is negligible. First, prior studies document effects of clawback adoption that indicate an increase in misreporting costs. Second, accounting restatements persist after SOX (Burks, 2011). Third, clawbacks have an additional disciplining effects given that they are easily enforceable relative to more costly actions such as class action lawsuits.

[3] We perceive financial reporting integrity to be the ex-post outcome of the ex-ante propensity to misreport, where the propensity to misreport is a function of financial incentives and personal misreporting costs. Increased misreporting costs in the beginning of period (t) can, ceteris paribus, lead to a higher reporting integrity at the end of period t. Increased incentives tied to earnings in the beginning of period $t + 1$ lead, ceteris paribus, to a decrease in financial reporting integrity at the end of period $t + 1$. We focus on the ex-ante trade-off between incentives and the propensity to misreport after an increase in misreporting costs due to clawback adoption.

We collect a sample of 8,098 firm-year observations from 1,560 Russel 3000 firms, where 38% have a clawback policy in place. Given that firms self-select into clawback adoption, in our analyses we use difference-in-difference (DID) models combined with propensity score matching (PSM). DID-models distinguish the effect of being a clawback adopter from the effect of the actual adoption. The PSM-methodology addresses any nonlinearities in the control variables and composes a control group similar to treatment firms (clawback adopters) except for the fact that the control firms do not adopt clawbacks.

Consistent with the idea that clawbacks are perceived by compensation committees as an effective deterrent against accounting manipulation by CFOs, we find an increased sensitivity of CFO bonuses to ROA following the implementation of clawbacks. We supplement this analysis with an "explicit approach" using hand-collected data from proxy statements. We find that clawback adoption is associated with an increased weight on financial measures in CFO bonus plans. We compare the sensitivity of bonuses to ROA following clawback adoption for CFOs relative to other named executive officers (NEOs). We find the increase in bonus incentives contingent on financial measures to be more pronounced for CFOs. This suggests that clawbacks have a marked effect on CFOs' misreporting costs and that clawbacks enable firms to more properly incentivize CFOs' decision making duties as concerns over financial reporting integrity may have prompted them to mute bonus incentives prior to clawback adoption.

We compare fraud- and performance-based clawbacks as the latter type of clawbacks does not require misconduct. We find some evidence that suggests that the adoption of performance-based clawbacks has a larger positive effect on CFO bonus incentives. We also find that clawback adoption is associated with greater equity incentives for CFOs. Finally, we exploit cross-sectional variation by using different proxies for a firm's susceptibility to misreporting. In general, we find evidence that the sensitivity of CFO bonuses to ROA varies systematically with the extent that the firm's accounting system is susceptible to misreporting. Specifically, the increase in CFO bonuses tied to accounting measures after adoption of clawbacks is less pronounced in subsamples with prior internal control material weakness disclosures, higher abnormal accruals, higher CEO power, and lower audit committee power.

We contribute to prior research in the following ways. First, we contribute to recent literature on CFOs and CFO compensation design. We find that CFO bonus contracts change after the implementation of clawback provisions, and that this change is more pronounced for CFOs relative to other executives. This suggests that clawbacks have a marked effect on CFOs' misreporting costs which allows firms to more fully incentivize their decision making duties. Second, we contribute to the literature on the effect of regulatory reforms on executive compensation. While prior studies primarily focused on how reforms affected the level and structure of executive compensation (e.g., Chhaochharia and Grinstein (2009)), this study investigates an important accounting question, i.e., how the implementation of clawback provisions affect the use of accounting measures in incentive contracts. We focus on annual bonus plans since these contracts often use earnings as a metric to measure managers' effort and bonus payouts may proxy for the boards' evaluation of CFOs' performance (Hayes and Schaefer, 2000). Note that while bonus contracts are typically smaller than equity incentives, our findings suggest that bonus plans are not inconsequential as we show that the use of accounting measures in bonus contracts is influenced by the implementation of clawbacks, as well as varies systematically with the risk of misreporting.

Third, while prior studies on regulatory reforms have focused on SOX, we examine one single provision from the DFA (i.e., the implementation of clawback provisions) that increases the personal misreporting cost but does not necessarily change the misreporting costs of the firm. This allows for a more straightforward prediction of the relation between clawbacks and the use of accounting information in CFO bonus contracts relative to more complex reforms such as SOX that influence the personal misreporting costs of executives but may also affect firms' misreporting costs.[4] In addition, our study contributes to prior clawback studies by showing how firms can benefit from clawbacks as it enables them to more strongly motivate productive effort while at the same time safeguarding their financial reporting integrity. Fourth, we report evidence that firms systematically

[4] For example, firms face negative stock price reactions and increased audit fees after internal control deficiency disclosures in the post-SOX era (Hammersley et al., 2008, Hogan and Wilkins, 2008).

vary the sensitivity of CFO bonuses to accounting measures with the risk of misreporting. While it is argued that using reported performance to motivate productive effort leads to overstatements, our findings show that firms balance the provision of incentives against their concerns about misreporting of accounting performance measures in the design of their incentive contracts.

The remainder of this paper is organized as follows. We review the literature and develop the hypothesis in the second section. In the third section, we describe the sample, empirical models, and variable measurement. We discuss our empirical findings in section four, and provide our conclusions and limitations in the fifth section.

3.2 Literature Review

3.2.1 CFOs and Accounting Manipulation

CFOs perform dual roles within corporations. On the one hand, CFOs have significant decision-making responsibilities as they serve as a member of the executive management team. They make decisions on e.g., financial planning and budgeting, cost reduction initiatives, debt versus equity financing, mergers and acquisitions, dividend and share repurchase policies, and treasury (Brav et al., 2005, Gore et al., 2011). On the other hand, CFOs play a key role in financial reporting. They have the ultimate responsibility over the preparation of financial statements (Mian, 2001). Geiger and North (2006) document how appointments of new CFOs are associated with significant changes in abnormal accruals, indicative of CFOs' influence on corporate reporting choices. Ge et al. (2011) report significant CFO effects for a range of accounting choices.[5] Bamber et al. (2010) document how individual CFOs exhibit distinctive disclosure styles (e.g., the frequency of management forecasts).

Recent studies also provide evidence that suggest that, relative to other executives, CFOs are in a unique position to engage in accounting manipulations. Graham et al. (2005) present

[5] They examine how CFOs influence the choice for off-balance sheet activities (operating leases), assumptions underlying the pension expense, meet and beat behavior, the likelihood of accounting misstatements, etc.

survey evidence where the majority of CFOs acknowledges that personal incentives shape their financial reporting decisions. Jiang et al. (2010) examine both CEO and CFO incentives and find that especially CFO incentives are associated with accrual-based earnings management. Chava and Purnanandam (2010) find that CFOs risk-taking incentives are more strongly associated with earnings smoothing through accruals, relative to CEO incentives. Kim et al. (2011) show how primarily CFO incentives, and not so much CEO incentives, are positively associated with firms' future stock price crash risk. While this suggests that CFOs manipulate the accounting system to attain personal financial gain, CFOs may also manipulate the financial reporting system because of the pressure exerted by their CEO (Friedman, 2014). Dichev et al. (2013) report that 91% of the surveyed CFOs acknowledge that pressure from within the firm represents a reason to misrepresent economic performance by manipulating the accounting system.[6] SEC Accounting and Auditing Enforcement reports (AAERs) provide anecdotal examples of CEOs presumed to pressure CFOs to manipulate accounts.[7]

Firms may want to emphasize the CFOs' role as the gatekeeper for the integrity of financial reports. Indjejikian and Matějka (2009) show how the design of CFO bonus plans, and in particular how bonuses are tied to financial performance, reflects the concerns about the financial reporting integrity. Incentives tied to accounting measures motivate CFOs to perform their decision-making tasks, but also incentivizes CFOs on performance measures they themselves generate. On the other hand, lower bonus incentives benefit CFOs' fiduciary responsibilities, yet this comes at the expense of properly incentivizing their decision-making duties.

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[6] In addition, 89% of the CFOs referred to their incentive contracts as a motive for earnings management.

[7] With regard to HealthSouth Corporation (HRC), the SEC stated that "When HRC's earnings fell short of [Wall Street analysts'] estimates, Scrushy [the CEO] directed HRC's accounting personnel to 'fix it' by artificially inflating the company's earnings to match Wall Street expectations." Concerning MCSi Inc., the SEC stated that "Stanley [the CFO], at the instigation of Peppel [the CEO] resorted to simply making up revenue by means of fictitious journal entries." (SEC, 2006).

3.2.2 Clawbacks

Recently, an increasing number of firms attempts to reinforce their financial reporting integrity through voluntary adoption of clawback provisions. Clawbacks were initiated by section 304 of SOX where the Securities and Exchange Committee (SEC) was authorized to recover the bonuses paid to CEOs and CFOs of public companies in the case of restatements that arise because of material noncompliance with a financial reporting requirement as a result of willful misconduct. However, because of ambiguities in SOX 304 and the SEC's limited resources, SOX 304 has only been successful enforced in a limited number of cases (Chan et al., 2012, Iskandar-Datta and Jia, 2013).[8] The Dodd-Frank Wall Street Reform and Consumer Protection Act from 2010 (DFA) also has a section on clawback policies (Section 954 on "Erroneously Awarded Compensation"). Here, the firm's board of directors instead of the SEC has to enforce a clawback. It does not require misconduct and clawback provisions typically also cover other executives within the firm than the CEO or CFO (Iskandar-Datta and Jia, 2013). CFOs are in all cases targeted by clawback provisions as the SEC argues that clawbacks would expressly include the principal financial officer given their responsibility for the financial information (SEC, 2015).

Many firms have voluntarily adopted clawback provisions to be enforced by the board of directors.[9] In 2012, almost 72% of the S&P500 firms have publicly disclosed their clawback policies. Clawback provisions are typically embedded in employment or compensation contracts. Trigger events that are most commonly listed are restatements (86%), violation of fiduciary duties (58%), fraudulent activities (36%), and misrepresentation (19%). Because firm-initiated clawbacks aim to reduce concerns regarding accounting manipulation for personal financial gain, clawback

[8] First, in 2005 it was determined in court that the SEC was the sole enforcer of section 304. However, the SEC's limited resources constrained the number of cases to be enforced. Second, there were ambiguities regarding the meaning of the term 'misconduct.' Third, whether the CFO must be personally involved in the misconduct is ambiguous. That is, it is unclear whether misconduct by another corporate employee suffices as a trigger event for the recoupment of CEO and CFO incentive compensation because it might be difficult to examine the individual solely responsible (Chan et al., 2012, Iskandar-Datta and Jia, 2013).

[9] Regulation S-K requires that publicly-traded firms disclose in their annual proxy statement "policies and decisions regarding the adjustment or recovery of awards or payments if the relevant registrant performance measures upon which they are based are restated or otherwise adjusted in a manner that would reduce the size of an award or payment." Executive Compensation Disclosure, 71 Fed. Reg. 78, 338 (Dec. 29, 2006) (altering Section 402 (b)(2)(viii) of Regulation S-K).

provisions emphasize incentive pay and firms in most cases will recover up to the full amount awarded.[10] According to Babenko et al. (2015), the primary enforcer of a clawback provision is the compensation committee (in 60% of their sample), followed by the board of directors (34%). In slightly more than half of the cases, there is discretion in determining whether a trigger event occurred, and the amount to be repaid.

3.2.3 Hypothesis

Clawbacks are expected to increase CFOs' misreporting costs. Clawbacks allow for recoupment of ill-gotten gains, while executives of firms without a clawback policy in place may retain ill-gotten gains even after dismissal. Increases in the personal cost of misreporting for CFOs through clawback adoption decreases their propensity to misreport for any level of incentives (Friedman, 2014, Indjejikian and Matějka, 2009). Given that the propensity to misreport is a function of the financial incentives that CFOs face as well as the personal misreporting costs that they incur, an increase in CFOs' misreporting costs may allow firms to more fully incentivize CFOs' decision making duties without increasing their propensity to misreport. Consistent with the notion that greater misreporting costs after clawback adoption encourage CFOs to produce more accurate financial statements, prior research on firm-initiated clawbacks documents positive market responses to adoption announcements, a lower likelihood of restatements, a higher earnings-response coefficient, a lower incidence of meeting or beating earnings benchmarks, lower accrual-based earnings management, and lower (unexplained) audit fees (Chan et al., 2012, 2015, deHaan et al., 2013, Iskandar-Datta and Jia, 2013). deHaan et al. (2013) examine the relation between clawback adoption and pay-for-performance sensitivity for CEOs and document an increased pay-for-performance sensitivity for CEOs, indicative of greater misreporting costs after clawback adoption.

The adoption of clawbacks and the subsequent increase in CFO misreporting costs enables firms to more fully incentivize CFOs decision making duties while carefully balancing the provision of

[10] Even if this exceeds the magnitude of the incentive pay that executives have received erroneously in the past on the basis of the inflated earnings (as incentive pay based on the restated earnings is typically lower).

incentives to motivate productive effort against the potential for misreporting. Despite that firms that use reported performance to motivate productive effort may need to tolerate some overstatements (Crocker and Slemrod, 2007), firms have been providing muted incentives to their CFOs given that CFO effort is recognized as a main determinant for the integrity of financial reports (Friedman, 2014, Indjejikian and Matějka, 2009). Firms that subsequently adopt clawback provisions and want to safeguard their financial reporting integrity may not want to counteract this effect by increasing bonus incentives of CFOs. This is especially important for CFOs given their focal role in financial reporting. On the other hand, clawbacks may have a marked effect on CFOs' misreporting costs and their propensity to misreport. The threat of dismissal after accounting irregularities is perceived to be stronger for CFOs relative to other executives given their special fiduciary role. For example, Burks (2010) finds that CFOs are more frequently dismissed relative to CEOs after restatements. The expected future income (alternative labor market prospects) after dismissal may be particularly weak as many firms prefer to appoint CFOs with strong accounting credentials (Bernard et al., 2017, Li et al., 2010). Hence, the monetary penalties associated with implementation of clawback provisions may have a more substantial effect on the wealth of CFOs relative to other executives who are not that likely to be dismissed and have the ability to generate future income.

In addition, increased misreporting costs of CEOs after clawback adoption may reduce the likelihood that CFOs will be pressured to misreport by CEOs. This may enable firms to deemphasize the role of CFOs as watchdogs for financial reporting integrity. Lastly, given that financial reporting integrity may be especially vulnerable to CFOs' propensity to misreport, firms have underincentivized CFOs' decision making duties prior to clawback adoption (Indjejikian and Matějka, 2009). Firms can more fully incentivize CFOs' decision making duties without immediately compromising financial reporting integrity as clawbacks lead to a significant increase in CFO misreporting costs. Given the prior findings on the positive relation between firm-initiated clawbacks and financial reporting integrity, we expect that firms perceive clawbacks as an effective deterrent against accounting manipulation by CFOs. Therefore, clawbacks may enable firms to provide stronger CFO bonus incentives tied to financial measures. In sum, subsequent to clawback adoption, firms can increase the CFO bonus incentives contingent on accounting measures as the likelihood of misreporting decreases with increases in misreporting costs. We formulate our hypothesis as follows:

H1: The adoption of firm-initiated clawbacks is associated with greater CFO bonus incentives tied to accounting measures.

3.3 Sample, Models and Data

3.3.1 Sample Selection

We start with an initial sample from 2007 to 2013 of 21,509 observations from the Corporate Library clawback database. The Corporate Library database provides information about the clawback adoption of Russell 3000 firms on the basis of SEC filings. We exclude financial firms as many of these firms in the US received federal bailout funds during the financial crisis and are subject to mandatory clawback provision. In addition, such firms may face additional provisions and limitations (e.g. limits on compensation), which may influence our findings (Chan et al., 2012, deHaan et al., 2013, Iskandar-Datta and Jia, 2013).

We collect data on firm fundamentals, executive compensation and corporate governance from Compustat, ExecuComp and ISS, data on accounting restatements and internal control weaknesses from Audit Analytics and data on class action lawsuits from the Securities Class Action Clearinghouse Database. Missing data leads to the exclusion of 13,411 observations. Our final sample is composed of 8,098 firm-year observations from 1,560 firms. For our main tests of annual bonus changes on annual changes in accounting performance, this yields 7,181 useable observations. We supplement our analyses on the full sample of publicly available data with analyses on a subset of our sample for which we hand-collect data from firms' proxy statements on the weights assigned to performance measures in CFO bonus plans.

From our full sample, 3,037 firm-year observations (38%) have a clawback policy in place while the remaining 5,061 observations (62%) have not adopted clawbacks. In Table 3.1, Panel A we report the adoption of clawback policies over the years. We find that the amount of firms having clawback policies in place has nearly tripled over our sample period, from 17% in 2007 up to 64% in 2013. Voluntary adoption of a clawback policy was rare before 2006. However, from the 2008 financial crisis onwards, public scrutiny over corporate practices and the anticipation of the DFA may lead firms to voluntarily install recoupment practices (Chan et al., 2012).

3.3.2 Empirical Models

In this section, we describe the models used to empirically test our hypothesis, as well as describe the main variables of interest. Two different models are used to examine the sensitivity of the CFO bonus to accounting performance for clawback adopters vis-à-vis non-adopters. The first model looks at the relationship between CFO bonuses and accounting performance using a changes specification (Cadman et al., 2010, deHaan et al., 2013, Hoitash et al., 2012). Changes specifications are considered to be less susceptible to confounding variables that are invariant over time.

In our second model, we take a general approach to address self-selection concerns and exploit the panel data structure by using a difference-in-difference (DID) methodology (Ashenfelter, 1978, Ashenfelter and Card, 1985) in combination with propensity score matching (PSM). Given that whether or not to adopt clawback provisions is a voluntary decision of firms, this may raise endogeneity concerns as adopters may differ in more respects from non-adopters than their clawback adoption decision. The focus is on omitted variables associated with the self-selection into the treatment (clawback adoption) that may also be associated with bonus incentives tied to financial measures. The DID-methodology distinguishes the effect of a clawback adoption from the effect of company characteristics typically associated with the adoption of clawbacks. The PSM-methodology addresses potential nonlinearities in control variables and composes a control group similar to the treatment firms (clawback adopters) except for the fact that the control firms do not adopt clawbacks during our sample period.

