Risk-Based Forecasting and Planning and Management Earnings Forecasts

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ABSTRACT: This study examines the association between a firm's internal information environment and the accuracy of its externally-disclosed management earnings forecasts. Internally, firms use forecasts to plan for uncertain futures. The risk management literature argues that integrating risk-related information into forecasts and plans can improve a firm's ability to forecast future financial outcomes. We investigate whether this internal information manifests itself in the accuracy of external earnings guidance. Using detailed survey data and publicly-disclosed management earnings forecast from a sample of publicly-traded U.S. companies, we find more sophisticated risk-based forecasting and planning processes associated with more accurate management earnings forecasts. These associations hold across a variety of different planning horizons (ranging from annual budgeting to long-term strategic planning), providing empirical support for the theoretical link between internal information quality and the quality of external disclosures.

Keywords: Management earnings guidance; budgeting; planning; forecasting; risk management

1. Introduction

This study provides evidence on the associations between specific attributes of a firm's internal forecasting and planning processes and the accuracy of the firm's externally-disclosed earnings forecasts. Theory predicts a link between the quality of information used for managerial decision-making and external reporting quality (Hemmer and Labro 2008). This theoretical prediction has led a number of recent studies to use the accuracy of management earnings guidance as a proxy for the quality of a firm's internal information (Gallemore and Labro 2014; Goodman et al. 2014; Heitzman and Huang 2014). However, the inability to observe a firm's internal information environment has limited researchers' ability to directly examine the link between internal information quality and external disclosure. Instead, studies have relied on proxies such as the rectification of internal control weaknesses or the adoption of enterprise information systems to capture firms' internal information environments (Dorantes et al. 2013; Feng et al. 2009). Although these studies provide initial evidence supporting the link between the quality of internal information and external earnings guidance, they provide little insight into how improved information quality manifests itself in more accurate earnings forecasts, or which specific internal practices are associated with greater forecast accuracy.

We begin to address these limitations using detailed survey data on the incorporation of risk considerations into the forecasting and planning processes of a sample of publicly-traded U.S. firms.[1] We then associate these practices with the accuracy of the firms' subsequent publicly-disclosed earnings forecasts. Recent studies indicate that managers believe that earnings forecasting has become increasingly difficult due to greater uncertainty in operating

[1] The survey covers the major elements of the Committee of Sponsoring Organizations of the Treadway Commission's enterprise risk management (COSO 2004) and internal control (COSO 2013) frameworks, which the SEC is advocating as "best practice" in risk and control assessment, especially over financial reporting (Stout 2014).

environments, and perceive one of their biggest forecasting challenges to be effectively integrating risk information into their forecasting and planning processes (Aberdeen 2012; AFP 2012, 2014; Deloitte 2012; KPMG 2007; PricewaterhouseCoopers 2011). This challenge has led both academics and practitioners to call for firms to adopt more sophisticated approaches for incorporating risk-related information into forecasts and plans (e.g., Alviniussen and Jankensgard 2009; Deloitte 2012; Ai et al. 2013; Morlidge et al. 2013).

Proponents of this integrated "risk-based forecasting and planning" (RBFP) approach contend that more consistent and sophisticated identification, quantification, and modeling of all types of risks and their interdependencies, and the incorporation of this information into financial and strategic forecasts and plans, can improve a firm's earnings forecasting ability by allowing the entity to better identify and measure the likelihood and impact of each risk event, to improve the consistency of key finance and risk assumptions and forecasting inputs, and to establish more realistic estimates and attainable goals that better align financial and strategic actions (Aberdeen 2012; Deloitte 2012; KPMG 2007).

Despite these potential forecasting advantages, the link between more sophisticated RBFP and the accuracy of management earnings guidance is not straightforward. Some critics question the value of RBFP. Difficulties in defining a firm's risk appetite and tolerances, limitations in risk-based forecasting models, and the inability to anticipate infrequent or extreme events are all claimed to limit the effectiveness of quantitatively-oriented RBFP practices (Taleb 2007; Danielsson 2008; Power 2009). Psychological studies also suggest that RBFP can hinder effective forecasting and planning if these practices provide managers with a false sense of security or cause overconfidence in tenuous forecasts (Kahneman and Lovallo 1993; Durand 2003). Finally, the managerial decision-facilitating role of internal information systems may have little influence on the quality of financial accounting disclosures that are focused on valuation and control. In particular, externally-disclosed management earnings guidance may not reflect managers' true earnings expectations, with numerous studies identifying various factors that can motivate managers to bias their externally-disclosed earnings forecasts (e.g., Lang and Lundholm 2000; Newman and Sansing 1993; Noe, 1999; Rogers and Stocken 2005). Given these differing potential outcomes, our analyses represent joint tests of the effectiveness of RBFP and the linkage between internal and external information quality.

Using publicly-disclosed annual management earnings forecasts made by 85 firms that completed a risk management benchmarking survey between 2011 and 2014, we examine the relations between more sophisticated RBFP practices and management earnings forecast errors and widths. RBFP potentially improves forecast accuracy both by improving forecasting ability and by leading to operational changes that reduce volatility and uncertainty. To isolate the effects of improved forecasting and planning ability, our tests include several controls for the volatility and uncertainty in the firm's operations. These controls allow us to examine whether RBFP improves forecasting ability not simply by reducing the volatility of a firm's operations, but by improving the forecasting process itself, providing managers with better information regarding upcoming earnings.

We find more sophisticated overall RBFP practices associated with smaller management forecast errors in the survey completion and subsequent years. We further examine the relations between individual RBFP practices and the magnitude of forecast errors. The forecasting and planning process consists of two stages: (1) information acquisition and processing, and (2) the integration of this information into forecasts and plans (Hogarth and Makridakis 1981). Our examination of the information acquisition and processing practices prescribed by RBFP proponents finds more consistent and sophisticated incorporation of quantitative information into risk assessments is significantly associated with smaller forecast errors, especially when used in conjunction with more sophisticated identification and use of information on risk drivers (sources of risks) and risk interdependencies. In addition, firms that produce forecast probability distributions using stochastic models and other methods have smaller errors than those producing only single- or multi-point forecasts for internal purposes. With respect to RBFP outputs, we find that the length of the planning horizon makes little difference, with greater incorporation of risk considerations into short-term annual budgets, medium-term capital investment and project decisions, and long-term strategic plans all associated with smaller forecast errors. Additional analyses provide evidence that these associations are not driven by the self-selection of firms into our sample or to correlated omitted variables.