The regression equation for our first model is formulated as follows:

$$\begin{aligned}\Delta BONUS_{it} =& \alpha_0 + \alpha_1 \Delta ROA_{it} + \alpha_2 \Delta ROA_{it} * ADOPT_{it} + \alpha_3 ADOPT_{it} \\ &+ \sum \alpha_k CONTROLS_{it} + \gamma_t + \delta_j + \epsilon_{it}\end{aligned} \tag{3.1}$$

where ΔBONUS is defined as the change in the sum of the discretionary and non-discretionary CFO bonus in year t relative to year t-1, ΔROA denotes the change in the accounting performance defined as net income in year t divided by beginning of year's assets, in year t relative to year t-1, and ADOPT represents an indicator variable equal to one if the firm has a clawback policy in place in year t, zero otherwise. Besides a vector of control variables, we include industry-fixed effects based on two digit SIC codes (δ_j) and year-fixed effects (γ_t) to account for variation across industries and over time. The coefficient α_1 describes the relationship between ROA and the CFO bonus for firm-year observations that have not adopted a clawback (composed of all firm-year observations of non-adopters and the pre-adoption firm-year observations of adopters), the sum of (α_1+α_2) denotes the relationship between ROA and the CFO bonus for firms that have adopted a clawback policy (post-adoption firm-year observations of adopters), and α_2 represents the difference in the relationship between ROA and CFO bonuses for firms that have vis-à-vis firms that have not adopted a clawback. On the basis of our hypothesis, we expect $\alpha_2 > 0$.

The regression equation for our second (PSM-DID) model is formulated as follows:

$$\begin{aligned}\Delta BONUS_{it} =& \beta_0 + \beta_1 \Delta ROA_{it} + \beta_2 \Delta ROA_{it} * CLAW_i * AFTER_{it} + \beta_3 CLAW_i * AFTER_{it} \\ &+ \beta_4 CLAW_i + \beta_5 AFTER_{it} + \beta_6 \Delta ROA_{it} * CLAW_i \\ &+ \beta 7 \Delta ROA_{it} * AFTER_{it} + \sum \beta_k CONTROLS_{it} + \gamma_t + \delta_j + \epsilon_{it}\end{aligned} \tag{3.2}$$

where CLAW is an indicator variable equal to one if the firm adopts a clawback at one point during the sample period, zero otherwise, and AFTER is an indicator variable equal to one for firm-years in which clawback adopters and control firms have clawback provisions in place, zero otherwise (each control firm is assigned an artificial adoption year based on when it is matched to the treatment firm even though it has never implemented a clawback). The CLAW variable controls for permanent differences between treatment and control firms while the AFTER variable controls for trends common to both the treatment and control group (Roberts and Whited, 2012).

CLAW*AFTER represents the difference-in-difference estimator. Besides a vector of control variables, we include industry-fixed effects based on two digit SIC codes (δ_j) and year-fixed effects (γ_t) to account for variation across industries and over time.

The coefficient β_1 describes the relation between ROA and the CFO bonus for control firms prior to the treatment, the sum of coefficients (β_1+β_6) denotes the relation between ROA and the CFO bonus for adopters prior to the treatment, the sum of coefficients (β_1+β_7) describes the relation between ROA and the CFO bonus for control firms after the treatment, and the sum of coefficients (β_1+β_2+β_6+β_7) represents the relation between ROA and the CFO bonus for adopters after the treatment. The coefficient of interest is the change in the bonus incentives before versus after adoption for clawback adopters, relative to the change before versus after for control firms.[11] On the basis of our hypothesis, we expect $\beta_2 > 0$.

3.3.3 Propensity Score Matching

PSM mimics the random assignment in an experimental setting through the ex-post construction of a control group, that is, identifying a control group similar to the treatment group with the only key difference that the comparison group did not participate in the treatment (did not adopt a clawback) (Rosenbaum and Rubin, 1985). We employ a full-dimensional matching to ensure that firms that adopt or not adopt a clawback share the same pre-treatment characteristics. First, for our full sample, we run a logistic regression model that predicts the propensity score on the basis of determinants of clawback adoption identified by prior literature (Chan et al., 2012, 2015, deHaan et al., 2013). Specifically, we match on: i) firm fundamentals such as firm size (SIZE), leverage (LEVERAGE), performance volatility (SD_ROA), and market performance (MARKET-PERF); ii) on proxies for financial reporting quality such as internal control material weakness

[11] The key assumption of DID models is that the average change in outcome would have been the same for the treatment and control group in the absence of treatment. It is referred to as the parallel trend assumption as it requires the trends in the outcome prior to treatment to be the same for treatment and control group. Treatment and control groups should be balanced after propensity score matching as if groups differ significantly along observables, chances are that they may also differ along unobservables (Roberts and Whited, 2012). We assume that any unobserved factors affect clawback and non-clawback adopters in a similar way.

disclosures (ICMWD), accounting restatements (REST), and class action lawsuits (CAL); iii) on proxies for corporate governance quality such as the size of the board (BOARD_SIZE) and audit committee (AUCOM_SIZE); and iv) on proxies for CFO entrenchment such as CFO total compensation (CFO_TOTCOMP) and the ratio of CFO compensation to other executives' compensation (COMP_CFOvsEXEC). Industry and year indicators are included. All variables are measured over the prior fiscal year.

We start our matching procedure with our main sample of 1,560 firm observations. This sample contains 56 firms that adopt and subsequently discard clawback policies during our sample period. We remove them as it is ambiguous whether they classify as treatment or control firms. We delete firm observations when firms already have clawback policies in place for the first firm-year observation in our sample as we do not have sufficient information to determine their adoption year.[12] As we match on lagged variables, we remove firms where we have missing information for the determinants of clawback adoption in the pre-adoption year, which leads to the exclusion of 320 firms. This leaves 540 treatment and 644 control firms for the first-stage estimation. Untabulated results indicate that adopting firms are larger ($p<0.01$), are higher leveraged ($p<0.1$), and have larger boards ($p<0.05$). In addition, the ratio of CFO to other executives' compensation ($p<0.01$) and market performance ($p<0.1$) are negatively related to the likelihood of being a clawback adopter.[13]

In a second step, for each year, we match first-year adopters to firms in the same year that have not adopted a clawback during the sample period on the basis of lagged variables. Consistent with prior studies (e.g, Chan et al. (2012, 2015), Iskandar-Datta and Jia (2013)), we use nearest neighbor matching without replacement, i.e., each treatment and control firm appears only once in the sample. To ensure high matching quality we set a caliper of 0.2 times the standard deviation of the propensity score (Rosenbaum and Rubin, 1985). T-tests on differences in means of the

[12] We do not observe these firms adoption years but only that they have a clawback in the first firm-year observation in our sample. For example, for a firm that shows up for the first time in our sample in 2007 and has a clawback in place, this means that it may have adopted in 2007 or before 2007. This biases the matching procedure as we do not know when to measure pre-adoption characteristics for treatment and control firms (for similar reasoning: see deHaan et al. (2013), footnote 12).

[13] Our results are consistent with prior research that shows, amongst others, a positive association for firm size and leverage, and a negative association for executive power (deHaan et al., 2013).

matching variables indicate that matching was successful in achieving covariate balance as no significant differences exist between the treatment and control group for all observed covariates. Of the 540 adopting firms that can be used for matching, 195 drop out due to insufficient matching quality, resulting in 345 unique adopters and 345 non-adopters. This results in 3,626 firm-year observations for hypothesis testing of the PSM-DID model.

3.3.4 Measurement of Control Variables

All variables are described in Appendix C. Firm size, growth opportunities, and stock market performance are typically perceived to influence executive compensation (Cadman et al., 2010, Carter et al., 2009) and therefore we include those firm-level variables in the control function of the empirical models. Firm size is measured by the natural logarithm of the book value of total assets (SIZE). Growth opportunities (GROWTH) are measured by the market value of equity divided by the book value of equity. Stock market performance (MARKETPERF) is measured by the change in the market value of equity in the respective year, scaled by the end-of-year market value of the prior year, adjusted by the value weighted market performance.

Furthermore, we include measures of firm complexity and financial condition that has been typically used in prior compensation literature (e.g., Armstrong et al. (2010)). We include the degree of diversification in different business segments (BUS_SEG) measured as segment sales over firm total sales squared summed over all segments a firm operates in, and we include firm age (FIRM_AGE) measured as the natural logarithm of the number of years a firm exists in the COMPUSTAT database. To control for the influence of a firm's financial condition on executive compensation, we include leverage (LEVERAGE) measured as the current plus long-term debt divided by current book value of total assets. In addition, we measure earnings volatility (SD_ROA) as the standard deviation of the past five years return on assets. Due to CFOs' fiduciary responsibilities, accounting misstatements can influence their compensation. We control for accounting restatements (LAG_REST) in the prior year. Likewise, we also control for class action filings in the prior year (LAG_CAL).

Finally, we incorporate a set of variables in our control vector to capture governance and CFO characteristics (Bushman et al., 2004, Larcker et al., 2007). We measure board size as the number of board members (BOARD_SIZE). In addition, we control for the fraction of outside directors on the board (PER_OUT_DIR), the average number of other boards outside directors serve on (BUSY_DIR), and the separation of the roles of CEO and chairman through an indicator variable equal to one if the CEO serves as the chairman on the board, zero otherwise (CEO_CHAIR). We develop a proxy for CFO power by measuring CFO tenure (TENURE). We build indicator variables to address the data availability for the governance variables (HAVE_CG).[14] Consistent with prior literature, we include levels of the control variables in our analyses.[15]

3.3.5 Descriptive Statistics

In Table 3.1, Panel B we report the summary statistics for the full sample and separately for clawback adopters and non-adopters. The mean bonus for a CFO in our full sample is about $422K. The average CFO bonus tied to financial measures represents about 18% of the total CFO compensation in a given year (BONUS_FINPM). Our sample firms report a mean ROA of 5% and face growth opportunities as indicated by a mean market-to-book ratio of 2.35. On average, our CEOs have a longer tenure relative to the CFOs and the average CFO works almost four years in her current position. Our sample firms on average finance about 20 percent of the assets through debt and 11% of the observations have at least one internal control material weakness reported during the prior 5 years. Also, 11% of the firms had a restatement in the prior year and 2% had a class action filing in the past year.

We report summary statistics separately for clawback adopters versus non-adopters. An indicator variable (CLAW) is defined equal to one if a firm adopts a clawback during the sample period, zero otherwise. Difference tests are performed based on t-tests and Wilcoxon rank-sum tests. We

[14] The indicator variable HAVE_CG equals one if data is available in the ISS database for BOARD_SIZE, PER_OUT_DIR, BUSY_DIR and EXEC_CHAIR, zero otherwise. We set the missing data for the remaining observations to zero (e.g., deHaan et al. (2013)).

[15] The inclusion of changes (instead of levels) of our control variables does not affect our inferences.

find that compared to non-adopters, adopting firms have a significantly higher CFO bonus. In addition, adopters have a larger book value of assets, operate in more business segments, and are more highly leveraged. We also find that clawback adopters had less internal control material weakness disclosures, have lower abnormal accruals, and some evidence that suggests that adopters have more class action filings and fewer restatements. In general, the sample characteristics are in line with prior research (Chan et al., 2012, deHaan et al., 2013).

3.4 Empirical Findings

3.4.1 Main Analysis

In Table 3.2, Panel A and Table 3.2, Panel B we report the regression estimates for the hypothesis tests. Table 3.2, Panel A provides the results for the model (with ΔBONUS as dependent variable) described by equation (1), while Table 3.2, Panel B reports the findings for the PSM_DID model described by equation (2). We report t-statistics based on robust regressions that exclude observations with Cook's D > 1 and subsequently performs Huber iterations followed by biweight iterations. Robust regressions outperform winsorizing or truncation techniques on outlier and leverage point detection and produce more accurate results due to the processing of influential observations (Leone et al., 2015).[16] We control for firm characteristics, corporate governance characteristics, CFO characteristics, as well as for industry- and year- effects.

Overall, the results indicate that clawback adoption is associated with greater CFO bonus incentives contingent on accounting measures. For Table 3.2, Panel A the coefficient on ΔROA that reflects the relation between accounting performance and the CFO bonus for those observations

[16] While many accounting studies winsorize or truncate the data, robust regressions use a sophisticated approach to maximally exploit the information within the data. Only points with high bad leverage points and vertical outliers (identified by Cook's D > 1) are deleted and remaining potentially influential observations will be downward weighted in an iterative process, to avoid bias of the fitted regression line and therefore the regression estimates. Verardi and Cox (2009) discuss the technical application of robust regressions in Stata. Leone et al. (2015) discuss the application of robust regressions in the accounting literature.

Table 3.1: Descriptive Statistics

Panel A: Frequency of clawback adoption across years

Year	Firms without Clawback policy in place	Firms with Clawback policy in place
2007	808 (83%)	171 (17%)
2008	1,019 (80%)	255 (20%)
2009	867 (70%)	367 (30%)
2010	747 (62%)	458 (38%)
2011	642 (57%)	484 (43%)
2012	613 (49%)	640 (51%)
2013	365 (36%)	662 (64%)
Total	5,061 (62%)	3,037 (38%)

Panel B: Summary statistics (full sample and by clawback adoption) of all variables included in the analyses

Variables	N	Full Sample			CLAW=0		CLAW=1	
		Mean	Median	Std. Dev.	Mean	Med.	Mean	Med.
BONUS	8,098	422.7***	264.1***	652.5	304.6	185.1	494.3	326.2
ΔBONUS	7,181	13.14	3.85	504.9	15.2	2.27	12.8	5.10
FINPM	1,784	78.3	80	22.8	78.8	85	78.2	80
BONUS_FINPM	1,784	0.18*	0.16**	0.13	0.19	0.15	0.18	0.16
ROA	8,098	0.05***	0.05	0.10	0.046	0.05	0.052	0.05
ΔROA	7,181	0.00	0.00	0.09	-0.00	0.00	0.001	0.000
SIZE	8,098	7.54***	7.43***	1.58	6.85	6.69	7.98	7.93
GROWTH	8,098	2.35	2.08	35.76	2.44	2.08	2.28	2.07
MARKETPERF	8,098	0.09**	0.00	0.59	0.10	0.00	0.08	-0.01
BUS_SEG	8,098	0.54***	0.54***	0.15	0.57	0.68	0.51	0.54
LEVERAGE	8,098	0.20***	0.19***	0.19	0.17	0.12	0.22	0.20
LAG_CAL	8,098	0.02	0.00***	0.13	0.017	0.00	0.020	0.00
LAG_REST	8,098	0.11**	0.00**	0.31	0.12	0.00	0.11	0.00
FIRM_AGE	8,098	3.17***	3.81***	0.68	2.99	2.94	3.27	3.26
SD_ROA	8,098	0.05***	0.05***	0.05	0.06	0.05	0.05	0.05
TENURE	8,098	3.48***	3.00**	1.91	3.42	3.00	3.52	3.00
BOARD_SIZE	8,098	6.82***	8.00***	4.27	5.51	7.00	7.51	9.00
PER_OUT_DIR	8,098	0.60***	0.75***	0.35	0.51	0.70	0.64	0.78
BUSY_DIR	8,098	0.64***	0.60***	0.56	0.48	0.38	0.73	0.75
CEO_CHAIR	8,098	0.42***	0.00***	0.49	0.36	0.00	0.44	0.00
HAVE_CG	8,098	0.75***	1.00***	0.43	0.68	1.00	0.78	1.00
ΔEQUITY_HOLD	3,811	174.2	146.2**	17,449	220.1	140.3	129.9	153.8
RET	3.811	0.15	0.08	0.64	0.16	0.08	0.14	0.08
REL_CEOPOWER	7,177	1.59	1.25	1.34	1.57	1.25	1.61	1.25
ICMWD	7,181	0.11***	0.00***	0.31	0.13	0.00	0.10	0.00
ABN_ACCR	5,684	0.05***	0.03**	0.04	0.05	0.03	0.04	0.03
REL_AUCOMPOWER	5,611	1.25***	1.11***	0.95	1.01	0.96	1.38	1.24

Table 3.1, Panel A shows the distribution of clawback adopters across years. Table 3.1, Panel B shows the summary statistics of the main sample. Difference tests are based on t-tests and Wilcoxon rank-sum (Mann-Whitney) tests of subsamples of firms that adopt clawbacks during our sample period (CLAW=1) versus firms that do not (CLAW=0). ***, **, * corresponds to 1%, 5%, and 10% significance levels (two-tailed). Appendix C provides variable definitions.

Table 3.2: CFO bonus incentives contingent on financial measures and clawback adoption

Panel A: Full Sample Model

DV=ΔBONUS		Predicted sign	Coefficient	t-statistics
Intercept	α_0		-2.726	-0.26
ΔROA	α_1	+	196.4***	6.96
ΔROA*ADOPT	α_2	+	238.7***	3.89
ADOPT	α_3		-2.34	-0.44
SIZE			6.68***	3.13
MARKETPERF			55.35***	11.34
MARKETPERF*ADOPT			37.62***	4.31
GROWTH			-0.094*	-1.69
BUS_SEG			4.96	0.32
FIRM_AGE			3.48	0.86
LEVERAGE			-25.38*	-1.91
SD_ROA			-30.40	0.71
LAG_REST			-9.59	-1.44
LAG_CAL			76.88***	4.89
TENURE			-2.37*	-1.74
BOARD_SIZE			-2.72*	-1.80
PER_OUT_DIR			-1.76	-0.07
BUSY_DIR			2.35	0.39
CEO_CHAIR			4.41	0.84
HAVE_CG			24.03	1.06
Industry and year effects			Yes	
F-test ($\alpha_1 + \alpha_2$)			62.85***	
F-Statistic			11.63***	
R-squared			0.11	
N			7,181	

Table 3.2, Panel A reports regression estimates from robust regressions of the following model:

$$\Delta BONUS_{it} = \alpha_0 + \alpha_1 \Delta ROA_{it} + \alpha_2 \Delta ROA_{it} * ADOPT_{it} + \alpha_3 ADOPT_{it} + \sum \alpha_k CONTROLS_{it} + \gamma_t + \delta_j + \epsilon_{it}$$

T-statistics are based on robust regressions. ***, **, * corresponds to 1%, 5%, and 10% significance levels (one-tailed when the coefficient sign is predicted, two-tailed otherwise). Robust regression dropped one observation during the estimation of the regression coefficients for the full sample model. Variables are defined in Appendix C. Industry effects based on two digit SIC codes and year fixed effects are included.

Panel B: PSM-DiD Model

DV=ΔBONUS		Predicted sign	Coefficient	t-statistics
Intercept	β_0		-40.75	-1.26
ΔROA	β_1	+	223.9***	3.31
ΔROA*CLAW*AFTER	β_2	+	206.2*	1.53
CLAW*AFTER	β_3		9.55	0.84
CLAW	β_4		-8.28	-0.93
AFTER	β_5		-9.11	-0.95
ΔROA*CLAW	β_6		9.75	0.11
ΔROA*AFTER	β_7		83.63	0.92
SIZE			3.66	1.18
MARKETPERF			62.0***	9.57
MARKETPERF*ADOPT			29.67***	2.61
GROWTH			0.02	0.15
BUS_SEG			21.83	1.10
FIRM_AGE			4.17	0.77
LEVERAGE			-0.97	-0.06
SD_ROA			76.01	1.24
LAG_REST			-11.59	-1.37
LAG_CAL			79.54***	3.52
TENURE			-2.30	-1.30
BOARD_SIZE			-4.46**	-2.17
PER_OUT_DIR			29.28	0.90
BUSY_DIR			-2.54	-0.33
CEO_CHAIR			4.08	0.62
HAVE_CG			16.21	0.55
Industry and year effects			Yes	
F-test ($\beta_1 + \beta_2 + \beta_6 + \beta_7$)			46.00***	
F-Statistic			7.28***	
R-squared			0.14	
N			3,626	

Table 3.2, Panel B reports regression estimates from robust regressions of the following model:

$$\begin{aligned}\Delta BONUS_{it} =& \beta_0 + \beta_1 \Delta ROA_{it} + \beta_2 \Delta ROA_{it} * CLAW_i * AFTER_{it} + \beta_3 CLAW_i * AFTER_{it} \\ &+ \beta_4 CLAW_i + \beta_5 AFTER_{it} + \beta_6 \Delta ROA_{it} * CLAW_i \\ &+ \beta 7 \Delta ROA_{it} * AFTER_{it} + \sum \beta_k CONTROLS_{it} + \gamma_t + \delta_j + \epsilon_{it}\end{aligned}$$

T-statistics are based on robust regressions. ***, **, * corresponds to 1%, 5%, and 10% significance levels (one-tailed when the coefficient sign is predicted, two-tailed otherwise). Robust regression dropped no observation during the estimation of the regression coefficients for the PSM-DID model. Variables are defined in Appendix C. Industry effects based on two digit SIC codes and year fixed effects are included.

that have not adopted the clawback[17]is positive and significant (p<0.01). More importantly, the coefficient on ΔROA*ADOPT that represent the difference in the relation between accounting performance and CFO bonus between clawback adopters and non-adopters is also positive and significant (p<0.01). This implies that the adoption of a clawback policy is associated with greater bonus incentives tied to financial measures for CFOs. The sum of coefficients (α_1+α_2) that represents the relation between accounting performance and CFO bonuses for clawback adopters is also positive and significant (p<0.01). The PSM-DID model produces similar findings. That is, the coefficients on ΔROA and ΔROA*CLAW*AFTER are positive and significant (p<0.01 and p=0.06, respectively).

We repeat the analyses for a levels-specification (i.e., regressing BONUS on ROA). Our inferences are not affected (non-tabulated). For the full sample model, the coefficient on ROA and ROA*ADOPT are positive and significant (coefficients: 181, p<0.01; and 341, p<0.01, respectively). For the PSM-DID model, the coefficient on ROA and ROA*CLAW*AFTER are both positive and significant (coefficients: 250, p<0.01; and 265, p=0.02, respectively). In sum, the findings suggest that clawback adoption is associated with greater CFO bonus incentives tied to accounting measures. With respect to the economic significance, for the PSM-DID models, clawback adoption leads to a 91% increase in the accounting-based pay-for-performance sensitivity.[18]

Besides the primary role of accounting measures in executive bonus plans, some firms also include market performance in bonus plans. We also examine whether clawbacks are associated with greater CFO bonus incentives tied to stock market performance. We find evidence consistent with this. We document that the coefficient on MARKETPERF*ADOPT is positive and significant for both the full sample model and PSM-DID model (p<0.01). With regard to the control variables, we find some evidence that CFO bonuses are higher for larger firms. We also document that CFO bonuses are lower in the year that the firm has a class action filing, when the firm is highly leveraged, when CFOs have longer tenure, and when boards become bigger.

[17] Please note that the non-adopting observations are composed of firms that do not adopt during the sample period, as well as firm-year observations of adopters before the actual adoption.

[18] Prior studies report increases in the pay-for-performance sensitivities of about 131% following SOX and clawback adoption (Carter et al., 2009, deHaan et al., 2013).

We perform analyses to assess the robustness of our findings (non-tabulated). First, as we have repeated firm observations in our panel data, we address the non-independence of our observations by repeating the main analysis using OLS with Huber-White clustered standard errors that account for heteroskedasticity and autocorrelation. Second, we examine whether our results are robust to an alternative measure of accounting performance and use operating income scaled by beginning of year's assets (e.g., Carter et al. (2009)). Third, we distinguish between early and late adopters as late adopters may have adopted clawbacks because of institutional pressures (e.g., from investors), recommendations from legal advisors, or mimetic behavior. We classify firm-year observations as early adopting if the first year that the adoption of a clawback is disclosed is 2007, 2008, or 2009 which results in 26% of the adopters being classified as early adopters. Fourth, we also repeat the analyses while assuming full target updating where the current year target on accounting performance equals the realization of the prior year accounting performance (Carter et al., 2009). This implies a levels-on-changes model (i.e., a regression of BONUS on ΔROA). Our findings from these robustness analyses are in line with our prior inferences.

3.4.2 Explicit Approach

In the prior analyses, we estimated the degree to which CFO are awarded bonus incentives tied to financial measures by regressing CFO bonuses on accounting performance. However, the actual performance measures used in CFO bonus contracts are unknown. Therefore, we validate our earlier findings by using an explicit approach that extracts information from firm proxy statements about, amongst others, the explicit weights assigned to financial performance measures in their bonus contracts. We restrict our sample to the firms in our original sample that are also incorporated in the S&P500 firms as our data must be hand-collected from the proxy statements and we expect disclosure quality to be higher for larger public firms (Lang and Lundholm, 1993). 395 S&P500 firms were in our original sample. For some observations, there was insufficient detail to extract the aggregate weight on financial performance measures in CFO bonus plans. 35 firm observations are completely removed from the sample. While we remove all observations for which incentive plans for CEOs only are discussed in the proxy statements, but retain firm-years in which CFO bonus plans are described to be similar to the bonus plans of CEOs or that of other executive officers.

Our final sample is composed of 1,784 firm-year observations.[19] [20] Almost all firm-year observations in our sample have financial measures in their CFO bonus contracts. The most commonly employed financial measures in CFO bonus plans are earnings per share, operating income and ROA. The average weight on financial measures in CFO bonus plans is 78%. The mean weight on financial measures shows a decrease in earlier years and an increase in later years of the sample period.[21] A simple t-test shows a significant increase in the aggregate weight on financial measures after clawback adoption (non-tabulated). Further, we also collected data on the use of non-financial performance measures in CFO bonus contracts. We find that in 40% (20%) [5%] of all CFO bonus contracts, non-financial measures related to general management (reporting and financing) [communication and teamwork] are part of the annual bonus plan. Our data shows that the incidence of general management measures in CFO bonus plans increases from 37% in 2007 to 42% in 2013, and reporting & financing measures appear more often in bonus contracts in 2013 (24%) than in 2007 (17%). The mean weight in general management (reporting and financing) is 30% (19%) for those firm-year observations that assigned a non-zero weight on those measures.

In order to assess the effect of clawback adoption on the use of financial measures, we conduct a PSM analysis with the 1,784 firm-years. In line with the finding that larger firms are more likely to adopt clawbacks, in our current sample 1,037 firm-year observations (58%) have a clawback policy in place while 747 firm-year observations (42%) have not adopted clawbacks.[22] Because we have fewer control observations in our current smaller sample relative to the original sample, we employ a full-sample matching with lagged values for the explanatory variables and industry and year effects as described in Section 3.3, but now match with replacement. That is, in order to have

[19] We only require information about aggregate weights on financial measures. Some firms solely incentivize CFOs on the basis of financial measures which corresponds to a weight of 100%.

[20] 191 (251) [247] 251 observations of the final sample are from 2007 (2008) [2009] 2010. In addition, 252 [315] 277 observations are from 2011 [2012] 2013.

[21] The weight on financial measures decreased from 79% in 2007, to 77% in 2011, and to 78% in 2013.

[22] The fraction of firms with clawback policies increased over our sample period (from 36% in 2007 to 52% in 2009, to 65% in 2011, and to 78% in 2013).

sufficient control firms available for the matching, we allow for the repeated use of control firms in the matching. The matching achieves covariate balance on all matching variables, and results in 94 unique pairs of treatment and control firms. With our matched sample of 1,037 firm-years, we examine the following two DID models:

$$\begin{aligned} FINPM_{it} =& \beta_0 + \beta_1 CLAW_i + \beta_2 AFTER_{it} + \beta_3 CLAW_i * AFTER_{it} \\ &+ \sum \beta_k CONTROLS_{it} + \gamma_t + \delta_j + \epsilon_{it} \end{aligned}$$

$$\begin{aligned} BONUS\_FINPM_{it} =& \beta_0 + \beta_1 CLAW_i + \beta_2 AFTER_{it} + \beta_3 CLAW_i * AFTER_{it} \\ &+ \sum \beta_k CONTROLS_{it} + \gamma_t + \delta_j + \epsilon_{it} \end{aligned}$$

where FINPM is defined as the percentage weight on financial performance measures in CFO bonus plans, and BONUS_FINPM is defined as the percentage of the CFO target bonus contingent on financial performance measures, scaled by total compensation (Indjejikian and Matějka, 2009). We cluster standard errors on firm and year level to take into account that we have repeated control firms in our analyses (deHaan et al., 2013).

Our findings are reported in Table 3.3. The results suggest that clawback adoption is associated with a greater weight on financial measures in CFO bonus plans. That is, the coefficients on CLAW*AFTER is positive and significant in the models explaining FINPM and BONUS_FINPM (p=0.03 and p=0.02). We have also repeated the analyses using our full sample of 1,784 firm-year observations. Our inferences are not affected. That is, the coefficient on ADOPT is positive and significant for both models (non-tabulated). In sum, we conclude that our current results corroborate our earlier findings.

3.4.3 CFO Bonus Plans versus Bonus Plans of other named Executives

Given the unique responsibilities of CFOs as the key executive officers responsible for the financial reporting process, the impact of clawback adoption may be more pronounced for CFOs relative to other executives. The monetary penalty associated with clawbacks in combination with the greater threat of dismissal may have a more marked effect on the misreporting costs of CFOs as with

Table 3.3: Percentage of CFO bonus contingent on financial measures and clawback adoption

		Predicted sign	DV=FINPM (t-statistics)	DV=BONUS_FINPM (t-statistics)
Intercept	β_0		159.8***	0.186***
			(10.24)	(3.28)
CLAW	β_1		-2.92	-0.023
			(-0.93)	(-1.34)
AFTER	β_2		-1.34	-0.017
			(-0.99)	(-1.14)
CLAW*AFTER	β_3	+	4.42**	0.036**
			(2.01)	(2.24)
Controls			Yes	Yes
Industry effects			Yes	Yes
F-Statistics			13.73***	7.28***
R-squared			0.27	0.21
N			1,037	1,037

Table 3.3 reports regression estimates from a OLS of the following two models:

$$FINPM_{it} = \beta_0 + \beta_1 CLAW_i + \beta_2 AFTER_{it} + \beta_3 CLAW_i * AFTER_{it} + \sum \beta_k CONTROLS_{it} + \gamma_t + \delta_j + \epsilon_{it}$$

$$BONUS\_FINPM_{it} = \beta_0 + \beta_1 CLAW_i + \beta_2 AFTER_{it} + \beta_3 CLAW_i * AFTER_{it} + \sum \beta_k CONTROLS_{it} + \gamma_t + \delta_j + \epsilon_{it}$$

T-statistics are based on OLS and are reported in parentheses. ***, **, * corresponds to 1%, 5%, and 10% significance levels (one-tailed when coefficient sign is predicted, two-tailed otherwise). Standard errors are clustered on a year and firm level. Variables are defined in Appendix C. Industry effects based on Fama French industry classification are included. FINPM and BONUS_FINPM are winsorized at the 1st and 99th percentile.

dismissal they will be less able to generate future income. In addition, firms that were reluctant to properly incentivize financial measures in CFO bonus plans given their key role in the financial reporting process may now rely on clawbacks to deter CFOs from exhibiting undesired behavior. Therefore, clawback adopters may now be able to adequately incentivize CFOs decision-making responsibilities without compromising their fiduciary responsibilities. Here, we examine whether we observe a stronger shift towards accounting measures following clawback adoption in CFO bonus plans, relative to the shift in the bonus plans of other named executives. We follow a procedure similar to Wang (2010) where we use non-CFO executive officers as a control group. We duplicate our firm-year observations for other identifiable non-CFO executive board members. We examine the following model:

$$\begin{aligned} \Delta BONUS_{it} =& \alpha_0 + \alpha_1 \Delta ROA_{it} + \alpha_2 \Delta ROA_{it} * ADOPT_{it} + \alpha_3 ADOPT_{it} \\ &+ \alpha_4 CFO_{it} + \alpha_5 CFO_{it} * \Delta ROA_{it} + \alpha_6 CFO_{it} * \Delta ROA_{it} * ADOPT_{it} \\ &+ \alpha_7 CFO_{it} * ADOPT_{it} + \sum \alpha_k CONTROLS_{it} + \gamma_t + \delta_j + \epsilon_{it} \end{aligned}$$

where CFO is an indicator variable equal to 1 if the executive is a CFO, zero otherwise. The coefficient α_2 represents the difference before versus after adoption for non-CFO executives. The sum of coefficients (α_2+α_6) reflects the difference before versus after adoption for CFOs. So, the coefficient α_6 represents the effect of clawback adoption for CFOs relative to non-CFOs. We expect that $\alpha_6 > 0$. The results are reported in Table 3.4.

The coefficient on ΔROA*ADOPT is positive and significant ($p<0.01$). This suggests that clawback adoption is associated with greater bonus incentives tied to financial measures for non-CFO executives. The coefficient of interest on ΔROA*ADOPT*CFO is positive and significant ($p<0.03$). This suggests that the increase in bonus incentives tied to financial measures is more pronounced for CFOs relative to other executives. So, in addition to the finding for non-CFO executives of a positive association between clawback adoption and bonus incentives tied to financial measures (deHaan et al., 2013), we also find this positive association to be more pronounced for CFOs relative to non-CFOs.

Table 3.4: CFO versus other named executives' bonus incentives and clawback adoption

DV=ΔBONUS		Predicted sign	Coefficient	t-statistics
Intercept	α_0		-4.56	-0.51
ΔROA	α_1	+	198.4***	12.22
ΔROA*ADOPT	α_2	+	177.0***	5.11
ADOPT	α_3		-3.55	-1.15
CFO	α_4		-0.16	-0.12
CFO*ΔROA	α_5		-4.79	-0.13
CFO*ΔROA*ADOPT	α_6	+	157.1**	1.94
CFO*ADOPT	α_7		6.12	1.09
Controls			Yes	
Industry and year effects			Yes	
F-test ($\alpha_2 + \alpha_6$)			20.74***	
F-test ($\alpha_5 + \alpha_6$)			4.37**	
F-Statistic			86.78***	
R-squared			0.18	
N			33,568	

Table 3.4 reports regression estimates from robust regressions of the following model:

$$\begin{aligned}\Delta BONUS_{it} =& \alpha_0 + \alpha_1 \Delta ROA_{it} + \alpha_2 \Delta ROA_{it} * ADOPT_{it} + \alpha_3 ADOPT_{it} \\ &+ \alpha_4 CFO_{it} + \alpha_5 CFO_{it} * \Delta ROA_{it} + \alpha_6 CFO_{it} * \Delta ROA_{it} * ADOPT_{it} \\ &+ \alpha_7 CFO_{it} * ADOPT_{it} + \sum \beta_k CONTROLS_{it} + \gamma_t + \delta_j + \epsilon_{it}\end{aligned}$$

T-statistics are based on robust regressions. ***, **, * corresponds to 1%, 5%, and 10% significance levels (one-tailed when coefficient sign is predicted, two-tailed otherwise). No observation is dropped in the robust regression procedure. We define the variables as follows: CFO = indicator variable equal to one if the named executive officer is CFO, zero otherwise. Remaining variables are defined in Appendix C. Industry effects based on two digit SIC codes and year fixed effects are included.

3.4.4 Performance-based versus Fraud-based Clawbacks

Until now, we treated clawback adopters as a homogeneous group. However, firms generally adopt either fraud-based clawbacks or performance-based clawbacks. Fraud-based clawbacks require misconduct to be triggered while performance-based clawbacks require material reporting mistakes. This is in line with the distinction between intentional (irregularities) and unintentional (errors) misstatements where irregularities are strongly associated with fraud-related class action lawsuits and errors are not (Hennes et al., 2008). The adoption of performance-based clawbacks may impose additional risk on CFOs if they have no perfect control over the clawback trigger. An increased risk exposure can lead to an increase in the risk premium and a decrease in performance-based pay. However, to the extent that the adoption of performance based clawbacks decreases the likelihood of both intentional and unintentional misstatements, and hence increases the financial reporting quality, it may increase the pay-for-performance sensitivity (deHaan et al., 2013). Our regression model is formulated as follows:

$$
\begin{aligned}
\Delta BONUS_{it} = {} & \beta_0 + \beta_1 \Delta ROA_{it} + \beta_2 \Delta ROA_{it} * CLAW_i * AFTER_{it} + \beta_3 CLAW_i * AFTER_{it} \\
& + \beta_4 CLAW_i + \beta_5 PB\_CLAW_i + \beta_6 PB\_CLAW_i * AFTER_{it} + \beta_7 AFTER_{it} \\
& + \beta_8 \Delta ROA_{it} * CLAW_i + \beta_9 \Delta ROA_{it} * PB\_CLAW_i \\
& + \beta_{10} \Delta ROA_{it} * PB\_CLAW_i * AFTER_{it} + \beta_{11} \Delta ROA_{it} * AFTER_{it} \\
& + \sum \beta_k CONTROLS_{it} + \gamma_t + \delta_j + \epsilon_{it}
\end{aligned}
$$

where PB_CLAW is an indicator variable equal to one if the firm will adopt performance-based clawback during the sample period, zero otherwise.[23] The difference in CFO bonus incentives before versus after adoption for fraud-based clawbacks is given by the sum of coefficients (β_2+β_{11}) while the difference in bonus incentives before versus after adoption for performance-based clawbacks is given by the sum of coefficients (β_2+β_{10}+β_{11}). So, the difference before versus after adoption for the two types of clawback adopters is given by the coefficient on ΔROA*PB_CLAW*AFTER. On the basis of earlier findings of deHaan et al. (2013), we expect β_{10}

[23] In our main sample, 53% adopts a performance-based clawback.