We also find more sophisticated RBFP practices significantly associated with smaller earnings forecast widths across most of our sample. The exception is firms using forecast probability distributions and/or stochastic models in forecasting. These results suggests that firms that attempt to model a large range of potential risk-related earnings outcomes are more likely to take into account the probability that some of the more extreme outcomes may materialize when making longer-term plans. Finally, we observe significant negative relations between the sophistication of RBFP practices and sales forecast errors in the subsample of firms that publicly disclose sales forecasts, but relatively little association between RBFP practices and publicly-disclosed capital expenditure forecast errors.

Our study makes several contributions to the accounting literature. First, our access to information on firms' internal forecasting and planning practices, as well as our ability to link these data to publicly-disclosed management earnings forecasts, allows us to provide some of the first direct evidence on the relation between specific internal information system attributes and external disclosures. In doing so, we support Hemmer and Labro's (2008) theoretical prediction that internal information quality is related to the quality of externally reported information, and help justify prior research's assumption that the accuracy of management earnings guidance is a reflection of internal information quality (Gallemore and Labro 2014; Goodman et al. 2014; Heitzman and Huang 2014).

Second, we extend the management earnings forecast literature. Hirst, Koonce, and Venkataraman's (2008) survey of this literature finds that research on the antecedent factors influencing the accuracy or other characteristics of management earnings forecasts is lacking. Our examination of one such factor – the quality of a firm's internal information environment, as measured by how effectively the firm incorporates risk-related information into its forecasting and planning processes – begins to open this black box.

Third, our study informs the forecasting, budgeting, and planning literatures. A 2015 AICPA survey of its Certified Global Management Accountant members found business planning, budgeting, and forecasting to be the topic that respondents said they are most in need of additional guidance and tools, followed by strategic planning. These topics rank ahead of traditional accounting research topics such as financial accounting and reporting, financial statement analysis, and cost management. Our study provides evidence on the value of one set of tools and practices available for improving forecasting and planning.

Finally, our study provides evidence on a specific mechanism linking integrated, enterprise-wide risk management practices to firm performance and value. While a growing literature examines the performance effects of enterprise risk management (ERM) (e.g., Gordon et al. 2009; McShane et al. 2011; Hoyt and Liebenberg 2011; Baxter et al. 2013), the majority of these studies examine the associations between aggregate measures of overall enterprise risk management adoption or use and aggregate measures of firm risk or value, shedding little light on the effects of different risk-focused planning and control practices on enterprise decision-making. Our examination of individual risk-based forecasting and planning practices, together with our investigation of a specific managerial outcome, begins to unravel the observed associations between enterprise risk management adoption and firm value.

2. **RBFP and Management Earnings Forecasts**

Management earnings forecasts are a key disclosure mechanism for voluntarily communicating a firm's financial prospects to market participants (Hirst et al. 2008). Theory predicts a link between the quality of information used for managerial decision-making and external financial disclosures (Hemmer and Labro 2008), suggesting that the quality of information that firms use to forecast earnings and develop financial plans should be associated with the accuracy of their externally-disclosed earnings forecasts. We test this prediction by examining the relation between the sophistication with which a firm incorporates risk considerations into its forecasting and planning processes and the accuracy of its external earnings guidance.

The ISO 31000 risk management standard defines risk as an uncertainty that, if it occurs, will have an effect on objectives (International Standards Organization 2009). This uncertainty can take a variety of forms, including financial, operational, strategic, compliance, and other risks such as natural disasters. Most firms make some attempt to consider risk in forecasting and planning (AFP 2014). However, these efforts are often undertaken on an informal, qualitative basis, with little interaction between financial planning, strategic planning, and risk management (Deloitte 2013).[2]

The goal of RBFP is to effectively incorporate risk considerations into forecasting and planning activities. RBFP practices combine holistic approaches to managing risks such as enterprise risk management (e.g., COSO 2004; Nocco and Stulz 2006) with advances in risk analysis and modeling (e.g., Mun 2010). Key elements of RBFP include employing more sophisticated quantitative methods to evaluate and monitor key risks, risk drivers, and risk interdependencies; assessing the extent to which these risks fit within the firm's risk appetite, risk tolerances, and risk capacity[3]; and formally incorporating these analyses into the firm's financial and strategic planning processes.

RBFP proponents claim that these practices can improve forecasting ability through two mechanisms. First, greater integration of risk considerations into forecasting and planning practices can provide information that allows the firm to take actions that reduce the volatility and uncertainty of its operations, which prior studies have found to be negatively associated with management earnings guidance accuracy (Ajinkya et al. 2005; Dichev and Tang 2009; Feng et al. 2009; Yang 2012). Rather than treating the risks of each significant decision or business unit independently, RBFP methods can increase understanding of the firm's overall risks and the interdependencies of these risks across the firm's portfolio of activities. This knowledge allows

[2] AFP (2014) find that only 23 percent of financial planning and analysis groups employ risk analysis on a regular basis, and just 21 percent of these groups have a high degree of collaboration with risk management. A survey by Marsh and RIMS (2014) adds that only 20 percent of firms believe that risk management has a significant impact on the setting of business strategy.

[3] Risk appetite represents the amount of risk exposure the firm is willing to accept to achieve its objectives, risk tolerance is the acceptable variation in outcomes related to each risk, and risk capacity is the maximum level of risk the firm can assume given its financial and nonfinancial resources.

the firm to consider how each decision or unit contributes to the firm's overall risk profile and to understand where interdependent risks can multiply or cancel each other out. By using this knowledge to coordinate risk-taking and risk responses across the enterprise, firms can minimize unwanted volatility through more informed and integrated risk avoidance, mitigation, sharing, and contingency planning efforts. Consistent with this prediction, studies by Ellul and Yerramilli (2013), Ittner and Keusch (2016), and others find negative associations between the sophistication of enterprise risk management practices and stock price volatility.