> 0. Our findings are reported in Table 3.5. Here, the coefficient on ΔROA*PB_CLAW*AFTER is positive but insignificant. As a robustness analyses, we repeat our analyses as a levels-model (we replace ΔBONUS by BONUS and replace ΔROA by ROA in the above equation). Here, we find a positive and significant coefficient on ROA*PB_CLAW*AFTER (p=0.04). Overall, we find some evidence that suggests that the adoption of performance-based clawbacks is associated with a greater increase of CFO bonus incentives tied to financial measures.[24]

3.4.5 CFO Bonus Incentives for Positive versus Negative Accounting Performance

Because of bonus floors, many bonus plans react differently to gains and losses. As bonus schemes are designed to more strongly reward positive earnings changes, we allow in our empirical model for non-linearity in our basic model specifications. Further, we allow for a concave relation between bonus changes and positive changes in ROA, hereby allowing for an infinite number of kink points in the bonus-payoff function. We examine the following regression model (Carter et al., 2009):

$$
\begin{aligned}
\Delta BONUS_{it} =& \beta_0 + \beta_1 \Delta ROA^{+}_{it} + \beta_2 \Delta ROA^{+}_{it} * CLAW_i * AFTER_{it} \\
&+ \beta_3 \Delta ROA^{-}_{it} + \beta_4 \Delta ROA^{-}_{it} * CLAW_i * AFTER_{it} \\
&+ \beta_5 CLAW_i * AFTER_{it} + \beta_6 CLAW_i + \beta_7 AFTER_{it} \\
&+ \beta_8 \Delta ROA^{+}_{it} * CLAW_i + \beta_9 \Delta ROA^{-}_{it} * CLAW_i \\
&+ \beta_{10} \Delta ROA_{it} * AFTER_{it} + \beta_{11} AFTER_{it} + \sum \beta_k CONTROLS_{it} \\
&+ \gamma_t + \delta_j + \epsilon_{it}
\end{aligned}
$$

where ΔROA^{+} is defined as the natural logarithm of one plus the change in ROA from previous to current year if ΔROA ≥0, zero otherwise;[25] and ΔROA^{-} is defined as the change in ROA

[24] Note that the coefficient on ΔROA*CLAW*AFTER is positive and significant. This indicates that the adoption of fraud-based clawbacks is associated with greater CFO bonus incentives tied to financial measures relative to non-clawback adopters. However, as described in the text, we find mixed evidence on the differential CFO bonus incentives of performance-based clawback adopters, relative to fraud-based clawback adopters.

[25] We exclude taxes as CFOs may actively manage taxes and be rewarded for this.Erickson et al. (2013) find that firms increase their reported tax losses to obtain cash refunds from prior tax payments, and document how investors recognize the value inherent in tax-motivated loss shifting.

Table 3.5: Performance-based versus fraud-based clawback adoption and CFO bonus incentives

DV=ΔBONUS		Predicted sign	Coefficient	t-statistics
Intercept	β_0		-42.71	-1.31
ΔROA	β_1	+	287.8***	6.79
ΔROA*CLAW*AFTER	β_2	+	314.5***	3.02
CLAW*AFTER	β_3		-2.14	-0.18
CLAW	β_4		4.40	0.43
PB_CLAW	β_5		-26.49***	-2.68
PB_CLAW*AFTER	β_6		35.96***	2.80
AFTER	β_7		-8.35	-0.85
ΔROA*CLAW	β_8		-51.74	-1.00
ΔROA*PB_CLAW	β_9		-159.5	-1.63
ΔROA*PB_CLAW*AFTER	β_{10}	+	77.45	0.44
ΔROA*AFTER	β_{11}		-9.69	-0.20
Controls			Yes	
Industry and year effects			Yes	
F-Statistic			7.05***	
R-squared			0.14	
N			3,626	

Table 3.5 reports regression estimates from robust regressions of the following model:

$$\begin{aligned}\Delta BONUS_{it} =& \beta_0 + \beta_1 \Delta ROA_{it} + \beta_2 \Delta ROA_{it} * CLAW_i * AFTER_{it} + \beta_3 CLAW_i * AFTER_{it} \\ &+ \beta_4 CLAW_i + \beta_5 PB\_CLAW_i + \beta_6 PB\_CLAW_i * AFTER_{it} + \beta_7 AFTER_{it} \\ &+ \beta_8 \Delta ROA_{it} * CLAW_i + \beta_9 \Delta ROA_{it} * PB\_CLAW_i \\ &+ \beta_{10} \Delta ROA_{it} * PB\_CLAW_i * AFTER_{it} + \beta_{11} \Delta ROA_{it} * AFTER_{it} \\ &+ \sum \beta_k CONTROLS_{it} + \gamma_t + \delta_j + \epsilon_{it}\end{aligned}$$

T-statistics are based on robust regressions. ***, **, * corresponds to 1%, 5%, and 10% significance levels (one-tailed when coefficient sign is predicted, two-tailed otherwise). No observation is dropped in the robust regression procedure. We define the variables as follows: PB_CLAW = indicator variable equal to one if the firm will adopt performance-based clawback during the sample period, zero otherwise. Remaining variables are defined in Appendix C. Industry effects based on two digit SIC codes and year fixed effects are included.

from previous to current year if ΔROA <0, zero otherwise. About half of our sample has a ΔROA smaller than zero. In Table 3.6 we report the findings of this analysis. The difference before versus after adoption between non-adopters and the adopters with a positive change in accounting performance is given by the coefficient on $\Delta ROA^{+} * CLAW * AFTER$. This coefficient is positive and significant (p<0.01). So, our prior findings hold for the subsample of firms featuring positive accounting outcomes. The difference before versus after adoption between non-adopters and the adopters with a negative change in accounting performance is given by the coefficient on $\Delta ROA^{-} * CLAW * AFTER$. This coefficient is significant but smaller in magnitude (p<0.05). As expected, the coefficient on the main effects ΔROA^{+} is positive and significant (p<0.01). We also find that the coefficient on ΔROA^{-} is positive and significant (p<0.01). In sum, we document that the sensitivity of CFO bonuses to accounting performance increases after clawback adoption. In line with prior studies, we find that bonuses respond to positive and negative earnings changes, and that bonus compensation seems to be more responsive to positive earnings changes (deHaan et al., 2013).

3.4.6 CFO Equity Incentives

Besides bonus incentives, CFOs are incentivized through equity-based compensation. We examine whether the adoption of clawback policies is also associated with the provision of equity incentives to CFOs. We focus our analyses on the equity portfolio holdings. In line with our prior intuition, we expect that CFO equity holdings are more sensitive to stock market returns following clawback adoption. We examine the following regression model:

$$\begin{aligned}\Delta EQUITY\_HOLD_{it} =& \beta_0 + \beta_1 RET_{it} + \beta_2 RET_{it} * CLAW_i * AFTER_{it} + \beta_3 RET_{it} * CLAW_i \\ &+ \beta_4 RET_{it} * AFTER_{it} + \beta_5 CLAW_i * AFTER_{it} + \beta_6 CLAW_i \\ &+ \beta_7 AFTER_{it} + \sum \beta_k CONTROLS_{it} + \gamma_t + \delta_j + \epsilon_{it}\end{aligned}$$

where ΔEQUITY_HOLD is the change in the value of the stock option and stock portfolio (Jiang et al., 2010) and RET represents the stock market performance and denotes the percentage change

Table 3.6: CFO bonus incentives and clawback adoption for positive and negative performance

DV=ΔBONUS		Predicted sign	Coefficient	t-statistics
Intercept	β_0		-33.32	0.303
ΔROA^+	β_1	+	422.5***	4.18
ΔROA^+ *CLAW*AFTER	β_2	+	542.1***	2.57
ΔROA^-	β_3		369.2***	4.79
ΔROA^- *CLAW*AFTER	β_4		386.4**	2.01
CLAW*AFTER	β_5		6.93	0.55
CLAW	β_6		-4.95	-0.49
AFTER	β_7		-7.48	-0.78
ΔROA^+ *CLAW	β_8		-64.8	-0.42
ΔROA^- *CLAW	β_9		134.9	1.00
ΔROA*AFTER	β_{10}		-122.0	-1.56
AFTER	β_{11}		-7.48	-0.78
Controls			Yes	
Industry and year effects			Yes	
F-Statistic			7.73***	
R-squared			0.15	
N			3,626	

Table 3.6 reports regression estimates from robust regressions of the following model:

$$\begin{aligned}\Delta BONUS_{it} =& \beta_0 + \beta_1 \Delta ROA^+_{it} + \beta_2 \Delta ROA^+_{it} * CLAW_i * AFTER_{it} \\ &+ \beta_3 \Delta ROA^-_{it} + \beta_4 \Delta ROA^-_{it} * CLAW_i * AFTER_{it} \\ &+ \beta_5 CLAW_i * AFTER_{it} + \beta_6 CLAW_i + \beta_7 AFTER_{it} \\ &+ \beta_8 \Delta ROA^+_{it} * CLAW_i + \beta_9 \Delta ROA^-_{it} * CLAW_i \\ &+ \beta_{10} \Delta ROA_{it} * AFTER_{it} + \beta_{11} AFTER_{it} + \sum \beta_k CONTROLS_{it} \\ &+ \gamma_t + \delta_j + \epsilon_{it}\end{aligned}$$

T-statistics are based on robust regressions. ***, **, * corresponds to 1%, 5%, and 10% significance levels (one-tailed when coefficient sign is predicted, two-tailed otherwise). One observation is dropped in the robust regression procedure. We define the variables as follows: ROA^+ = earnings before taxes divided by beginning of the year assets if ROA≥0, zero otherwise; ROA^- = earnings before taxes divided by beginning of the year assets if ROA<0, zero otherwise; ΔROA^+ = one plus the natural logarithm of change in ROA from previous to current year if ΔROA≥0, zero otherwise; ΔROA^- = change in ROA from previous to current year if ΔROA<0, zero otherwise; ΔROA = change in earnings before taxes divided by beginning of the year assets. The remaining variables are defined in Appendix C. Industry effects based on two digit SIC codes and year fixed effects are included.

in the firm's stock price. In Table 3.7 we report the main results. The coefficient of interest, The coefficient of interest, RET*CLAW*AFTER, is positive and significant ($p<0.05$). This implies that clawback adoption is associated with increased sensitivity of the equity portfolio to stock market returns. Overall, the findings suggests that clawback adopters, in conjunction to providing greater bonus incentives tied to financial measures, also provide stronger equity incentives to their CFOs.

Table 3.7: CFO equity incentives and clawback adoption

DV=ΔEQUITY_HOLD		Predicted sign	Coefficient	t-statistics
Intercept	β_0		-772.9***	-3.48
RET	β_1	+	1,398***	21.86
RET*CLAW*AFTER	β_2	+	246.8**	2.07
RET*CLAW	β_3		-80.24	-0.95
RET*AFTER	β_4		-90.17	1.08
CLAW*AFTER	β_5		106.0	1.34
CLAW	β_6		-62.35	-1.08
AFTER	β_7		-14.55	-0.22
Controls			Yes	
Industry and year effects			Yes	
F-test $\beta_1 + \beta_2$			98.82***	
F-Statistics			32.71***	
R-squared			0.40	
N			3,811	

Table 3.7 reports regression estimates from robust regressions of the following model:

$$\begin{aligned}\Delta EQUITY\_HOLD_{it} =& \beta_0 + \beta_1 RET_{it} + \beta_2 RET_{it} * CLAW_i * AFTER_{it} + \beta_3 RET_{it} * CLAW_i \\ &+ \beta_4 RET_{it} * AFTER_{it} + \beta_5 CLAW_i * AFTER_{it} + \beta_6 CLAW_i \\ &+ \beta_7 AFTER_{it} + \sum \beta_k CONTROLS_{it} + \gamma_t + \delta_j + \epsilon_{it}\end{aligned}$$

T-statistics are based on robust regressions and are reported in brackets. ***, **, * corresponds to 1%, 5%, and 10% significance levels (one-tailed when coefficient sign is predicted, two-tailed otherwise). No observations are dropped in the robust regression procedures. Variables are defined in Appendix C. Industry effects based on two digit SIC codes and year fixed effects are included.

3.4.7 The Level and Structure of CFO Compensation

While the focus of this paper is on the effect of clawback adoption on the use of financial measures in CFO bonus plans, we follow prior literature on the effect of regulatory reforms on executive compensation (e.g., Carter et al. (2009), Chhaochharia and Grinstein (2009), deHaan et al. (2013)) and also examine the effect of clawback adoption on the level and structure of CFO compensation. Given the risks that CFOs of clawback adopters may now lose previously awarded compensation, firms may increase the fixed part of their compensation or alter the level of the variable compensation. Either of these may lead to changes in total compensation. Therefore, we examine the effect of clawback adoption (CLAW*AFTER) on CFO total compensation, CFO salary, CFO bonus, and CFO option awards while including our standard vector of control variables.[26] We find that clawback adoption has a significant positive effect on CFO salary, but we do not find significant effects for CFO total compensation, bonus, or option grants. Our finding on CFO salary seems to suggest that CFOs are rewarded for the additional risk that is imposed on them with the introduction of clawbacks by means of higher (fixed) salaries. Our finding corroborates prior research on the effect of the adoption of clawback policies on CEO salary levels (deHaan et al., 2013).

3.4.8 The Moderating Effect of the Firm's Susceptibility to Misreporting

In our final analysis, we exploit variation in firms' susceptibility to misreporting to examine how this moderates the relation between firm-initiated clawbacks and CFO bonus incentives tied to financial measures.[27] We, therefore, re-estimate our prior findings in subsamples for high and low susceptibility to misreporting. We expect that the association between accounting bonuses and

[26] Our results speak as well to the compensation mix as we include CFO total compensation as control variable in our tests explaining salary, bonus, and option awards. In addition, we add an indicator variable for CFO turnover as control in all tests because the level of compensation may include components from severance arrangements in the year of turnover. We also run additional tests excluding total compensation as a control to reflect the effect of clawbacks on the magnitude of the different compensation components. There we find that CLAW*AFTER is associated with greater stock grants.

[27] The number of observations is slightly smaller than for our main analyses because of missing values on the proxies for the susceptibility to misreporting. In those cases where we compose subsamples based on median splits, the subsamples are not perfectly balanced in size because of the decision to allocate observations with a median value to either the HIGH or LOW subsample. Our findings are similar in either case.

CFO bonuses will be less pronounced in the subsamples characterized by a high susceptibility to misreporting. More importantly for our hypothesis test, we expect that the association between the adoption of clawbacks and greater sensitivity of CFO bonuses to accounting performance is weaker for firms characterized by a greater susceptibility to misreporting. We expect the coefficients on ΔROA and ΔROA*ADOPT to be greater than zero for the subsamples characterized by a low susceptibility on misreporting. In addition, we test for significant differences in the coefficients on ΔROA and ΔROA*ADOPT between subsamples of firms characterized by high versus low susceptibility to misreporting. We use four proxies indicative of a firm's susceptibility to misreporting.

Our first proxy is internal control material weakness disclosures (ICMWD). We argue that firms with recent ICMWD are more susceptible to misreporting.[28] As ineffective internal controls indicate the susceptibility of the accounting system to manipulation, we expect adopters to be more reluctant to emphasize CFO bonus incentives contingent on accounting measures when they experienced greater internal control deficiencies. The LOW subsample is composed of firms without any ICMWD in the prior five years and the HIGH subsample features firms with at least one ICMWD in the prior five years (Hoitash et al., 2012).

We use the magnitude of absolute abnormal accruals (ABN_ACCR) as our second proxy for firms' susceptibility to misreporting based on the assumption that the accounting system is more susceptible to misreporting when earnings deviate from underlying cash flows (Dichev et al., 2013, Indjejikian and Matějka, 2009). We expect that adopters deemphasize CFO bonus incentives tied to accounting measures when they have greater abnormal accruals. ABN_ACCR denotes the average value of absolute performance adjusted abnormal accruals over the last two years. The subsample HIGH (LOW) denotes those firm-year observations with an absolute value on the

[28] Prior literature documents that ICMW are associated with inadequate accounting resources, a lack of qualified accounting personnel, lack of segregation of duties, deficiencies in revenue-recognition policies, deficiencies in the period-end reporting process and accounting policies, inappropriate account reconciliation, and inadequate internal controls in subsidiaries (Ge and McVay, 2005). They are associated with greater abnormal accruals and lower accrual quality (Ashbaugh-Skaife et al., 2008).

performance adjusted abnormal accruals equal or higher (lower) than the sample-median of the abnormal accruals.

We use power of the CEO relative to the power of the CFO (REL_CEOPOWER) as our third proxy for the susceptibility to misreporting. Prior research indicates that powerful CEOs may pressure CFOs into accounting manipulation (Feng et al., 2011, Friedman, 2014).[29] REL_CEOPOWER is measured by CEO tenure at the current firm divided by CFO tenure, such that higher values indicate higher relative CEO power (Badolato et al., 2014, Bedard et al., 2014, Friedman, 2014). The subsample HIGH (LOW) denotes firm-year observations with relative CEO power equal or higher (lower) than the sample-median.

Our final proxy represents the power of the audit committee relative to the power of the CFO (REL_AUCOMPOWER). Besides the CFO, also audit committees have an influence over financial reporting quality as they can constrain earnings management in the form of accounting irregularities and abnormal accruals (Badolato et al., 2014, Farber, 2005, Klein, 2002). Beck and Mauldin (2014) show how CFOs exert greater influence when audit committees are less powerful. We define REL_AUCOMPOWER as the product of the audit committee financial expertise and prestige, divided by CFO prestige. Here, we assume that CFOs typically possess financial expertise. We measure the numerator as the natural logarithm of the number of financial experts on the audit committee and the number of outside board seats of audit committee members. It is argued that a greater number of outside board seats indicates greater status and prestige of audit committee members (Badolato et al., 2014, Erkens and Bonner, 2012). The denominator is the sum of one plus an indicator variable equal to one if the CFO has a board position, zero otherwise (Bedard

[29] This coincides with the literature on business-unit level financial controllers who act as business partners for business-unit managers, but also (based on their functional responsibilities) act as gatekeepers and provide local information to corporate control. Indjejikian and Matejka (2006) show how an increased focus on supporting the business-unit manager goes at the expense of their functional role as gatekeeper.

et al., 2014).[30] The subsample HIGH (LOW) denotes firm-year observations with relative audit committee power equal or higher (lower) than the sample-median.[31]

Our findings are reported in Table 3.4.8.[32] First, we find a positive association between accounting performance and CFO bonuses prior to clawback adoption, as indicated by a positive and significant coefficient for α_1. A test for significant differences for the coefficient α_1 across subsamples of high vs. low susceptibility of misreporting indicates that, in most cases, a greater susceptibility to misreporting is associated with less CFO bonus incentives tied to financial measures prior to clawback adoption.[33] Specifically, we find the relation between accounting performance and CFO bonuses to be weaker in the high ICMWD subsample, the high abnormal accruals subsample, and in the low relative audit committee power subsample.

When we turn to the effect of adoption of clawback policies on CFO bonus incentives, we find the positive effect to be less pronounced in those subsamples characterized by a high susceptibility to misreporting. We find that the coefficient α_2 is significantly smaller in the subsamples of high ICMWD, high abnormal accruals, and high relative CEO power. In sum, we find evidence to suggest that clawback adopters characterized by a greater susceptibility to misreporting emphasize the fiduciary role of CFOs as gatekeeper for financial reporting integrity by awarding them with relatively smaller increment in bonus incentives.

[30] So, the denominator is equal to one in all cases as CFOs have per definition financial expertise and is equal to two if CFOs have a board position as well.

[31] On average, 10% of the CFOs have a board position at their firm. The first quartile, the mean, and the third quartile of the number of audit committee members with financial expertise is 1, 1.83, and 3, respectively. Audit committees on average have 3.65 outside board seats with a first (third) quartile value of 2 (5) (non-tabulated).

[32] Our tests for ΔROA and ΔROA*ADOPT are based on two-directional tests as we cannot a priori say whether clawbacks are associated with greater accounting-based pay-for-performance sensitivities in the subsample with a high susceptibility to misreporting. Difference tests between subsamples are one-directional.

[33] The tests (one-tailed) for significant differences of ΔROA*ADOPT across subsamples are based on the significance of the coefficients on ΔROA*ADOPT when we interact this variable with ICMWD and ABN_ACCR, while at the same time also interacting all control variables with ICMWD and ABN_ACCR. The same procedure is used when testing for a significant difference of the main effect ΔROA across subsamples.

Table 3.8: The moderating effect of susceptibility to misreporting on the relation between clawback adoption and CFO bonus incentives

DV=ΔBONUS		ICMWD		Abnormal accruals		Relative CEO power		Relative audit committee power	
		HIGH	LOW	HIGH	LOW	HIGH	LOW	HIGH	LOW
Intercept	α_0	-97.29	-44.57*	-116.8***	-30.38	-50.07	-68.04**	7.401	275.5***
		(-1.46)	(-1.73)	(-3.12)	(-0.72)	(-1.14)	(2.17)	(0.09)	(3.16)
ΔROA	α_1	146.4**	205.4***	185.7***	360.0***	199.9***	195.6***	461.3***	273.0***
		(2.39)	(6.51)	(5.34)	(5.12)	(4.59)	(5.25)	(5.63)	(5.95)
ΔROA*ADOPT	α_2	-112.7	382.5***	130.2*	576.9***	51.10	411.3***	339.5**	177.7*
		(-0.93)	(5.43)	(1.74)	(4.02)	(0.55)	(4.92)	(2.29)	(1.92)
ADOPT	α_3	-3.991	-1.731	-4.379	-1.313	-2.51	-3.35	-9.07	1.14
		(-0.27)	(-0.31)	(-0.60)	(-0.15)	(-0.33)	(-0.56)	(-0.91)	(0.17)
Controls		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry and year effects		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
F-test ($\alpha_1 + \alpha_2$)		0.10	85.75***	22.13***	54.36***	26.22***	64.62***	40.21***	30.98***
F-Statistic		5.89***	40.90***	5.66***	6.89***	9.27***	8.46***	5.90***	6.30***
R-squared		0.32	0.36	0.13	0.15	0.11	0.15	0.16	0.15
N		795	6,386	2,842	2,842	3,628	3,549	2,688	2,923
Diff. α_1 across high vs. low subsamples		α_1 HIGH < α_1 LOW (*)		α_1 HIGH < α_1 LOW (**)		No significant difference in α_1		α_1 HIGH > α_1 LOW (**)	
Diff. α_2 across high vs. low subsamples		α_2 HIGH < α_2 LOW (***)		α_2 HIGH < α_2 LOW (***)		α_2 HIGH < α_2 LOW (**)		No significant difference in α_2	

Table 3.4.8, reports regression estimates from a robust regression of the following model:

$$\Delta BONUS_{it} = \alpha_0 + \alpha_1 \Delta ROA_{it} + \alpha_2 \Delta ROA_{it} * ADOPT_{it} + \alpha_3 ADOPT_{it} + \sum \alpha_k CONTROLS_{it} + \gamma_t + \delta_j + \epsilon_{it}$$

in subsamples of high versus low susceptibility of misreporting. We use the following four proxies for misreporting: ICMWD is defined as the number of years in which firm reported internal control deficiencies over the prior 5 years. The subsample HIGH (LOW) denotes those firm-year observations where at least one (no) internal control deficiency is reported during the prior 5 years. ABN_ACCR is defined as the average value of absolute performance adjusted abnormal accruals over the last two years. The subsample HIGH (LOW) denotes those firm-year observations with an absolute value on the performance adjusted abnormal accruals equal or higher (lower) than the sample-median of the abnormal accruals. Relative CEO power (REL_CEOPOWER) is defined as the CEO tenure divided by the CFO tenure. The subsample HIGH (LOW) denotes those firm-year observations with a relative CEO power equal or higher (lower) than the sample-median. Relative audit committee power (REL_AUCOMPOWER) is the product of audit committee financial expertise and prestige, divided by CFO prestige: (ln(1+AU_BOARD)*ln(1+AU_FINEXP))/(1+CFO_BOARD). The subsample HIGH (LOW) denotes those firm-year observations with a relative audit committee power equal or higher (lower) than the sample-median. We expect α_1 >0 and α_2 >0 for the subsamples characterized by a low susceptibility to misreporting. The tests (one-tailed) for significant differences of α_1 and α_2 across the HIGH versus LOW subsamples are based on the significance of the coefficients on ΔROA and ΔROA*ADOPT while we interact both with ICMWD, ABN_ACCR, REL_CEOPOWER, and REL_AUCOMPOWER, respectively, while at the same time also interacting all control variables with ICMWD, ABN_ACCR, REL_CEOPOWER, and REL_AUCOMPOWER, respectively. T-statistics are based on robust regressions and are reported in brackets. ***, **, * corresponds to 1%, 5%, and 10% significance levels (one-tailed when the coefficient sign is predicted, two-tailed otherwise). For ICMWD, one (one) observation is dropped in the robust regression procedure for the high (low) subsample. For abnormal accruals, one (zero) observation(s) are dropped in the robust regression procedure for the high (low) subsample. For relative CEO power, two (zero) observations are dropped in the robust regression procedure for the high (low) subsample. For relative audit committee power, no observations are dropped in the robust regression procedure for both subsamples. Remaining variables are defined in Appendix C. Industry effects based on two digit SIC codes and year fixed effects are included.

As additional non-tabulated robustness analyses, we repeat the analyses with the explicit weights on financial measures in CFO bonus contracts as the dependent variable (FIN_PM and BONUS_FINPM). As we discussed in the prior section, we hand-collected this data from the proxy statements which leads to a final sample of 1,784 firm-year observations. Given that we investigate the cross-sectional variation across clawback adopters, we use our full sample on the hand-collected data and subsequently test whether the coefficient on ADOPT is significantly different across subsamples of high vs. low susceptibility to misreporting.[34] Despite the reduced power in this analyses, our findings corroborate some of our earlier findings. When we use FIN_PM as the dependent variable, we find the effect of clawback adoption to be significantly stronger in the subsample of high relative audit committee power ($p<0.05$). When we turn to BONUS_FINPM, we find stronger effects for clawback adopters in the subsample of high relative audit committee power and the subsample of low relative CEO power ($p<0.05$) (non-tabulated). All other tests comparing the coefficient on ADOPT across subsamples yield insignificant differences. In sum, our findings suggest that firms take the risk of misreporting into account when they design CFO bonus plans. That is, we find the positive effect of adoption of clawback policies on CFO bonus incentives to be less pronounced in subsamples characterized by a high susceptibility to misreporting.

3.5 Summary and Conclusions

CFOs have important decision making duties, while they are also acknowledged to have a focal role in the financial reporting process. Recent studies compare CEO and CFO incentives and provide empirical evidence that especially CFO incentives are associated with accounting manipulation. This may (partly) represent an unavoidable cost for firms as they have to trade-off the fiduciary duties against the decision-making duties of CFOs. Given that clawbacks are documented to increase the misreporting costs, we examine whether adoption of clawback provisions is associated with greater CFO bonus incentives tied to accounting measures. We find clawback adoption to be

[34] The regression model is: FIN_PM_{it} or $BONUS\_FINPM_{it} = \alpha_0 + \alpha_1 ADOPT_{it} + \sum \alpha_k CONTROLS_{it} + \gamma_t + \delta_j + \epsilon_{it}$.

associated with greater CFO bonus incentives tied to accounting measures, and find the increase in bonus incentives to be more pronounced for CFOs relative to other named executive officers (NEOs). Interestingly, we find the greater bonus incentives for CFOs to be moderated by companies' susceptibility to misreporting.

As for any study, our study is subject to limitations. First, given that firms self-select into the clawback adoption, it may be argued that firms that adopt clawbacks may differ in other respects from non-adopters than solely the adoption in itself. We try to address this by combining a difference-in-difference methodology (DID) in combination with propensity score matching (PSM). Second, our analyses are based on the implicit approach where we regress CFO bonus outcomes on accounting performance. This is informative of the bonus incentives tied to financial measures; however, in this approach also increases in target bonuses without a change in the weight on financial measures will also lead to an increase of pay-for-performance sensitivity. For a subset of our sample we also manually collect data about the incentive weights in CFO bonus plans. The findings from the analysis using the incentive weights are also in line with our hypothesis; confirming our previous notion that CFO incentives change as a consequence of clawback adoption. Third, financial reporting integrity is the product of the propensity to misreport of different executives where we focus on the CFO given their focal role in financial reporting. But increased misreporting costs of other executives, such as CEOs, and their propensity to misreport may also influence the degree to which firms can increase the pay-for-performance sensitivity of CFOs. Likewise, prior findings of an increased pay-for-performance sensitivity of CEOs may be driven by increased misreporting costs of CFOs. Our finding that clawbacks lead to a more pronounced increase in the pay-for-performance sensitivity for CFOs relative to NEOs substantiates the prior intuition that CFOs and their incentive compensation design play an important role in safeguarding firms' financial reporting integrity.

Finally, mandatory clawback adoption is pending. On July 2015, the SEC issued Proposed Rule 10D-1 that directs stock exchanges to establish listing standards requiring firms to adopt a clawback policy.[35] The rules has not been finalized yet following the comment period. On April 2017, the House Financial Services Committee released a discussion draft of the Financial CHOICE Act aimed at revising some parts of DFA. The CHOICE Act does not seem to affect clawbacks that much. Section 849 of this CHOICE act limits the clawback obligation to only the executive officers who had control or authority over the financial reporting resulting in the restatement. This only underlines our focus on CFOs and CFO incentive compensation design following the implementation of clawback policies. Irrespective of the final implementation of this regulation, the trend towards voluntary adoption continues. By mid-2015, the time the SEC issued Proposed Rule 10D-1, approximately 76% of the S&P 1500 had a voluntary clawback provision in place (Bakke et al., 2016). This indicates that firm-initiated clawback provisions are perceived to be value-enhancing by shareholders and boards.

[35] Under Proposed Rule 10D-1, clawbacks are triggered by accounting restatements, would apply to incentive-based compensation that were awarded erroneously up to three years before the restatement, and would apply irrespective of an executive's responsibility for the restatement.

Appendix C

Variable Description

Variables are constructed as follows:

BONUS	Sum of discretionary and nondiscretionary annual CFO bonus.
ΔBONUS	Change in sum of discretionary and nondiscretionary annual CFO bonus.
FINPM	Percentage of CFO bonus contingent on financial performance measures.
BONUS_FINPM	Percentage of CFO bonus contingent on financial performance measures, scaled by total compensation.
ROA	Net income divided by lagged total assets.
ΔROA	Change in ROA from previous to current year.
CLAW	Indicator variable equal to one if the firm will adopt clawback policy during the sample period, zero otherwise.
AFTER	Indicator variable equal to one if firm has adopted a clawback policy for the respective year, zero otherwise. For non-adopters, it is equal to one for the same years as for the matched clawback adopter.
ADOPT	Indicator variable equal to one if the firm has adopted clawback policy for the respective year, zero otherwise.
SIZE	Natural logarithm of total assets.
GROWTH	Market value of equity divided by book value of equity.
MARKETPERF	Change in market value of equity in a year, scaled by the end-of-year market value of the prior year, adjusted by value weighted market performance.

BUS_SEG	Firms segment sales over firm total sales squared, summed over all segments a firm operates in.
LEVERAGE	Long term plus current debt, divided by book value of total assets.
LAG_CAL	Indicator variable equal to 1 if a firm has a class action filing in the past year, 0 otherwise, as reported in the Stanford Securities Class Action Clearinghouse database.
LAG_REST	Indicator variable equal to 1 if a firm restates earning in the past year due to accounting errors or irregularities, zero otherwise, as reported in Audit Analytics.
FIRM_AGE	Natural logarithm of number of years a firm exists in Compustat.
SD_ROA	Standard deviation of ROA.
TENURE	Tenure of the current CFO as reported in Execucomp.
BOARD_SIZE	Number of directors serving on the board as reported in ISS.
PER_OUT_DIR	Fraction of outside directors serving on the board as reported in ISS.
BUSY_DIR	Average number of other boards outside directors sit on as reported in ISS.
CEO_CHAIR	Indicator variable equal to one if the CEO is also chairman of the board as reported in ISS, zero otherwise.
HAVE_CG	Indicator variable equal to 1 if data for the corporate governance variables are available in ISS, 0 otherwise.
ΔEQUITY_HOLDINGS	Change in the stock option and stock portfolio.
RET	Change in stock price, scaled by beginning of year's stock price.
ICMWD	Proxy for firm's susceptibility to misreporting measured by internal control material weaknesses disclosures. Defined as an indicator variable being one if a firm reports material weaknesses in the last five years, 0 otherwise.
ABN_ACCR	Proxy for firm's susceptibility to misreporting measured by the average value of absolute performance adjusted abnormal accruals over the last two years.
REL_AUCOMPOWER	Proxy for firm's susceptibility to misreporting measured by the audit committee expertise (AU_FINEXP), audit committee prestige (AU_BOARD), and CFO prestige (CFO_BOARD), defined as: (ln(1+AU_BOARD)*ln(1+AU_FINEXP))/(1+CFO_BOARD).
REL_CEOPOWER	Proxy for firm's susceptibility to misreporting measured by the CEO power relative to CFO power defined as CEO tenure divided by CFO tenure.

Chapter 4

The Role of Internal Forecasting and Misreporting in Meeting Performance Benchmarks

4.1 Introduction

This paper examines the role of *internal* forecasting. Prior work on forecasting in the accounting literature has predominantly focused on the external disclosure of management forecasts to capital market participants (e.g., Hirst et al. (2008)). However, evidence suggests that forecasting is in the first place motivated by internal purposes. The vice-chairman and former CFO of General Electric argues that ”The goal of forecasting, from our organization’s point of view, is not to get the most accurate point estimates. (..) What we really care about is the quality of the thinking and the dialogue among our managers that takes place.” (Sherin (2010), p. 11). Davila and Foster (2007) show how financial planning systems (comprised of operating budgets, cash flow projections, and sales projections) are the management control systems that are most widely adopted at early stage firms. Prior research shows how budgeting and forecasting are most strongly explained by the internal demands related to strategy formation, operational planning of activities, monitoring and control, and communication and coordination of resources (Hansen and Van der Stede, 2004, Sivabalan et al., 2009).[1] We believe that our paper contributes to the accounting literature by studying internal forecasting as part of a firm's internal information environment. The internal forecasts contain the projections that are embedded in the (static) annual budget, as well as the supplementary forecasts that are made during the fiscal year. Our paper specifically speaks to the planning, coordination and control role of budgeting and forecasting as opposed to the, relatively more extensively studied, evaluation and incentive compensation role of budgets.

We argue that better internal forecasting enables firms to develop more accurate projections of future performance. The information acquisition and processing that is required to develop internal forecasts may also enable firms to more swiftly and accurately assess the impact of unfolding contingencies on their future (financial) performance (Ittner and Michels, 2016). In addition, internal forecasting supports firms to promptly and accurately adjust their operations (including the allocation of resources) in the case of imminent contingencies (Cassar and Gibson, 2008). Likewise, the information about imminent contingencies and their implications that have materialized in forecasts may also trigger strategy revisions. Ceteris paribus, this suggests that firms with better internal forecasting will have a higher likelihood of achieving performance benchmarks. Prior surveys of executives give insight into the pressures that managers face to, amongst others, meet analyst forecasts, avoid debt covenant violation or credit rating downgrades, and enhance their reputation with stakeholders, such as customers, suppliers, and creditors, and hence get better terms of trade (Graham et al., 2005). We expect that firms will invest in internal forecasting when the pressure to meet external performance benchmarks is higher.[2] In line with this argument, we hypothesize that the importance to meet performance benchmarks is associated with better internal forecasting.

[1] They also partition between listed and unlisted firms and find that external disclosure-related reasons are also perceived as less important by listed firms.

[2] We use the term performance benchmarks to refer to benchmarks that are externally imposed on the respective entity. When the entity, for example, represents a daughter company, an external benchmark can also be the performance expectation set by the mother company. We refrain from focusing on benchmarks that are used within the entity in their evaluation and compensation systems as in many firms forecasting is separate from performance measurement and compensation. In our empirical analyses we also control for the possibility that forecasting information is also used for performance measurement and incentive compensation purposes.

Next, we turn towards the relation between the pressure to meet performance benchmarks and misreporting. Many accounting studies have shown an interest in executives' misreporting choices and the role of performance benchmarks (e.g., Badertscher et al. (2012)). Graham et al. (2005) show in their survey how firms take a mix of accounting and real economic actions to, amongst others, meet last years' or quarters' performance, meet analyst forecasts, avoid losses and debt covenant violations, maintain or improve credit ratings, and reduce volatility in reported performance. Similarly, Merchant (1990) documents that the pressure to meet financial benchmarks is positively associated with misreporting of profit measures (e.g., by delaying expenditures or accelerating sales), especially so in firms that operate in more uncertain environments. Consistent with prior research, we hypothesize that the pressure to meet performance benchmarks is associated with misreporting.

Lastly, we examine the interrelation between internal forecasting and misreporting as two means to meet performance benchmarks. Investing in internal forecasting is costly: it requires the acquisition, analysis and interpretation of large amounts of information from multiple sources. As previously mentioned, we expect benchmark pressure to increase the demand for internal forecasting to achieve a reduction in information asymmetries between different organizational units and levels, to improve coordination amongst organizational units, to facilitate organizational learning, and to provide more insight into potential contingencies and possible corrective actions in response to those contingencies (e.g., Ittner and Michels (2016)). We argue that internal forecasting can also decrease the need for misreporting as better internal forecasting may reduce the likelihood that 'inadequate' performance benchmarks are set. In addition, internal forecasting may increase the likelihood that imminent contingencies are identified, possible consequences for strategic and operational plans assessed, and operations adjusted. As a result, internal forecasting may reduce the necessity to engage in misreporting to achieve performance benchmarks.