A second potential mechanism linking RBFP and earnings forecast accuracy, and the focus of our study, relates to improvements in the forecasting process itself. The RBFP literature contends that these practices improve both the information gathering and processing stage of the forecasting process and the achievability of the resulting plans. The data gathering stage of the RBFP process begins with the identification of risks, risk drivers, and risk interdependencies, followed by quantitative risk assessments (Mun 2010; Curtis and Carey 2012). The risk assessment brings quantitative inputs and methods to the evaluation of risks and risk interdependencies relative to the firm's risk appetite and tolerances.

Although many firms produce single or multi-point forecasts based on these risk assessments, proponents of RPFP call for the use of stochastic or probabilistic models and distributions that better capture the uncertainty in outcomes when measuring the likelihood and impact of each potential risk event on financial performance. Key measures such as cash-flow-at-risk and earnings-at-risk can then be generated by "shocking" financial forecasts against major risk drivers to create a probability distribution for each period (Deloitte 2013).

Consistent application of comprehensive, quantitatively-oriented risk assessments and probabilistic models is said to improve understanding of current and emerging risks by providing best and worst case performance scenarios and identifying risks that fall outside of established tolerances. Enhanced quality and consistency of key finance and risk assumptions and forecasting inputs, greater alignment of risk-return profiles across the firm, improved quantitative understanding and analysis of the risk drivers that contribute most to earnings exposure, and enhanced analytical capabilities can improve a firm's ability to assess and incorporate uncertainty in forecasts and plans (Aberdeen 2012; Deloitte 2012; KPMG 2007).[4] Behavioral research adds that more sophisticated RBFP data processing practices can also reduce many common forecasting biases. For example, experiments find that the use of scenario analysis, a common RBFP tool, reduces overconfidence, confirmation, and framing biases, and leads to higher quality decisions than more general strategic planning techniques such as strengths, weaknesses, opportunities, and threats (SWOT) analysis (Schoemaker 1993; Bradfield 2008; Meissner and Wulf 2013).

These potential forecasting benefits lead us to predict that, controlling for the level of firm volatility and uncertainty, more consistent and sophisticated RBFP risk driver analyses and quantitative assessment practices and the development of stochastic or probabilistic forecasting models are positively associated with earnings forecast accuracy.

Even if more sophisticated risk assessments and quantitative analyses and modeling allow firms to better identify what risks to monitor, to establish more realistic estimates and attainable goals, and to facilitate the development of contingency plans for meeting the firm's earnings targets under a range of scenarios (Aberdeen 2012; Deloitte 2012; KPMG 2007), the

[4] These claims are consistent with studies finding that forecasts that are based at least partially on quantitative methods are more accurate than those based purely on qualitative judgment (Lawrence et al. 2006). Similarly, Cassar and Gerakos (2013) find that the accuracy of hedge fund managers' performance forecasts during the financial crisis were positively associated with their use of value-at-risk modeling and stress testing.

link between RBFP and annual earnings forecast accuracy may still depend upon the planning horizon covered by the forecast (Toneguzzo 2010). Financial and strategic plans can range from short-term annual budgets that closely match the time frame of the external earnings forecast, to mid-term capital expenditure and project plans, to long-term strategic analyses. Incorporating the results from quantitative risk assessements into the budgeting process can improve earnings forecasting by supporting resource allocations that are consistent with the desired risk-return profile and within the firm's financial capacity to bear the desired risks (Cassar and Gibson 2008; Alviniussen and Jankensgard 2009). Integrating risk assessments into capital investment decisions can ensure that interactions between risks that are shared across multiple business units, projects, and time periods are considered, and promotes improved coordination of capital requirements, cash flow potentials, and risk exposures (Froot and Stein 1998; Ai et al. 2012). Considering risk assessment results in the strategic planning process further supports forecasting ability by allowing firms to evaluate whether one strategic initiative introduces risks that conflict with the goals of another, and to assess whether the combined risks of the various strategic choices fall within the firm's risk appetite and tolerances (Beasley and Frigo, 2010).

Differences in the time horizons of these various plans may influence their earnings forecasting benefits (Toneguzzo 2010). In the short-term, many risks are operational or financial in nature, and firms are more likely to have the required knowledge to effectively assess and model the expected impact of these risks on earnings. As the planning horizon gets longer, strategic risks become more important and unanticipated or unknowable risks become more likely, which may make accurate earnings forecasts more difficult. Conversely, greater incorporation of risk consdierations into longer-term strategic planning may allow firms to better understand and integrate the risks across their various stratgeic choices, thereby allowing them to minimize or compensate for unexpected earnings shortfalls to a greater extent than might be possible if risks are only considered in shorter-term and narrower budgeting and capital expenditure decisions. Curtis et al. (2014), for example, find that strategic decisions may be more predictive of future finanical outcomes than shorter-term capital expenditure decisions.

While the preceding arguments link more sophisticated RBFP practices to improved forecasting performance, this link has been questioned by critics of formal, quantitative risk management processes. Taleb (2007) and Makridakas and Taleb (2009), for example, are highly critical of quantitative risk models and forecasts. They argue that accurate risk forecasting is not possible for many reasons, including the use of statistical models that underestimate uncertainty because they assume that events are independent, forecast errors are tractable, and variances in forecasting errors are finite, known, or constant; the presence of new, infrequent, or unforeseen events that make prediction based on historical data of limited value; the lack of information on the underlying distributions of these new or infrequent events; and the tendency to overlook important non-quantifiable or hard to obtain information on many types of risks. Behavioral studies have also found that more sophisticated forecasting and planning practices can lead to significant cognitive biases. More sophisticated quantitative risk analyses may give the perception of false accuracy. Similarly, forecasts that anchor predictions on plans and scenarios can create an "illusion of control" over uncertain future events, leading to positive forecast biases and larger forecast errors (Kahneman and Lovallo 1993, Durand 2003). Experiments indicate that the identification of more potential risks during the planning process can also lead to greater over-optimism in forecasts (Jorgensen 2010). Power (2009) highlights three additional flaws in the adoption of formal, integrated risk management processes such as RBFP. First, the very notion of a singular risk appetite that underlies the top-down RBFP approach is problematic because organizations are comprised of a variety of risk appetites that change over time. Second, many integrated risk management processes are predicated on notions of internal control, compliance, and auditability, which conflict with need to confront the ambiguity and flexibility required to effectively manage risks and their outcomes. Third, the expansive reach of new, integrated risk management processes requires a high level of identification and understanding of interconnectedness and risk interdependencies that has proved elusive.