But misreporting is also considered to be costly to firms and managers. Reporting choices that are motivated to (opportunistically) meet-and-beat benchmarks are likely to induce bias or noise in the disclosure, which impairs the predictive usefulness and representational faithfulness of reported numbers (Badertscher et al., 2012). Misreporting that encompasses real economic decisions may be costly as such decisions represent deviations from normal business practice such as making sales at a discount at the end of the year while full prices could have been charged in the beginning of the new year or postponing positive NPV projects (Cohen et al., 2008). In addition, misreporting may be a 'first step on a slippery slope to fraud' (Schrand and Zechman, 2012) with potential negative consequences for managers in terms of their future salaries and career opportunities (Desai et al., 2006). So, given the potentially costly nature, actual performance may not deviate too much from the performance benchmarks to make misreporting a feasible alternative. Internal forecasting may enable firms to respond in a timely fashion and help prevent a severe misalignment between performance benchmarks and business reality. In general, because of their costly nature, misreporting choices may require accurate assessments of potential consequences when contingencies unfold. Therefore, internal forecasting may be helpful when firms engage in misreporting to achieve performance benchmarks. Given a certain level of benchmark pressure, the relation between internal forecasting and misreporting is an open empirical question which we attempt to address in this paper.

We use data collected from a survey of financial executives that are members of the Executive Master of Finance & Control (EMFC) association, members of the Certified Management Accounting (CMA) Chapter Amsterdam, or members of a CFO panel. Our respondents have followed postgraduate finance & accounting education and have substantial working experience. Therefore, we regard them as being qualified to provide valid responses to questions about forecasting and reporting practices in their entity. Our survey is targeted at financial executives of investment centers because this level of analysis is consistent with our theory on forecasting and misreporting (Luft and Shields, 2003). Our final sample is composed of 112 observations.

As we assume a timeline of events within an accounting year where forecasting precedes misreporting choices (e.g., Friedman (2014)), we start our empirical analysis using OLS with forecasting as our explanatory variable of interest. We find that benchmark pressure is positively associated with internal forecasting. In a subsequent test and consistent with prior research, we find that benchmark pressure is positively associated with misreporting. Finally, we document that internal forecasting is negatively and significantly associated with misreporting. These results suggests that firms investments in internal forecasting reduce the need for misreporting in response to benchmark pressure.

Our study contributes as follows. First, while most of the prior accounting literature on forecasting has focused on the voluntary disclosure of management forecasts, we aim to contribute by examining firms' internal forecasting. This coincides with the intuition that only a small fraction of the larger US firms externally disclose forecasts, the primary goal of internal forecasting is to support internal decision making and control (instead of the voluntary disclosure of forecasts), and that a growing number of firms is forecasting on a frequent, and sometimes even continuous, basis.

Second, our study adds to the management accounting literature on forecasting and budgeting. Much prior literature in this area has focused on the evaluation and incentive role of budgeting, even though several authors find that the planning and control role of budgets may be more important for firms (e.g., Hansen and Van der Stede (2004), Libby and Lindsay (2010)). Few studies have investigated internal forecasting across organizations; this is surprising as forecasting is recognized by both academics and practitioners as a key tool used by financial managers to derive greater value from their budgeting process (e.g., Thornton (2015)). Our paper adds to recent work on the planning, resource allocation and control role of forecasting (e.g., Becker et al. (2016), Brüggen et al. (2016), Campbell et al. (2011), Davila and Foster (2007)).

Third, prior research has identified both the importance of meeting benchmarks for firms, as well as the use of reporting choices to achieve those benchmarks (Badertscher et al., 2012, Dichev et al., 2013, Graham et al., 2005). We show how one potential negative effect of benchmark pressure (i.e., misreporting) may be curbed by internal forecasting. Our results suggests that forecasting supports the achievement of performance benchmarks and also reduces the need to engage in misreporting as an alternative means to attain benchmarks. The importance of forecasting seems important as failing to meet benchmarks is costly for firms, yet misreporting accounting numbers is also costly both for firms as well as for managers.

The remainder of the paper is structured as follows. Section 2 reviews prior literature and develops the hypothesis. Section 3 describes the sample and measures and section 4 presents the results. The final section provides concluding comments.

4.2 Literature Review

4.2.1 Internal Forecasting

Forecasts may be important for corporate decision making and the support of firm growth and profitability. Sales forecasts provide the input for production planning, input acquisition, and investment planning (i.e., capacity). Subsequent cash flow forecasts are an important input for financing decisions, and in conjunction with the projected income statement and (dis)investment plans ultimately give rise to estimated balance sheet positions. Inaccurate forecasts may lead to overly high costs due to excess capacity (e.g., inventory build-up) or may lead to high costs because of late adjustments and potential stock-out costs (Cassar and Gibson, 2008). Internal forecasting is usually done on a frequent or even continuous basis, and enables organizations to assess whether the firm's strategy and operations are in line with developing market realities. Internal forecasting may be conducive to the internal information environment of the firm. Prior research describes internal information quality (IIQ) in terms of the 'accessibility, usefulness, reliability, accuracy, and quantity' of the data and knowledge collected, generated, and consumed within an organization (Gallemore and Labro, 2015). The term IIQ is meant to capture the quality of firms' decision facilitating information; the underlying assumption is that a high IIQ should lead to improved managerial decision-making (Horngren and Datar, 1997).

Internal forecasts contain (1) projections that are part of the (static) annual budget, as well as (2) supplementary forecasts that are made during the fiscal year, for example on a monthly basis. Internal forecasts form the basis of the beginning-of-the-year budgeting process that involves resource allocation and planning activities, as well as provide subsequently timely updates of environmental developments for monitoring and control purposes. Updating internal forecasts reduces the time interval between planning and business reality, which should make organizations more competitive and responsive to change, especially when economic conditions change rapidly (Neely et al., 2001). We focus on both initial and subsequent forecasts; initial forecasts are often outdated at the time they are being used; therefore, firms supplement them with frequently updated forecasts to reflect the latest information available which, in turn, allows managers to adjust their strategies and operations, and revise their planning and allocation of resources (Cassar and Gibson, 2008, Hansen et al., 2003, Hansen and Van der Stede, 2004, Libby and Lindsay, 2010).

We focus on the planning and coordination role of forecasting as opposed to the performance evaluation role as only the prior one unambiguously enhances firms' internal information quality. That is, prior research suggests that there is tension between the planning and coordination role versus the evaluation and incentive role of forecasting and budgeting (Hansen and Van der Stede, 2004). In some firms forecasting is decoupled from target setting as the role of forecasting is to strive for realism whereas the role of target setting is to challenge managers. While accurate numbers are required for planning and coordination, the use of information from budgeting and forecasting for performance evaluation and incentive compensation purposes encourages strategic behavior of employees (Cassar and Gibson, 2008).

Prior research suggests that the initial forecasts embedded in the budgets are usually fixed throughout the year, while the subsequent forecasting provides managers with the information that supports them in monitoring, coordination and control (Frow et al., 2010). Planning, coordination and monitoring seem to be of major importance to firms. Davila and Foster (2007) show that many firms in an early stage already adopt financial planning systems comprised of operating budgets and sales and cash flow projections to facilitate the control of their operations and achieve benchmarks; whereas financial evaluation systems are typically adopted at a later stage. Brüggen et al. (2016) document the role of sales forecasts as a coordination device between sales and production. Some scholars emphasize that organizational learning is embedded in the periodic updating of budgets and forecasts (Campbell et al., 2011, Simons, 1994). Overall, a survey of mid-sized and large Australian organizations reveals that planning and control reasons are ranked as more important (e.g., cost control, board monitoring and formulation of action plans) relative to evaluation reasons for the use of budgets and forecasts (Sivabalan et al., 2009).

We define the quality of a firm's internal forecasting as that firm's capacity to deploy a combination of forecasting practices that have been identified by prior literature as fostering firms' internal information environment. Generating accurate internal forecasts requires firms to have recent information available from multiple sources and multiple perspectives, as well as the capacity to understand and interpret this information to update future projections using information from this multiplicity of sources (Cassar and Gibson, 2008, Ittner and Michels, 2016). Specifically, given the inherent complexity and uncertainty underlying future projections, firms may benefit by incorporating uncertainty in their projections, evaluating alternative scenarios, and updating their planning. Ittner and Michels (2016) find that incorporating uncertainties can improve firms' forecasting accuracy through the use of forecasting methods that explicitly incorporate uncertainties, the development of more realistic estimates, and the development of contingency plans for meeting goals under different scenarios. Brüggen et al. (2016) show how the explicit labeling of some part of the aggregate sales forecast as dependent on the unfolding of a contingent demand 'event' results in lower sales forecast errors and lower inventory 'buffer' stock.

In addition, developing adequate forecasts typically involves the integration of inputs from many different participants and information sources within the firm (Cassar and Gibson, 2008). Prior literature has focused on the involvement of different functions within the organization, because cross-functional communication is perceived to benefit forecasting due to the acquisition and dissemination of information as well as the shared interpretation of information (Davis and Mentzer, 2007, Zotteri and Kalchschmidt, 2007). Similar, Dorantes et al. (2013) find how the integration of information from different business functions can be facilitated by the adoption of information technology (i.e., enterprise information systems).

Furthermore, attention has been devoted to the degree of information exchange within the supply chain. External information from suppliers and customers can help firms to better comprehend the dynamics on input and output markets. Knowledge about plans of customers and suppliers allows companies to better forecast their own sales and production activities (Kalchschmidt, 2012). Overall, improved information enables companies to develop better predictions and a better planning of activities on input and output markets, investments and hiring decisions, scheduling and processing, and financing decisions (Cassar and Gibson, 2008). For example, accurate projections of future cash flows and working capital enable firms to adequately manage their liquidity. Accurate cash flow forecasts are also important for firms expanding activities and financing growth through internally generated cash flows (Wasley and Wu, 2006).

4.2.2 Hypothesis Development

We argue that greater internal forecasting enable firms to better meet their performance benchmarks. The pressure to meet these benchmarks, which may include earnings expectations from capital market participants, debt covenants with banks or (industry-specific) nonfinancial benchmarks, will motivate firms to invest in their internal forecasting.[3] For example, investments in internal forecasting are expected to generate more accurate projections of future benchmarks because of greater information acquisition and processing capabilities. Formulating accurate projections may be crucial as it contributes to the achievability of performance benchmarks (Cassar and Gibson, 2008, Horngren and Datar, 1997). In addition, early recognition of external shocks may allow companies to react and adjust operations in a timely fashion (Ittner and Michels, 2016). Having access to a diverse set of internal and external information sources enables companies to develop a better understanding of the dynamics of the environments in which they operate. The vice-chairman and former CFO of General Electric states in this respect: "We bring in outside parties to challenge our own assumptions about the industries we operate in and to develop multiple scenarios." (Sherin (2010), p. 9).

Contingency analyses may help companies in their assessment of the likelihood of potential external developments, the impact those developments may have on operations, strategy, and

[3] We assume that investments in internal forecasting lead to better internal forecasting. Therefore, we use the terminology *internal forecasting quality* when stating the hypotheses and occasionally in the text.

performance, and potentially adequate responses to those external developments. Ultimately, this acquired knowledge can be impounded in the operational planning process, allowing for both a swifter and a more accurate response to unfolding developments. For example, firms can decide to revise strategic and/or operational plans, as well as the allocation of internal resources during the year if market conditions require to do so. In General Electric, an important feature of the forecasting process is: "[. . .] to identify risks to our business plan, and to come up with ways of managing them down to acceptable levels. [. . .] One purpose of our planning is to ensure that we have anticipated these downwards risks and have either found a way to limit them, or have a plan to respond to them quickly if the materialize." (Sherin (2010), p. 10).

Overall, higher quality internal forecasting should enable firms to forecast performance benchmarks more accurately, to quickly and accurately assess the impact of unfolding contingencies on their projections, and to swiftly and accurately decide how to respond to unfolding contingencies when adjusting their strategic and operational planning as well as their business operations in order to achieve pre-set performance benchmarks. Prior literature recognized the importance for firms of meeting benchmarks. Graham et al. (2005) show how, for public firms, meeting performance benchmarks is especially motivated by the need to maintain or increase stock price and reduce stock price volatility; meeting benchmarks is particularly important for private firms in order to achieve or preserve a desired credit rating, avoid debt-covenant violation and assure suppliers and customers that business is stable to achieve better terms of trade. Therefore, we argue that the quality of internal forecasting can be expected to be conducive for firms to meet performance benchmarks.[4] To test this, we employ a measure of the ex-ante likelihood of the importance for a firm to achieve these performance benchmarks, namely a firms' pressure to meet benchmarks (Merchant, 1990). Increasing benchmark pressure proxies for the increasing importance of meeting (internal and external) benchmarks, which, as we hypothesize, leads to adoption of higher quality internal forecasting:

[4] We do not have data on the achievement of performance benchmarks. Instead of examining whether internal forecasting leads to a greater achievement of benchmarks, we examine whether a greater pressure to meet performance benchmarks is associated with investments in internal forecasting.

H1: Benchmark pressure is positively associated with internal forecasting quality.

Firms may have alternative means to increase the likelihood that they will meet their performance benchmarks. Graham et al. (2005) show how firms take a mix of accounting and real actions, such as postponing positive NPV projects (e.g., R&D), incentivizing buyers to purchase products now by offering them discounts or more lenient credit terms, recording revenues now rather than next quarter (when justified in both quarters), postponing to take an accounting charge, etc. as a means to meet their benchmarks. Similarly, Merchant (1990) finds that firms manipulate performance measures and adjust operations (e.g., by delaying expenditures or accelerating sales) when the pressure to meet financial benchmarks increases. In their survey among CFOs of public and private U.S. firms, Dichev et al. (2013) find that at least 87% of respondents agree that pressure to hit earnings benchmarks motivates them to manage earnings. As we are interested in the interrelation between misreporting and internal forecasting, we first want to establish that in our sample benchmark pressure motivates CFOs and controllers to misreport earnings, which leads to our second hypothesis:

H2: Benchmark pressure is positively associated with misreporting.

We now turn to the question regarding the relation between firms' internal forecasting and their misreporting. On the one hand, greater forecasting may lead to more accurate projections, and more swift and accurate updates of projections, as well as better intervention in business operations to minimize adverse performance implications of external shocks. Together, this may decrease the demand for misreporting as an alternative means for meeting performance benchmarks.[5] Given that misreporting as well as implementing high quality internal forecasting is costly, firms may trade-off one with the other in order to meet performance benchmarks. In that case, we expect that firms characterized by higher investments in their internal forecasting to have less need to engage in end-of-the-year misreporting. In addition, firms and managers are more likely to invest in internal

[5] For example, firms that require debt financing are more inclined to turn down loan proposals that are accompanied by restrictions that are going to be binding in the near future, as predicted by their internal forecasts.

forecasting relative to manipulate performance measures considering the relatively potential costs of misreporting for both firms (Dechow et al., 1996) and managers (Desai et al., 2006).

On the other hand, internal forecasting may also support misreporting. Real earnings management is considered to be costly as such decisions represent deviations from normal business practice (e.g., postponing positive NPV projects) (Cohen et al., 2008). Accounting choices that are made to opportunistically meet-and-beat benchmarks are likely to induce bias or noise in the reporting which impairs the information role of reported accounting numbers (Badertscher et al., 2012). As firms are restricted in the extent of misreporting because of its costly nature, the pre-managed earnings has to be sufficiently close to the performance benchmark to facilitate misreporting. For example, surveyed CFOs state that the most common ’red flags’ (signals that alert an outside user about potential misreporting) are: (1) significant deviations of GAAP earnings from cash-flows, (2) deviations from industry or economy norms/experience, or (3) large one-time or special item write-downs, or large changes in accruals (Dichev et al. (2013), p. 28). In addition, misreporting is costly for executives, especially for CFOs and other finance professionals (Hennes et al., 2008). If internal forecasting is not entirely sufficient to attain the performance benchmark, then being close to a performance benchmark can be a necessary condition for being able to meet the performance benchmark by means of misreporting. In sum, both internal forecasting and misreporting may be used to achieve benchmarks; whether they are positively or negatively associated represents an empirical question. Due to these conflicting lines of argument we state our last hypothesis in a non-directional form:

H3: Internal forecasting quality is associated with misreporting.

4.3 Research Method

4.3.1 Survey Design and Sample

To test our hypothesis, we collect data from a survey of financial executives that are either member of the Executive Master of Finance & Control (EMFC) association at the VU University Amsterdam or the University of Amsterdam,[6] or are member of the Certified Management Accountant (CMA) Chapter at the VU University Amsterdam, or are a member of the CFO panel associated with the VU University Amsterdam.[7] We target our survey at financial executives of investment centers as this level of analysis is consistent with our level of theory on internal forecasting and misreporting (Graham et al., 2005, Luft and Shields, 2003). Because respondents have followed postgraduate accounting education and have substantial work experience, we expect them to be knowledgeable about forecasting and reporting practices within their entities and therefore qualified to provide valid responses to survey questions. Surveys enable researchers to address relevant questions given the lack of publicly available data on management accounting practices (Ittner and Larcker, 2001). To increase the quality of the survey, we ensured respondents that responses would be treated anonymously, we pre-tested the survey, and positioned our variables of interest in separate parts of the questionnaire (Van der Stede et al., 2005). All members were invited by e-mail to participate in the online survey. The respondents had about eight weeks to participate. One reminder was sent after six weeks leaving respondents with another two weeks to participate before the online survey was closed.

This procedure yields an initial sample of 155 respondents who completed the questionnaire. We excluded 28 observations where the respondent's entity is not an investment center and removed 15 observations due to missing data. So, our final sample consists of 112 observations.[8] We test for the presence of a response bias in two ways. First, we compare the target population and our final sample on demographic variables such as age and gender. We do not find significant differences

[6] The EMFC is a Dutch two-year part-time postgraduate program and the CMA is a U.S. one-year part-time postgraduate program both aimed at accounting and control professionals. Current students and graduates can become member of the respective CMA and EMFC association.

[7] The CFO-panel is a network of CFOs of the 100 largest organizations in the Netherlands, where members meet annually at the Finance Transformation Forum. The VU University is associated with this CFO network as a knowledge partner.

[8] We have an aggregate response rate of 5.6%. This is comparable to earlier studies such as Indjejikian and Matějka (2009) and Dichev et al. (2013). This aggregate response rate can be further broken down into a 13% response rate for members of the CFO panel, a 4.8% response rate for members of the EMFC associations, and a 8.4% for the members of the CMA Chapter. What is most important for survey research is not the response rate, but rather the representativeness of the responses (Van der Stede et al., 2005). That is, whether respondents systematically differ from non-respondents. We, therefore, assess the presence of a response bias.

in means.[9] Second, we compare the responses of early and late respondents as late respondents are more similar to non-participants.[10] We do not find significant differences of means or medians for demographic characteristics of the respondents, their education and tenure, the dependent and independent variables of interest, and general firm characteristics such as firm size, sales, and growth (non-tabulated).

Our respondents are relatively senior as they are, on average, 40 years old. 51% have a CMA or equivalent (EMFC) qualification and 11% have a CPA qualification. We collected data on the current job title of the respondents. Most respondents have the title of Business Controller (29%), CFO/financial director (25%), Group Controller (13%), and Finance Manager (10%) (non-tabulated).

4.3.2 Variable Measurement

We describe the measurement of our dependent and independent variables of interest, as well as the measurement of our control variables. For the variables that are measured using Likert scales, we assess the convergent validity by examining the correlations with alternative measures (Lattin and Green, 2003). If possible, we rely on more objective data instead of perceptual measures to evaluate convergent validity (Ittner and Larcker, 2001). All variables and their constructs are as well in detail described in Appendices D and E.

Dependent and Independent Variables of Interest

The variable data misreporting (MISREP) is measured using an adapted five-item survey instrument that reflects accounting and real economic actions to influence reporting (Graham et al., 2005, Maas and Matejka, 2009, Merchant, 1990). Respondents indicated how often they took the following actions to influence performance: (i) change accounting estimates (e.g., estimation of uncollectible accounts expense, write-offs and impairments), (ii) re-label line items, (iii) record transactions

[9] We only have data on population demographics for the EMFC and CMA target population.

[10] The date of the reminder e-mail is used to distinguish early vs. late respondents.

early or late (when justified), (iv) provide or refuse price discounts or more/less lenient credit terms to influence sales levels, and (v) postpone or accelerate discretionary expenditures (investments in R&D, advertising, maintenance, etc.). The survey uses a five-point Likert scale (1 = never occurs, 3 = occurs sometimes, 5 = occurs very frequently). We establish convergent validity by examining the correlations with two objective measures. As expected, we find that respondents with CPA qualification are less likely to misreport (-0.24, $p<0.01$) (Bamber et al., 2010, Ge et al., 2011). Further, respondents' current job tenure (-0.19, $p<0.05$) is negatively associated with misreporting, which is in line with the intuition that managers try to favorably influence the market's perception of their ability in their early years of service (Ali and Zhang, 2015).

Our independent variable of interest, internal forecasting (FORECAST), is measured using a five-item instrument. We asked respondents whether they agreed with the following statements on their entity's forecasting system: (i) on top of P&L, we forecast many other items (e.g., cash flow or balance sheet items), (ii) we use different management information systems from the same vendor when making our forecasts, (iii) we take into account different environmental situations when forecasting, (iv) people from different business functions are involved in forecasting, and (v) we use external support like market research and involve supply chain firms to forecast demand. Prior literature has identified these practices to be associated with improved forecasting (e.g., Davis and Mentzer (2007), Kalchschmidt (2012)). To evaluate convergent validity, we examine correlations with three objective measures. The positive correlations with the number of FTE committed to the forecasting process (0.40, $p<0.01$), the number of business functions involved in the forecasting process (e.g., sales, operations, finance, logistics) (0.32, $p<0.01$), and the use of scenario planning (0.37, $p<0.01$) are all indicative of a satisfactory convergent validity.

Our third variable of interest, benchmark pressure (BENCHM_PRESS), is measured using a four-item instrument. Respondents have been asked to indicate whether they agree on the following statements: (1) In the eyes of the hierarchical superiors, achieving the performance benchmarks is an accurate reflection of whether the entity is succeeding in business, (2) The entity is constantly reminded by hierarchical superiors of the need to meet the performance benchmarks, (3) The organization achieves control over the entity principally by monitoring whether they are going to meet the performance benchmarks, and (4) In the eyes of the hierarchical superiors, not achieving the performance benchmarks reflects poor performance of the entity (Libby and Lindsay, 2010, Van der Stede et al., 2005). We establish convergent validity by examining the correlation between the weight on financial performance measures in compensation schemes and benchmark pressure. The correlation between these two variables is positive ($p<0.06$), adding credibility to the validity of our measure.

Other Variables

We include unique determinants of internal forecasting and misreporting, as well as a set of general controls that we employ in all tests of the hypotheses. We explain each below.

The unique determinants of FORECAST are information management and M&A. We measure the degree of information management (INFO_MAN) using an adapted instrument used by Chang et al. (2014). We measure, amongst others, the degree of adoption of common data definitions, process ownership, standardized common processes, standard information architecture, and the reduction of stand-alone applications. Information management is positively associated with increased perceived effectiveness by the finance function of its activities on financial planning, budgeting, and reporting (Chang et al., 2014). In addition, information management has been argued to be a source of greater business insight; to develop the deeper, broader understanding required for forecasting requires integrated (financial and operational) information. Next, M&A captures discontinuous growth, and hereby situations under which forecasting may prove difficult as the prediction of future values depends on the degree in which expected synergies materialize. Furthermore, producing high quality forecasts when M&As happened may require more effort because of the lack of comparability in the accounting across acquiring and acquired entities and subsequent effort directed towards integration of accounting systems of multiple entities. M&A is an indicator taking the value of one if an entity was involved as purchasing entity in major mergers or acquisitions within the last three years, zero otherwise. We expect INFO_MAN to be positively and M&A to be negatively related to FORECAST.

As unique determinants of MISREP we employ job-tenure and CEO power. We measure the years that the respondent is in his or her current position (JOB_TENURE); previous research suggests that the likelihood of earnings management decreases over job tenure (Ali and Zhang, 2015). Next, POWER is an indicator variable equal to one if respondents have a longer reporting relation with their line manager (divisional or firm-level CEO) than with the functional supervisor (corporate CFO, audit committee), zero otherwise. Maas and Matejka (2009) show for business unit controllers how a stronger relation with their business unit manager (relative to corporate control) increases the likelihood of misreporting. Likewise, CFOs with long relationships with CEOs (audit committees) are more (less) likely to misreport (Beck and Mauldin, 2014, Friedman, 2014). We expect JOB_TENURE to be negatively and POWER to be positively related to MISREP.

We chose a basic set of variables in order to control for heterogeneity in types of firms. GROWTH represents growth options and is measured by the sales growth relative to the prior year. We include an indicator variable for loss-making entities (LOSS) equal to one if net income was smaller than zero, zero otherwise. REV measures entities' revenues and ranges between one and nine, where REV ranges between one and nine dependent on whether revenue is up to €10 million, from €10 to €50 million, from €50 to €100 million, from €100 to €250 million, from €250 to €500 million, from €500 million to €1 billion, from €1 to €5 billion, from €5 to €15 billion, or higher than €15 billion. The ratio of debt to assets denotes leverage. LEVERAGE is equal to one if the debt-to-assets ratio is smaller than 20%, two if the ratio is between 20% and 40%, three if it is between 40% and 60%, four if it is between 60% and 80%, and five if the ratio is higher than 80%. Environmental volatility (ENV_VOL) is measured following Khandwalla (1972), and we use the five-item instrument that asks the respondents rate of change in their environment on categories such as buying patterns and requirements of customers, competitor strategies, technological developments, etc. We also include a measure of information asymmetry (INF_ASYM) using a six-item scale of Dunk (1993). Both survey measures for environmental volatility as well as for information asymmetry have been used repeatedly in prior studies (e.g., Abernethy et al. (2013, 2004)). We classify firms as being active in one of the following five industries: Public sector, service excluding financial services, financial institutions and financial service, manufacturing, or natural resources and extraction.

4.3.3 Factor Analysis

We use exploratory factor analysis to develop our latent variables.[11] We perform factor analysis on all independent variables separately and jointly. In the latter case, we use factor analysis with orthogonal rotation and retain factors with an eigenvalue greater than unity (Nunnally and Bernstein, 1994). The results for our joint factor analyses are reported in Appendix E. We construct our composite variables using factor scores.

In Table E.1 and Table E.2, summary statistics and factor loadings for misreporting (MISREP), and internal forecasting (FORECASTING) are presented. For MISREP [FORECASTING], the average factor loading is 0.57 [0.47] and the reliability of our survey instrument seems to be satisfactory given a Cronbach alpha of 0.71 [0.61].[12] We believe that the reliability of our forecasting variable is acceptable given that our instrument has not been used much in prior research and standards decrease when instruments are composed of a confined number of items (Hair et al., 2014).

In Table E.3, summary statistics and cross-loadings for our explanatory variables benchmark pressure (BENCHM_PRESS), information asymmetry (INF_ASYM), environmental volatility (ENV_VOL), and information management (INFO_MAN) are described. The results show a clean factor structure as the loadings of the item on the constructs that they are theoretically associated with markedly exceed the loadings on other constructs. The average factor loadings for

[11] Factor analysis intends to identify underlying constructs that reflect what the items share in common. It is assumed that only the common variance and not the specific and error variance is of interest in defining the structure of the items. So, factor analysis only considers the common or shared variance.

[12] The Cronbach alpha is a measure of the reliability that specifically looks at internal consistency of a survey instrument. Higher values support the reliability as individual items should measure the same construct and therefore be sufficiently correlated.

BENCHM_PRESS, INF_ASYM and ENV_VOL, and INFO_MAN are 0.74, 0.75, 0.60,and 0.64 respectively, and all exceed the lower bound of 0.30 as the minimum level for interpretation of factor structure (Hair et al., 2014). The discriminant validity seems satisfactory given the small cross-loadings. The Cronbach alpha of our instruments is 0.84 (BENCHM_PRESS), 0.88 (INF_ASYM) and 0.77 (ENV_VOL), and 0.81 (INFO_MAN).

To further substantiate the reliability of our factor analysis outcomes, we perform confirmatory factor analyses. First, the results indicate that all factor loadings are significant. Subsequently, we compute the composite reliability for each of the constructs. It is defined as the squared sum of the standardized loadings divided by the squared sum of the standardized loadings and the sum of the error variances. The composite reliability ranges between 0.60 for FORECAST to 0.88 for INF_ASYM. We also examine the average amount of variance in the items captured by the construct, i.e., the variance extracted. The variance extracted varies between 0.33 for MISREP and 0.66 for INF_ASYM.[13] Finally, we also examine the discriminant validity of or constructs, i.e., whether constructs are unique and capture something not captured by other constructs. We examine for each construct whether the average variance extracted exceeds the squared correlation between two constructs (Fornell and Larcker, 1981). The results suggest adequate discriminant validity as for each pair of two constructs, the average variance of each of the two constructs strongly exceed the squared correlation between the two constructs.

Lastly, we assess whether the results are susceptible to common method bias. As a first step, we perform an exploratory factor analysis with all items and find no indication that one factor accounts for most of the variance in the items.[14] Subsequently, we assess whether a six-factor model provides a better fit to the data relative to a one-factor model. We find that the six latent factors provide a better fit to the data compared to a one-factor model (Δ_{x2}=789.68, p<0.01).[15]

[13] Specifically, the composite reliability (variance extracted) for MISREP, FORECAST, BENCH_PRESS, ENV_VOL, INF_ASYM, and INFO_MAN is 0.71 (0.33), 0.60 (0.37), 0.85 (0.43), 0.77 (0.44), 0.88 (0.66), and 0.81 (0.43) respectively.

[14] Specifically, we find that the first factor accounts for 22% of the variance.

[15] Reductions in the chi-square statistic indicate a better fit with the data as each model is tested against the null that the proposed model fits as well as a perfect model.

4.3.4 Empirical Model

We test our hypotheses by means of the following three regression models. Following Leone et al. (2015), we estimate robust regressions as they are less sensitive to outliers and so-called influential observations.[16] In all our models, β_1 represents the relation between benchmark pressure and internal forecasting or misreporting; on the basis of our hypotheses, we expect $\beta_1 > 0$ in all tests. δ_j denotes industry fixed-effects.

$$\begin{aligned} FORECAST_i = &\beta_0 + \beta_1 BENCHM\_PRESS_i + \beta_2 INFO\_MAN_i + \beta_3 M\&A_i \\ &+ \sum \beta_k CONTROLS_i + \delta_j + \epsilon_i \end{aligned} \tag{4.1}$$

$$\begin{aligned} MISREP_i = &\beta_0 + \beta_1 BENCHM\_PRESS_i + \beta_2 POWER_i + \beta_3 JOB\_TENURE_i \\ &+ \sum \beta_k CONTROLS_i + \delta_j + \epsilon_i \end{aligned} \tag{4.2}$$

In model 4.3, β_2 represents the relation between benchmark pressure and internal forecasting. On the basis of our third hypothesis, we do not have a directional expectation regarding β_2.

$$\begin{aligned} MISREP_i = &\beta_0 + \beta_1 BENCHM\_PRESS_i + \beta_2 FORECAST + \beta_3 POWER_i \\ &+ \beta_4 JOB\_TENURE_i + \sum \beta_k CONTROLS_i + \delta_j + \epsilon_i \end{aligned} \tag{4.3}$$

Note that in examining the relationship between internal forecasting and misreporting, we assume a timeline of events within a fiscal year where internal forecasting precedes misreporting. That is, internal forecasting is employed at the start and during the accounting year while misreporting is mainly employed at the end of the accounting period, when it becomes clear how the overall performance is going be (Bouwens and Kroos, 2011). At that point in time, managers will make decisions on whether to take manipulative actions to achieve performance benchmarks. Our regression specification is also consistent with Hofmann and van Lent (2015), who argue that more slow-moving elements of organizational design can be exploited as explanatory variables in an empirical specification.

[16] In robust regressions observations with Cook's D>1 are excluded and the potential impact of remaining influential observations is addressed by means of downward weighting of these observations in an iterative process to avoid bias of regression estimates (Leone et al., 2015). For an implementation in Stata see Verardi and Cox (2009).

4.4 Empirical Results

4.4.1 Descriptive Statistics

Table 4.1 reports the descriptive statistics. The average firm in our sample has approximately revenues between €250 and €500 million. The mean growth in sales is 3.7%, 14% report a loss, and the average debt-to-assets ratio is between 20% and 40%. In around half of all cases a firm experienced a recent M&A. The average respondent is 40 years of age, has a postgraduate qualification and works for three years in its current position. About 11% of the respondents has a CPA qualification (untabulated).

Table 4.1: Summary statistics. Variable definitions are reported in Appendix D.

	N	Mean	St. dev.	P10	P25	Median	P75	P90
MISREP	112	0.008	0.844	-1.10	-0.70	-0.04	0.56	1.14
FORECAST	112	0.017	0.722	-0.89	-0.48	0.02	0.54	0.98
BENCHM_PRESS	112	0.038	0.849	-1.17	-0.57	0.15	0.51	0.95
INFO_MAN	112	0.009	0.904	-1.24	-0.56	-0.02	0.79	1.10
M&A	112	0.49	0.50	0.00	0.00	0.00	1.00	1.00
JOB_TENURE	112	3.035	2.912	1.00	1.00	2.00	4.00	6.00
POWER	112	0.125	0.332	0.00	0.00	0.00	0.00	1.00
GROWTH	112	3.735	12.08	-3.70	0.00	3.00	5.00	10.0
ENV_VOL	112	0.023	0.857	-1.10	-0.43	0.02	048	1.14
LOSS	112	0.142	0.352	0.00	0.00	0.00	0.00	1.00
REV	112	4.964	2.378	2.00	3.00	5.00	7.00	8.00
LEVERAGE	112	2.330	1.245	1.00	1.00	2.00	3.00	4.00
INF_ASYM	112	0.566	0.970	-1.25	-0.49	0.13	0.73	1.28

Table 4.2 presents the bivariate relation between our variables (significant correlations on a 10% level are in bold). We find that internal forecasting (FORECAST) is inversely related to misreporting (MISREP), however the bivariate correlation is weak ($p<0.15$). Benchmark pressure (BENCHM_PRESS) is positively associated with internal forecasting ($p<0.10$) but not bivariately

correlated with misreporting (p=0.23). As expected, internal forecasting is positively correlated with information management (INFO_MAN)(p<0.01) and weakly negatively related to M&A (p<0.11). Further, firms with better forecasting processes seem to have higher revenues (p<0.01) and are less indebted (p<0.05). In line with prior research we find that misreporting is negatively related to job-tenure (Ali and Zhang, 2015) and positively related to our measure of CEO power (Feng et al., 2011, Maas and Matejka, 2009).

Table 4.2: Pearson correlations. Variable definitions are reported in Appendix D. Correlations that are significant at the 10% or lower are reported in bold.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
(1) FORECAST	1.00												
(2) MISREP	-0.14	1.00											
(3) BENCHM_PRESS	**0.16**	0.11	1.00										
(4) INFO_MAN	**0.32**	**-0.17**	0.08	1.00									
(5) M&A	-0.15	0.08	-0.07	0.06	1.00								
(6) POWER	-0.01	**0.23**	-0.05	0.05	0.01	1.00							
(7) JOB_TENURE	-0.13	**-0.19**	-0.12	-0.07	-0.13	**0.25**	1.00						
(8) REV	**0.32**	0.13	0.12	0.15	0.08	0.05	**-0.19**	1.00					
(9) GROWTH	-0.13	0.01	-0.15	0.01	**0.22**	-0.04	-0.15	**-0.20**	1.00				
(10) LOSS	-0.09	0.02	0.03	**-0.16**	-0.09	0.15	**0.23**	-0.11	**-0.27**	1.00			
(11) ENV_VOL	0.02	-0.03	**0.24**	**0.21**	0.03	-0.05	-0.10	0.04	-0.15	0.01	1.00		
(12) INF_ASYM	0.00	0.10	-0.01	0.11	-0.01	**0.18**	0.13	-0.13	0.00	0.10	0.03	1.00	
(13) LEVERAGE	**-0.19**	0.13	**-0.16**	-0.10	**0.17**	**0.18**	0.06	0.06	-0.04	**0.28**	**-0.21**	-0.08	1.00

4.4.2 Main Analyses

In Table 4.3 we show regression estimates of the test of hypothesis 1. Consistent with our hypothesis, we find that benchmark pressure is positively related with internal forecasting (i.e., β_1 is positive and statistically significant ($p<0.07$)). This suggests that firms have better internal forecasting when the (perceived) necessity to meet performance benchmarks is higher. The results on our control variables are largely in line with results of the bivariate analysis (that is, there is a significantly positive relation between internal forecasting and information management and revenues, and a weakly significant negative relation with M&A). Overall, our findings support our first hypothesis.