It may also be the case that internal management accounting practices such as RBFP practices may be useful internal decision-making tools, but the managerial decision-facilitating role of internal information systems may play little part in the choice of financial accounting disclosures that focus on valuation and control. For example, studies indicate that managers may have incentives to bias their external earnings forecasts in order to deter potential industry entrants (Newman and Sansing 1993), facilitate security issuance (Lang and Lundholm 2000), improve trading profitability (Noe 1999), or reduce expected legal costs (Rogers and Stocken 2005). As a result, the external disclosure may not reflect management's actual earnings expectations. Thus, failing to find an association between RBFP and external forecast accuracy in our tests could be attributed either to the ineffectiveness of these practices or to the lack of a link between a firm's internal information quality and external forecasts.

3. Sample and Data

3.1 Sample Selection

Our sample is drawn from respondents to Aon's Risk Maturity Index (RMI) survey.[5] Aon, a leading provider of insurance brokerage, risk management, and human resource services,

[5] Neither author has received any compensation or funding from Aon.

designed the RMI as a self-assessment tool for organizations to evaluate and benchmark their enterprise risk management capabilities. The survey was developed in collaboration with academics and industry risk experts, and covers the major elements of the Committee of Sponsoring Organizations of the Treadway Commission's enterprise risk management framework (COSO 2004).[6] The survey instrument was extensively pre-tested with a group of risk management executives to ensure that the questions and response anchors were understandable and the questions could be accurately answered.

The RMI survey is aimed at high-level risk management and C-suite executives who are actively involved in their firms' risk management activities. Participation is solicited through industry and professional conferences and contacts with Aon clients.[7] To ensure data integrity, potential participants must contact Aon to confirm that they have the requisite knowledge of the firm's risk management practices to accurately complete the survey. If the participant is qualified, they receive an invitation e-mail containing a unique password that allows access to the on-line survey and serves as a firm identifier. The survey does not need to be completed in a single session, allowing participants to gather additional information when needed to answer a question. All participants are informed that their responses will be used for Aon and academic research purposes.

The RMI survey was launched in 2011. Our analyses focus on 85 publicly-traded U.S. respondents that completed the survey between 2011 and 2014 and have the required IBES,

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[6] The Committee of Sponsoring Organizations of the Treadway Commission (COSO) is an initiative supported by the Institute of Management Accountants, the American Accounting Association, the American Institute of Certified Public Accountants, the Institute of Internal Auditors, and Financial Executives International. COSO's enterprise risk management model is a widely-adopted framework that defines the essential components of an ERM process.
[7] Due to the ad hoc nature of the solicitation process, we cannot determine a response rate.

Compustat, CRSP, and Thomson-Reuters Institutional Holdings data for our sample period. Firms enter the sample in the fiscal year they complete the survey. Management earnings forecasts are then examined from that year through 2014. Each firm completes the survey only once, so our analyses assume that the sophistication of a firm's RBFP practices relative to those of other firms in the sample remains fairly persistent in the years following the survey's completion.

Table 1 describes the sample's industry composition. Compared to the population of firms on Compustat, our sample has substantially greater proportions of manufacturing, utilities, and wholesale/retail firms, and relatively fewer business equipment and financial firms.

Panel A of Table 2 provides the survey respondents' job titles: 71.77 percent are risk management executives (Risk Manager/Director of ERM or Chief Risk Officer), 14.12 percent are finance executives (Chief Financial Officer or Treasurer/Vice President of Finance), 3.53 percent are Internal Audit heads, and 2.35 percent are General Counsels/Corporate Secretaries, with the remaining 8.24 percent holding a variety of other positions. Two-thirds of the respondents are Aon clients, with approximately five percent receiving ERM consulting advice from Aon. Most of these clients use Aon for insurance brokerage or human resource management services. For confidentiality reasons, Aon did not provide us with information on which respondents are clients.

3.2 Variable Definitions

Aon provided the RMI survey respondents' identities to us on a confidential basis. This allows us to combine survey responses and publicly-available data in our tests. In the following sections, we first describe how we construct our risk-based forecasting and planning variables from the survey responses. We then outline our management forecast accuracy and related control variables.

3.2.1 Risk-Based Forecasting and Planning Variables

We use 25 questions from the survey to measure six individual components of risk-based forecasting and planning. The first three components capture the extent to which firms identify and assess risks and the extent to which quantitative methods are used to carry out these activities. The remaining three components relate to how firms use risk information in budgeting, capital expenditure and project decisions, and strategy development. Appendix A provides the questions used to construct the RBFP variables, together with their response frequencies.

We base the variable *Risk Drivers* on five questions assessing the consistency with which the firm identifies risk drivers and risk interdependencies, and the extent to which risk management activities are linked to specific risk drivers. The majority of firms (58 percent) consistently identify and document risk drivers for key risks. However, firms are less likely to consistently identify common drivers between key risks (38 percent), map specific risk drivers to risk management activities (35 percent), or analyze risk drivers to identify common risks (35 percent). Even fewer firms (13 percent) formally leverage common risk driver information to identify correlations and require this information to be considered in risk assessment processes.

While *Risk Drivers* focuses on the identification of risks and their interdependencies, *Quant. Assess.* focuses on how firms measure risks. We base *Quant. Assess.* on seven questions evaluating the extent to which firms use quantitative methods in their assessment of risk thresholds, risk exposures, and risk management effectiveness. Qualitative assessments based on managerial perceptions dominate risk assessments and evaluations. For example, 73 percent of the respondents have developed their risk assessment criteria to align with management's risk tolerance perceptions rather than with quantified risk appetite and risk tolerance statements, and 7 percent have not developed any risk assessment criteria at all. Similarly, the criteria for evaluating the effectiveness of the management of key risks is primarily qualitative (e.g., "adequate", "weak") in 58 percent of the firms, with no evaluation criteria in 19 percent of firms. Only 29 percent of respondents have consistently established quantitative thresholds and tolerances for key risks. Some firms formally incorporate ranges or distributions into their internal forecast using historical data or other quantitative methods (51 percent), but many only do so informally, relying on management judgment (39 percent).