Next, we examine hypothesis 2, that is, we test whether there is a relation between misreporting and benchmark pressure. Reported in Table 4.4, we find that misreporting increases with benchmark pressure ($p<0.1$), hence our second hypothesis is supported. As expected and observed in the bivariate examinations, POWER ($p<0.05$) and JOB_TENURE ($p<0.05$) determine firms misreporting behaviour. In addition, information asymmetry seems to drive misreporting ($p<0.06$).

Finally, we turn to the test of hypothesis 3, that is, an examination of the joint association between benchmark pressure, internal forecasting and misreporting. Results are reported in Table 4.5. As in our prior tests, we expect and find β_1 to be significantly positive ($p<0.07$). More interesting, our empirical results suggest that internal forecasting is negatively associated with misreporting. That is, β_2 is negative and statistically significant ($p<0.1$). Results on control variables (i.e., POWER, JPB_TENURE, INF_ASYM) are similar to the ones in the tests for hypothesis 2. Overall, these results show that firms with better internal forecasting engage in less misreporting, which suggests that firms that have (ex-ante) sound internal forecasting may not need to engage in potentially costly misreporting (ex-post).

Table 4.3: Benchmark pressure and internal forecasting

DV=FORECAST	Predicted sign	Coefficient	p-value
Intercept		0.018	(0.946)
BENCHM_PRESS	+	0.131*	(0.061)
INFO_MAN		0.189**	(0.013)
M&A		-0.182	(0.180)
GROWTH		-0.001	(0.894)
ENV_VOL		-0.105	(0.193)
LOSS		-0.035	(0.866)
REV		0.086***	(0.003)
LEVERAGE		-0.062	(0.294)
INF_ASYM		-0.052	(0.472)
Industry effects		Yes	
F-Statistic		3.05***	
R-squared		0.29	
N		112	

In Table 4.3 regression estimates from robust regressions of the following model are reported:

$$\begin{aligned} FORECAST_i = & \beta_0 + \beta_1 BENCHM\_PRESS_i + \beta_2 INFO\_MAN_i + \beta_3 M\&A_i \\ & + \beta_4 GROWTH_i + \beta_5 ENV\_VOL_i + \beta_6 LOSS_i + \beta_7 REV_i \\ & + \beta_8 LEVERAGE_i + \beta_9 INF\_ASYM_i + \delta_j + \epsilon_i \end{aligned}$$

P-values are based on robust regressions. ***, **, * corresponds to 1%, 5%, and 10% significance levels (one-tailed when the coefficient sign is predicted, two-tailed otherwise). No observation was dropped during the estimation of the regression coefficients via robust regressions. Variables are defined in Appendix D. Industry effects are included.

Table 4.4: Benchmark pressure and misreporting

DV=MISREP	Predicted sign	Coefficient	p-value
Intercept		-0.003	(0.993)
BENCHM_PRESS	+	0.145*	(0.092)
POWER		0.685**	(0.012)
JOB_TENURE		-0.067**	(0.031)
GROWTH		-0.001	(0.982)
ENV_VOL		-0.051	(0.615)
LOSS		0.007	(0.980)
REV		0.001	(0.972)
LEVERAGE		0.075	(0.318)
INF_ASYM		0.179*	(0.050)
Industry effects		Yes	
F-Statistic		1.81*	
R-squared		0.19	
N		112	

In Table 4.4 regression estimates from robust regressions of the following model are reported:

$$\begin{aligned} MISREP_i = & \beta_0 + \beta_1 BENCHM\_PRESS_i + \beta_2 POWER_i + \beta_3 JOB\_TENURE_i \\ & + \beta_4 GROWTH_i + \beta_5 ENV\_VOL_i + \beta_6 LOSS_i + \beta_7 REV_i \\ & + \beta_8 LEVERAGE_i + \beta_9 INF\_ASYM_i + \delta_j + \epsilon_i \end{aligned}$$

P-values are based on robust regressions. ***, **, * corresponds to 1%, 5%, and 10% significance levels (one-tailed when the coefficient sign is predicted, two-tailed otherwise). No observation was dropped during the estimation of the regression coefficients via robust regressions. Variables are defined in Appendix D. Industry effects are included.

Table 4.5: Internal forecasting and misreporting

DV=MISREP	Predicted sign	Coefficient	p-value
Intercept		-0.031	(0.932)
BENCHM_PRESS	+	0.169*	(0.063)
FORECAST	?	-0.222*	(0.090)
POWER		0.696**	(0.011)
JOB_TENURE		-0.072**	(0.023)
GROWTH		-0.001	(0.888)
ENV_VOL		-0.071	(0.489)
LOSS		-0.006	(0.984)
REV		0.038	(0.332)
LEVERAGE		0.057	(0.467)
INF_ASYM		0.164*	(0.073)
Industry effects		Yes	
F-Statistic		1.98**	
R-squared		0.22	
N		112	

In Table 4.5 regression estimates from robust regressions of the following model are reported:

$$
\begin{aligned}
MISREP_i = & \beta_0 + \beta_1 BENCHM\_PRESS_i + \beta_2 FORECAST + \beta_3 POWER_i \\
& + \beta_4 JOB\_TENURE_i + \beta_5 GROWTH_i + \beta_6 ENV\_VOL_i + \beta_7 LOSS_i \\
& + \beta_8 REV_i + \beta_9 LEVERAGE_i + \beta_{10} INF\_ASYM_i + \delta_j + \epsilon_i
\end{aligned}
$$

P-values are based on robust regressions. ***, **, * corresponds to 1%, 5%, and 10% significance levels (one-tailed when the coefficient sign is predicted, two-tailed otherwise). No observation was dropped during the estimation of the regression coefficients via robust regressions. Variables are defined in Appendix D. Industry effects are included.

4.5 Conclusion

In this study, we are specifically interested in firms' internal forecasting. We position internal forecasting as part of firms' internal information environment. Internal forecasts typically contain projections embedded in the static annual budget, as well as the supplementary forecasts that are made during the fiscal year. While prior accounting literature on forecasting mainly focused on management forecasts as a means of disseminating information and guiding capital market participants' expectations, empirical evidence suggests that forecasting is in the first place motivated by internal purposes.

We find that firms' internal forecasting is driven by pressure to achieve externally imposed performance benchmarks, indicating that these firms invest more in their internal forecasting processes. Next, we turn towards misreporting as an alternative means to achieve performance benchmarks established by prior literature. We find that misreporting relates to firms pressure to achieve performance benchmarks. Finally, we examine the relation between internal forecasting and misreporting as means to achieve performance benchmarks. Consistent with the intuition that greater internal forecasting quality decreases the demand for misreporting as alternative means for meeting performance benchmarks, our results suggest that firms with better internal forecasting engage in less misreporting.

We contribute to literature on forecasting with a focus on the internal role of forecasting (as part of firms' internal information environment), as opposed to the more extensively studied external role (i.e., voluntary disclosure). Further, we contribute to management accounting literature on the planning and control role of budgeting, while prior literature largely examined the evaluation and incentive role of budgeting. Finally, a large set of papers examines the importance of meeting benchmarks and reporting choices in order to do so; we emphasize in our study an alternative means of meeting performance benchmarks and its' relation to misreporting.

As every other study, this study has limitations. As we employ a survey method we run the risk of response bias. Even though we often validate answers that require respondents' perception with objective measures, we can never fully assure the answers are unbiased. Further, we are limited in our ability to collect supplemental data. We try to address these points with a thorough survey set-up and execution. Finally, we only have a cross-section of firm-level data available, which limits us in making causal inferences.

Appendix D

Variable Description

Variables are constructed as follows:

MISREP	Measured using an five-item survey instrument that reflects accounting and real economic actions to influence reporting and is described in Appendix E.
FORECAST	Measured using a five-item instrument described in Appendix E.
BENCHM_PRESS	Measured using a four-item instrument described in Appendix E.
INFO_MAN	Measured using a six-item instrument described in Appendix E.
M&A	Indicator taking the value of one if an entity was as purchasing entity involved in major mergers or acquisitions within the last 3 years, zero otherwise.
POWER	Indicator variable equal to one if the respondent has a longer reporting relation with their line manager (divisional or firm-level CEO) than with the functional supervisor (corporate CFO, audit committee), zero otherwise.
JOB_TENURE	Years that the respondent is in his or her current position.
GROWTH	Sales growth relative to the prior year.
ENV_VOL	Measured using a six-item instrument described in Appendix E.
LOSS	Indicator variable for loss-making entities equal to one if net income was smaller than zero, zero otherwise.
REV	Measures entities' revenues and ranges between one and nine.
LEVERAGE	Measures firms' debt-to-assets ratio and ranges between one and four.
INF_ASYM	Measured using a six-item instrument described in Appendix E.

Appendix E

Description and Statistical Properties of Latent Constructs

Table E.1: Summary statistics and factor loadings on misreporting (MISREP). In this table responses to the following question are presented: How frequently took your entity the following actions to influence performance? Items are measured on a scale from 1 (never occurs) to 5 (occurs very frequently).

	Mean	Std. Dev.	Min.	Max.	Factor pattern
Change accounting estimates to shift profits between periods (e.g., estimation of uncollectible accounts expense, write-offs, impairments).	2.29	1.04	1	5	0.59
Re-label line items.	1.78	0.81	1	4	0.60
Record transactions early or late (if justified).	1.87	0.87	1	4	0.65
Provide/refuse price discounts or more/less lenient credit terms to influence sales levels.	2.20	1.13	1	5	0.56
Postpone/accelerate discretionary expenditures (investments in R&D, advertising, maintenance, etc.).	2.27	1.07	1	5	0.47
Cronbach alpha: 0.71					

Table E.2: Summary statistics and factor loadings on internal forecasting (FORECAST). In this table responses to the following question are presented: Please indicate whether you agree with the following statements on your entity's organizational forecasting system. Items are measured on a scale from 1 (completely disagree) to 5 (completely agree).

	Mean	Std.Dev.	Min.	Max.	Factor pattern
On top of P&L, we forecast many cash flow and balance sheet items.	3.72	1.25	1	5	0.42
We use different management information systems from the same vendor when making our forecasts.	2.74	1.40	1	5	0.43
We take into account different environmental situations when we forecast.	3.89	1.09	1	5	0.58
People from different business functions are involved in our forecasts.	3.89	1.16	1	5	0.59
We use external support like market research or involve supply chain firms to forecast demand.	2.49	1.37	1	5	0.34
Cronbach alpha: 0.61					

Table E.3: Summary statistics and cross loadings on latent independent variables. Items for benchmark pressure are measured on a scale from 1 (completely disagree) to 5 (completely agree), items for information asymmetry are measured on a scale from 1 (higher level is much better informed) to 5 (I am much better informed), and items for environmental volatility are measured on a scale from 1 (highly stable, infrequent change) to 5 (highly volatile, constant change). Items for information management are measured on a scale from 1 to 4 (where 1 = no plans to adopt, 2 = started (<25%), 3 = partly achieved (25%-75%), 4 = entity-wide adoption).

	Summary statistics		Cross-loadings			
	Mean	Std.Dev.	1	2	3	4
Benchmark pressure (BENCHM_PRESS)						
In the eyes of the hierarchical superiors, achieving the performance benchmarks is an accurate reflection of whether the entity is succeeding in business.	3.72	0.89	-0.0057	0.0828	**0.6841**	0.0930
The entity is constantly reminded by hierarchical superiors of the need to meet the performance benchmarks.	3.65	1.08	-0.0466	0.0535	**0.7026**	0.1580
The organization achieves control over the entity principally by monitoring whether they are going to meet the performance benchmarks.	3.72	0.90	0.0160	0.0045	**0.7604**	0.1035
In the eyes of the hierarchical superiors, not achieving the performance benchmarks reflects poor performance of the entity.	3.49	0.95	0.0056	0.0386	**0.8169**	0.1476

Cronbach alpha: 0.84

Information asymmetry (INF_ASYM)

Relative to the higher level, who is better informed about the activities of your entity?	3.50	1.19	**0.8233**	-0.0221	-0.0191	0.0835
Relative to the higher level, who is better informed about input-output relations inherent in the internal operations of your entity?	3.60	1.11	**0.8646**	0.0486	-0.0497	0.0717
Relative to the higher level, who is more certain about the performance potential of your entity?	3.83	1.06	**0.7510**	-0.0114	-0.0340	0.1071
Relative to the higher level, who is better able to estimate the impact of external conditions on the activities of your entity?	3.83	1.03	**0.6325**	-0.0828	-0.0272	-0.0334
Relative to the higher level, who has a better understanding of what can be achieved within your entity?	3.08	1.02	**0.6607**	0.1627	0.0754	-0.0567
Relative to the higher level, who is more familiar, in a technical fashion, with the work of your entity?	3.25	1.06	**0.7666**	0.1492	0.0309	-0.0492
Cronbach alpha: 0.88						

Environmental volatility (ENV_VOL)

What is the rate of change in the buying patterns and requirements of customers?	3.38	1.11	-0.1095	0.1108	0.0951	**0.6710**
What is the rate of change in distributors' attitudes?	2.55	1.11	0.2433	0.0292	0.2321	**0.5203**
What is the rate of change in industry buying patterns?	3.08	1.07	-0.0544	0.1369	0.1101	**0.7219**
What is the rate of change in competitor strategies?	3.00	1.09	0.0658	0.0501	0.1490	**0.5303**
What is the rate of change in technical developments relevant to your entity's business?	3.22	1.15	0.0122	0.0260	0.0818	**0.6015**
What is the rate of change of the changes in the (service) production process?	2.98	0.96	0.0158	0.0720	-0.0237	**0.4920**
Cronbach alpha: 0.77						

Information management (INFO_MAN)

Does your entity have a strict adherence to common data definitions?	2.91	0.88	0.0811	**0.6948**	0.1394	0.1035
Does your entity have a definition of business process owners?	2.86	0.93	0.1166	**0.6507**	0.0829	0.1415
Does your entity use standardized common processes?	3.33	0.86	0.1521	**0.6336**	-0.0369	0.0046
Does your entity use standard chart of accounts / standard information architecture?	2.87	0.85	-0.0543	**0.5613**	-0.0313	0.2179
Does your entity reduce the number of stand-alone applications?	2.72	0.79	-0.0087	**0.7146**	0.0496	0.0494
Does your entity rationalize the use of data warehouses?	2.59	0.88	-0.0687	**0.6221**	0.0223	-0.0178
Cronbach alpha: 0.81						

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English Summary

In this dissertation, I examine two relevant topics for managers and capital market participants, namely firms' forecasting and their reporting choices. Increasing our understanding of firms forecasting practices is relevant as we learn about the means of firms to assess economic uncertainty. The findings presented in chapter 2 suggest that well-connected board members are able to provide managers with information about macroeconomic or industry-wide developments, which facilitates the quality of managers forecasts. These findings indicate the importance of directors' advisory role, as opposed to their well-studied monitoring duties. In chapter 4, I show how forecasting processes interplay with managers reporting choices. The results indicate that more elaborate forecasting processes lead to less misreporting, suggesting that focus on forecasting processes reduces the need for potentially costly misreporting at the end of the fiscal year. Understanding firms misreporting practices is relevant as misreporting can lead to a distorted perception of the underlying economics of a firm by capital market participants. In chapter 3, I examine the impact of firm-initiated clawbacks on the firm's incentive compensation design decisions. The results suggest that the increased misreporting costs enable firms to increase the incentives for productive effort while at the same time safeguarding financial reporting integrity.

I examine the research questions outlined in this dissertation by means of standard as well as more sophisticated microeconometric techniques. I collect data of U.S.-listed firms from public available sources. The data collected of Dutch firms are confidential and were collected by means of a survey. This dissertation contains three stand-alone studies, where two are co-authored with my promoter Frank Verbeeten and my co-promoter Peter Kroos. The contribution of each author is specified in the section *co-author list*.

Dutch Summary

In dit proefschrift onderzoek ik twee onderwerpen die relevant voor zowel managers als kapitaalmarktdeelnemers (banken, analisten), namelijk de prognoses ('budgetten en forecasts') die bedrijven opstellen en afgeven en hun rapportage keuzes. Het vergroten van ons begrip van de prognosepraktijken van bedrijven is relevant om zicht te krijgen op de wijze waarop bedrijven economische onzekerheid beoordelen. De bevindingen in hoofdstuk 2 suggereren dat bestuursleden met een groter netwerk beter in staat zijn om managers informatie te verstrekken over macro-economische of industriële ontwikkelingen, waardoor de kwaliteit van de prognoses van managers wordt verbeterd. Deze bevindingen wijzen op het belang van de adviserende rol van de bestuurders; in tegenstelling tot hun controlerende taken is deze adviesrol nog veel minder onderzocht. In hoofdstuk 4 laat ik de interactie zien tussen het proces van het opstellen van een prognose en de rapportagekeuzes die managers maken. Uit de resultaten blijkt dat een meer uitgebreide prognose tot minder sturing in de rapportages leidt, wat suggereert dat meer aandacht voor het opstellen van de prognose de behoefte aan – mogelijk dure – sturing van de rapportages aan het eind van het fiscale jaar vermindert. Het begrijpen van de oorzaken die bedrijven aanzet tot (minder) sturing van de rapportages is relevant, omdat sturing van de rapportage kan leiden tot een vervormde perceptie van de onderliggende waarde van een onderneming door kapitaalmarktdeelnemers – met als ongewenst effect een inefficiënte allocatie van kapitaal. In hoofdstuk 3 onderzoek ik het effect van door de onderneming geïnitieerde 'clawbacks' op de inrichting van het beloningssysteem van de financieel directeur. Bij een 'clawback' bestaat de mogelijkheid om een te veel betaalde bonus, die is gebaseerd op onjuiste (financiële) gegevens, terug te vorderen bij het management (onder meer de financieel directeur) van de onderneming. De resultaten suggereren dat clawbacks de kosten van sturing in de rapportage voor de financieel directeur verhogen, waardoor bedrijven de productieve inspanningen van de financieel directeur kunnen verhogen zonder dat dit de integriteit van de financiële verslaggeving in gevaar brengt.

Ik onderzoek de onderzoeksvragen die in dit proefschrift zijn uiteengezet met behulp van zowel standaard- als meer geavanceerde micro-econometrische technieken. Ik heb data verzameld van Amerikaanse beursgenoteerde bedrijven vanuit publiek beschikbare bronnen. De verzamelde gegevens van Nederlandse bedrijven zijn verzameld door middel van een enquete, waarbij vertrouwelijkheid naar de respondenten is gegarandeerd. Dit proefschrift bevat drie op zichzelf staande studies; twee daarvan zijn mede geschreven door mijn promotor Frank Verbeeten en mijn co-promotor Peter Kroos. De bijdrage van elke auteur is gespecificeerd in de sectie *co-author list*.