Distribs. is an indicator variable that equals one in the 29 percent of firms that use probabilistic distributions and/or stochastic modeling techniques in developing forecasts, and zero in the remaining firms. Whereas *Quant. Assess.* focuses on whether firms measure risks using quantitative and/or qualitative methods, *Distribs.* captures the form of the resulting forecast. In our sample, only 40 percent of firms that stated that they formally incorporate historical data or other quantitative methods when developing internal forecasts also stated that they use forecast distributions and/or stochastic forecasting models, with the rest using these quantitative methods to develop single- or multi-point forecasts. Moreover, the single *Distribs.* question does not load on the same factor as the seven *Quant. Assess.* questions in our sample, indicating that *Quant. Assess*. and *Distribs.* represent both conceptually and statistically distinct constructs.

The next three variables measure the incorporation of risk considerations into plans spanning different time horizons. The variable *Budgeting* encompasses three questions assessing how firms incorporate risk into budgeting decisions. Responses to these questions indicate that many firms do not consistently consider risk assessments or risk differences when budgeting. More than a third of the respondents rarely or never explicitly reference risk assessments or analysis plans in their budgeting processes (40 percent), or evaluate risk management expenditures for effectiveness (such as cost savings vs. exposure reduction) when budgeting and allocating resources (38 percent). Only 31 percent of the firms explicitly set different risk-based return expectations for different business units and incorporate the different expectations in budget and resource allocation decisions.

Capital Invest. is based on responses to five questions on the use of risk-related practices in project and capital investment decisions. The majority of firms make some attempt to identify risks for significant project or investment decisions, either as part of a general SWOT (strengths, weaknesses, opportunities, and threats) analysis (44 percent) or through a dedicated risk identification and assessment methodology separate from SWOT (47 percent). When identifying risks, firms typically focus on both existing and emerging risks (58 percent of respondents). Firms compare these identified risks to quantified risk appetites and tolerances less frequently, with only 29 percent doing so consistently. Just 33 percent of firms consistently and formally compare a new investment against the organization's overall risk profile. Despite textbook prescriptions for managers to risk-adjust discount rates when making capital investment decisions, only 34 percent of respondents formally use quantitative analyses of project risk to adjust hurdle rates for significant capital investment decisions. The remaining firms do so never or rarely (22 percent), or informally based on management judgment or previous experience (44 percent).

We assess the integration of risk considerations into the strategic planning process using the variable *Strategy*, which is based on four questions related to how the firm incorporates risk appetite and risk assessments into the development and communication of strategic plans. Although 69 percent of the firms highlight how their risk management strategy aligns with their overall strategy when communicating strategic direction, this is frequently based on informal references to the concepts of risk appetite and tolerances (53 percent) rather than formal references to defined risk appetite and tolerances (16 percent). Only 20 percent formally apply risk appetite and/or tolerance concepts to strategy development, and just 32 percent formally incorporate key risk information from the risk management process into the strategic planning process. Over a quarter of the respondents (26 percent) do not conduct risk identification during the strategic planning process, and when they do only 38 percent use the risk identification exercise to develop an emerging risk profile.

The responses to each question underlying our RBFP variables are provided on fully-anchored three point scales, with larger scores reflecting more consistent or sophisticated application of the risk-based forecasting and planning practices prescribed in the enterprise risk management literature. We assess the uni-dimensionality of our multi-item *Risk Drivers, Quant. Assess.*, *Budgeting*, *Capital Invest.*, and *Strategy* constructs using principal components analysis. All of the questions associated with a given RBFP variable load on a single factor, with all factor loadings exceed 0.42. The composite reliability of the multi-item constructs, as measured using Cronbach's alpha, ranges from 0.79 for *Budgeting* to 0.88 for *Risk Drivers*, supporting the statistical reliability of our RBFP constructs. Given these results, we compute values for the five multi-item RBFP constructs based on the average standardized values for the individual questions included in each construct.

The individual RBFP variables represent components of an overall RBFP process. Consequently, it may be the case that the adoption of a more sophisticated overall RBFP process has a greater effect on forecast accuracy than the adoption of individual RBFP practices. We therefore generate the variable *Overall RBFP* as the average of the standardized scores for the six individual RBFP variables, providing a broad measure of the entire risk-based forecasting and planning process.

Panel B of Table 2 provides summary statistics for *Overall RBFP,* as well as its six subcomponents. Although we calculate the construct scores at the firm level, panel B provides summary statistics at the firm-year level, which is the level of analysis used in our tests. Panel C of Table 2 reports correlations between *Overall RBFP* and the six individual constructs. Correlations among the individual constructs range from 0.16 to 0.70, indicating that greater sophistication in the use of one set of RBFP practices does not necessarily imply equal sophistication in another. *Distribs.* has the lowest correlations with *Overall RBFP* (r = 0.52) and the other individual RBFP practices (0.16 to 0.34), consistent with the use of probabilistic distributions and/or stochastic models being a very distinct risk management and forecasting practice.

3.2.2 Management Earnings Guidance

The primary outcome of interest in our tests is management's external earnings forecast accuracy. We evaluate forecast accuracy using publicly-released management earnings guidance, as provided by IBES, which gathers the forecasts from public disclosures such as press releases and conference calls. We use management's annual earnings forecasts rather than quarterly forecasts because the longer forecast horizon is more likely to match the horizons over which the firm uses risk information for annual budgeting, project and capital investment decisions, and strategic planning. We gather annual forecasts issued within one year of the firm's fiscal year end. We take the earliest forecast made in this window, again to achieve a longer forecast horizon over which the benefits of forward-looking information from the risk forecasting and planning process are more likely to manifest themselves.

We construct two variable to evaluate attributes of management forecasts. *Mgmt Error* equals the absolute value of actual earnings per share less management's forecast, as a percentage of share price three days prior to the forecast. If the manager forecasts a range of earnings values, we use the midpoint of this range. Forecast width (*Width*) equals the upper bound of the forecast range minus the lower bound, as a percentage of price. Point forecasts are assigned a *Width* of zero.

3.2.3 Control Variables

We employ a variety of variables to control for factors that prior studies have found to be associated with a firm's forecast accuracy or risk management practices. Several variables capture firm-level attributes. *Size* is defined as the natural logarithm of the market value of equity at the beginning of the year. Prior research finds that larger firms have higher quality disclosure practices (Lang and Lundholm 1993), make more accurate management forecasts (Yang 2012), and have more sophisticated enterprise risk management processes (Gatzert and Martin 2015). *MTB* is beginning of year market value of equity divided by beginning of year book value of equity, and is a commonly used proxy for growth opportunities. *R&D* is research and development costs divided by beginning of year assets. Firms with more growth opportunities and higher levels of research and development are likely to face greater uncertainty, making forecasting more difficult (Cheng et al. 2013). *Ownership* is the percentage of the firm held by institutional owners. Firms with high institutional ownership have been found to forecast more accurately (Ajinkya et al. 2005) and to have more sophisticated ERM processes. *Segments* is the natural logarithm of the total number of operating segments in the firm. Although firms with more segments may be able to reduce risk by being better diversified, more complex operations may complicate forecasting and increase the benefits from risk management activities. *Age* is the number of years the firm has been listed in CRSP. Older firms are expected to be more stable and display less variability.

Two variables control for industry attributes. *HHI* is the Herfindahl-Hirschman Index, where industries are defined by four-digit SIC code. Firms in more concentrated industries may face more opaque information environments (Ali et al. 2014), making forecasting more difficult. *Lit. Risk* is an indicator variable for firms in SIC industries 2833-3836, 3570-3577, 3600-3674, 5200-5961, or 7370-7374 (Cheng et al. 2013). Firms subject to greater litigation risk may issue more pessimistic forecasts (Rogers and Stocken 2005).

Finally, *Following* is the natural logarithm of the number of analysts providing an earnings estimate for the firm in the current year, which has been found to be associated with management earnings guidance (Ajinkya et al. 2005). *Horizon,* in turn, is the natural logarithm of the number of days between the management guidance date and the earnings announcement date. The further from the earnings announcement date, the harder it should be to predict earnings.

To isolate RBFP's effect on management's forecasting ability through improvements in internal information quality, we include four variables to control for the possibility that more sophisticated RBFP practices enable more accurate forecasting not because they provide management with better forecasting information, but because they lead to actions that lessen the variability and uncertainty in a firm's operations. *Return Vol.* is the standard deviation of daily stock returns over the previous year. Volatility reflects uncertainty about the firm's operations that likely makes forecasting more difficult. *Analyst Uncert.* is the standard deviation of analyst forecasts made for the year, using the last forecast by each analyst prior to the management forecast. This variable is meant to capture uncertainty among investors regarding upcoming earnings (Barron et al. 1998). *Analyst Error* is the absolute value of actual earnings per share less the median analyst forecast at the time of the management forecast, scaled by price. *Analyst Error* captures the ability of parties outside the firm to predict upcoming earnings. This variable is an important control as it measures the difficulty of forecasting earnings based on all publicly-available information. To the extent that any real actions taken in response to internal RBFP information are observable to the market, the remaining variation in *Mgmt Error* (after controlling for *Analyst Error)* should be related to management's ability to better forecast earnings as a result of their internal forward-looking information. Finally, using survey responses, we control for whether or not the firm changed its strategic direction in the prior two years as a result of new information or understanding concerning a major risk. Any improvement in forecast accuracy relating to a change in strategic direction is likely to reflect changes in operations due to improved risk-related information rather than being purely due to changes in forecasting ability. The variable *Strategy Change* equals one if the respondent answered that they changed strategic direction, and zero otherwise.

3.3 Descriptive Statistics

Descriptive statistics are presented in Table 3. The first three columns provide descriptive statistics for the firms in our sample. We include all firm-years after the firm completes the survey and for which an earnings forecast was made, for a total of 211 observations. The next three columns give descriptive statistics for the set of Compustat firms with data available to compute all of the measures used in our analyses. We include these comparative statistics to assess the representativeness of our sample. A t-test of differences in means between our sample and the Compustat sample reveals many significant differences. In particular, *Mgmt Error* is lower in our sample than in the Compustat sample. This raises the concern that the firms in our sample take the survey because they enjoy firm-specific benefits from risk management practices.

Alternatively, the difference in *Mgmt Error* may be due to differences in observable characteristics that have been found to be associated with earnings forecast accuracy. For example, our sample is larger, older, has higher analyst following, lower return volatility, and lower analyst's uncertainty and forecast error, all of which are likely to be associated with management forecast accuracy. We therefore create a propensity matched sample from Compustat using the variables *Size, MTB, R&D, HHI, Ownership, Lit. Risk, Segments, Age, Following, Return Vol., Analyst Uncert.,* and *Analyst Error*. As seen in the last columns of Table 3, our sample and the matched sample of Compustat firms are similar on all of our variables ($p > 0.10$). In particular, *Mgmt Error* is not significantly different between our sample and the matched Compustat sample, indicating that our firms are not systemically better forecasters than similar firms that are not in our sample. We revisit potential selection issues after presenting our primary results.

Pearson correlations between the variables used in our tests are provided in Table 4. *Overall RBFP* has a significantly negative correlation with *Mgmt Error*. As expected, *Mgmt Error* is also highly correlated with *Analyst Error* (0.90), reflecting the fact that both of these variables capture the difficulty of forecasting earnings. Correlations between *Overall RBFP* and both *Return Vol.* and *Analyst Error* are negative and significant, consistent with claims that more sophisticated RBFP practices provide information that allows firms to take actions that reduce volatility and uncertainty in the entities' operations. The significant positive correlation between

Overall RBFP and *Strategy Change* also suggests that firms with more sophisticated RBFP are more likely to make strategic changes based on the improved risk-related information generated by the RBFP process. By including these variables as controls, any observed relation between RBFP practices and forecast accuracy is more likely to reflect variations in forecasting ability rather than differences in variability and uncertainty brought about by RBFP-driven changes in operations.

4. Results

4.1 Forecast Errors and Risk-Based Forecasting and Planning

We predict a negative association between our risk-based forecasting and planning measures and the magnitude of management forecast errors (*Mgmt Error*). Table 5 presents results from our tests of this prediction. We include year fixed effects in the models and cluster standard errors by firm. In the first column, we regress *Mgmt Error* on the broad risk-based forecasting and planning measure *Overall RBFP.* Each successive column replaces *Overall RBFP* with one of its underlying components: *Risk Drivers, Quant. Assess, Distribs., Budgeting, Capital Invest.,* or *Strategy*.

The results show that RBFP is consistently associated with lower management forecast error. The coefficients on *Overall RBFP* and all six of the components are negative, with only *Risk Drivers* marginally insignificant ($p = 0.104$, two-tailed). The estimated coefficient on *Overall RBFP* corresponds to a one standard deviation increase in this variable reducing *Mgmt Error* by 16.1 percent from its mean value.

The significant negative coefficient on *Quant. Assess.* suggests that more consistent and sophisticated use of quantitative risk measurement practices can improve forecasting ability, contradicting recent criticisms of quantitatively-oriented risk management processes. The estimated coefficient on *Quant. Assess.* implies that a one standard deviation increase in this variable is associated with a 12.9 percent reduction in *Mgmt Error* from its mean value. Similarly, the highly significant negative association between *Distribs.* and *Mgmt Error* indicates that firms that develop forecasts based on probability distributions and/or stochastic modeling have management earnings forecast errors that are 0.204 percentage points lower than firms that do not use these methods. This is relative to a mean *Mgmt Error* of 0.761 percent. Although *Risk Drivers* is marginally insignificant in Table 5, when this variable is interacted with *Quant. Assess.* (not reported in the table), the interaction term is negative and statistically significant ($t = -2.67$), indicating that forecast errors are lower when firms employ quantitative risk measurement techniques together with more consistent and sophisticated risk driver analyses.[8]

The significant negative coefficients on *Budgeting, Capital Invest.,* and *Strategy* suggest that incorporating risk-related information into planning processes improves earnings forecasting performance across a variety of planning horizons. The estimated coefficients on *Budgeting, Capital Invest.,* and *Strategy* suggest that one standard deviation changes in these variables'

[8] We also estimated models with interactions between each pair the three information gathering and processing variables and the three planning variables. The only other significant relation is a positive interaction between *Distribs.* and *Budgeting.* In this model, the coefficient on the *Budgeting* main effect is -0.139 ($p = 0.02$, two-tailed) and the coefficient on the interaction term is 0.139 ($p = 0.08$, two-tailed), indicating that greater incorporation of risk considerations when budgeting is associated with smaller earnings forecast errors unless distributions are used in forecasting, in which case Budgeting has no significant effect. We also find that *Distribs.* has a significantly negative main effect on forecast errors regardless of the other RBFP practice included in the model, suggesting that the use of probability distributions and/or stochastic models when forecasting can improve forecasting ability, independent of the other RBFP practices adopted by the firm.

scores are associated with *Mgmt Error* values that are 14.6 percent, 7.5 percent, and 14.5 percent lower than the average *Mgmt Error*, respectively.[9]

4.1.1 Changes in Forecast Errors and Risk-Based Forecasting and Planning

One limitation of our data is that we only observe each firm's response to the survey at a single point in time. Consequently, we are unable to include firm fixed-effects or examine whether changes in RBFP are associated with changes in forecast accuracy. However, by relying on surveys indicating that relatively few firms began implementing enterprise risk management processes prior to the financial crisis of 2007-2008 (Aon 2010, McKinsey 2014), we can provide some evidence consistent with the significant negative relation between our RBFP variables and forecast errors being due to increases in firms' use of more sophisticated risk-based forecasting and planning processes.

The earliest respondents in our sample completed the survey and entered the sample in 2011, so all of the survey responses capture post-crisis practices. We make the assumption that all of our samples' RBFP practices were less developed prior to the financial crisis. If this assumption holds and firms with more sophisticated RBFP only adopted these more advanced practices after the crisis period, we should observe a significant association between forecast accuracy and our RBFP variables after the crisis period, but not before. In addition, those firms

[9] One question is whether our inclusion of *Analyst Uncertain*. and *Analyst Error*, which are highly correlated with *Mgmt Error*, is over-controlling for the influence of RBFP or is driving our results. Estimating the *Mgmt Error* model using only the other control variables produces an adjusted R-squared of 0.19. When we introduce the RBFP variables to this is base model, the models' adjusted R-squareds range from 0.20 to 0.21 and the coefficients on all of the RBFP variables are negative and significant, with the exception of *Strategy* which is negative but insignificant. This evidence suggests that the inclusion of *Analyst Uncertain*. and *Analyst Error* as control variables is not driving our overall results.

with the highest RBFP scores should also be the firms that experienced the greatest improvement in forecast accuracy from the pre-crisis period to the post-crisis period.

Following this logic, we repeat the analysis in Table 5, but expand the sample period to include fiscal years 2005-2007. We also add the indicator variable *Post*, which takes the value of one for all years after a firm completed the survey (2011 at the earliest) and zero for the years 2005-2007, and interact this variable with the RBFP components. Panel A of Table 6 presents the results from this analysis. No RBFP component is significantly associated with *Mgmt Error* prior to the crisis period, consistent with limited adoption of the risk-based forecasting and planning processes in this earlier period. In contrast, the interactions of *Post* with *Overall RBFP, Quant. Assess., Budgeting,* and *Strategy* are significantly negative, consistent with the adoption of these practices increasing the accuracy of management's earnings forecasts.

Panel B of Table 6 extends this analysis to examine the time series trend in forecast errors following the survey response date. In these tests, we add the variable *Trend* and the interaction between this variable and the RBFP components. *Trend* equals zero in the pre-crisis years and one in the survey response year, and increases in value by one for each subsequent year the firm is in the sample. If firms with more sophisticated RBFP practices continue to improve their forecasting abilities in the years following their survey responses to a greater extent than firms with less sophisticated practices, then the interaction between *Trend* and RBFP should be negative and significant (that is, subsequent forecast errors become even smaller in the firms with higher RBFP scores). However, if firms with lower RBFP scores make greater subsequent improvements in their RBFP practices than firms with already high RBFP scores, we should observe the differences in forecast errors between the firms diminishing over time.

Consistent with firms with more sophisticated RBFP practices continuing to improve their forecasting ability to a greater extent than the less sophisticated respondents, we find a highly significant ($p < 0.01$, two-tailed) coefficient on the interaction between *Trend* and *Overall RBFP*. We also find significant negative coefficients on the interactions between *Trend* and all of the individual components except for *Distribs.*. Thus, even if the firms with lower RBFP scores improved the sophistication of their practices in the years following completion of the survey, they did not improve their forecasting ability to the same extent as the firms with more sophisticated RBFP practices to begin with.[10]

4.1.2 Potential Impact of Confounding Variables

Although we include controls in our tests for many factors that are likely to influence both the choice of RBFP techniques and earnings forecast errors, the possibility remains that some unmeasured, omitted factors drive our results. To offer evidence on the likelihood of this issue, we calculate the impact threshold for a confounding variable (ITCV) as proposed in Frank (2000) and recommended by Larcker and Rusticus (2010). The ITCV captures how strongly an omitted variable would have to be correlated with the dependent and independent variables of a regression, conditional on the included controls, to cause the coefficient on the independent variable to no longer be statistically significant.

In Table 7, we reproduce the main result from Table 5 showing a significantly negative association between *Mgmt Error* and *Overall RBFP*. From this regression, we calculate the ITCV of −0.214. This value indicates that if the partial correlation of an omitted variable with

[10] The results in Panel B of Table 6 are not driven by pre-existing forecasting improvement trends in the 2005-2007 time period. When we estimate the models using only these years and code *Trend* as one in 2005, two in 2006, and three in 2007, the coefficients on *Trend*, the RBFP components, and their interactions are all statistically insignificant.

Mgmt Error multiplied by the omitted variable's partial correlation with *Overall RBFP* is less than −0.214, the coefficient on *Overall RBFP* would no longer be statistically significant if that omitted variable was included in the regression.

To assess how likely it is that such a variable exists, we examine the partial correlations of the included control variables. In the last column of Table 7, we calculate the impact of each control variable. The variable's impact is the product of its partial correlations with *Mgmt Error* and *Overall RBFP*. All of the control variables' impacts are substantially below the ITCV, indicating that an omitted variable would have to have stronger correlations with *Mgmt Error* and *Overall RBFP*, conditional on the included controls, than any of our included controls to overturn the significance of the coefficient on *Overall RBFP*.

4.1.3 Self-Selection Concerns

Another factor potentially limiting the interpretation of our findings is firms self-selecting into our sample, both by choosing to complete the survey and by choosing to provide an earnings forecast.

Our survey responses are gathered from firms that opt-in to take the Aon survey. If these firms are systematically different from the general population, our results may not generalize outside of our sample. The concern is that only firms that are likely to benefit from more sophisticated risk forecasting and planning methods take the survey. However, if this concern is true, then all of the firms in our sample should have relatively advanced RBFP practices. The data show, however, that there is wide variation in the practices within our sample (see Appendix A and the discussion of survey responses in section 3). Moreover, when we compared *Mgmt Error* from our sample to a matched sample of firms in Table 3, we found no significant differences in mean forecast errors. If our sample consists of firms that receive greater forecasting benefits from RBFP than otherwise similar firms, we would expect our sample to have more sophisticated RBFP and higher forecast accuracy when compared to a matched sample. However, if these two sets of firms are not systematically different, we would expect the sample and matched firms to have similar levels of RBFP on average, and similar forecast accuracy as well. While we cannot observe RBFP for these other firms, we can observe their forecast accuracy, which is not significantly different on average.

Addressing the issue of firms selecting into our sample with a selection model is not practical, as there is unlikely to be an instrument that is strongly associated with firm-specific benefits of RBFP (and thus the decision to participate in the survey), but is not related to forecast accuracy. For example, firms in more volatile or uncertain environments may benefit more from RBFP, but these same factors are also important determinants of forecasting accuracy (moreover, we attempt to control for this uncertainty with the variables *Return Vol., Analyst Uncert.,* and *Analyst Error*). To the extent that our set of controls is incomplete, the earlier tests in Table 7 suggest that the impact of the omitted variable would need to be quite large to overturn the paper's results.

A different potential selection problem is firms choosing to provide earnings forecasts. We hypothesize that more sophisticated RBFP practices enable better forecasts, but firms may choose to forecast only if they expect their forecasts to be sufficiently accurate. This would suggest that firms with higher RBFP scores choose to forecast, as they expect to have accurate forecasts. However, firms with less sophisticated RBFP practices will only forecast if other factors enable relatively accurate forecasts. We attempt to control for these other factors with our set of controls.

To more formally investigate the possibility that only firms with more sophisticated RBFP issue earnings guidance, we examine the robustness of our findings using a Heckman self-selection model. We conduct this test using all 175 publicly-traded U.S. firms that completed the RMI survey between 2011 and 2014 and have the data required for our analyses. This larger sample includes both the 85 responding firms that provided management earnings guidance during this period (the primary sample for our tests) and 90 responding firms that did not provide earnings guidance. By pooling these observations, we can examine whether the decision to disclose is associated with the responding firms' RBFP scores, and incorporate the probability of disclosure into our forecast accuracy model.

Once again, a firm enters the sample in the year it completes the survey and remains in the sample through 2014. We retain all 486 firm-years in this sampling period and code the dependent variable in the first stage probit model one if earnings guidance is provided in a given year, and zero otherwise. Independent variables are the same as those used in our other forecast accuracy tests. In the second stage, we employ the 211 firm-years with earnings forecasts that were used in the earlier tests. The variable *Following* serves as the excluded instrument. Prior research (e.g., Ajinkya et al. 2005) indicates that the provision of guidance is positively associated with analyst following, but one can argue that analyst following itself is unlikely to directly improve management forecast accuracy. A similar argument can be made for *Ownership.* Consequently, we follow Feng et al. (2009) and exclude *Following*, as well as *Ownership*, in the second stage models, and add the inverse Mills ratio from the first stage.

When we estimate the first stage model shown in Table 8, we find no significant association between *Overall RBFP* and a respondent's decision to issue earnings guidance. Moreover, in the second stage forecast accuracy model, the inverse Mills ratio is insignificantly different from zero while the coefficient on *Overall RBFP* remains significantly negative. These tests suggest that our forecast error results are not driven by firms with more sophisticated RBFP practices choosing to disclose annual earnings guidance to the market.

4.2 RBFP and Earnings Forecast Width

We examine the associations between RBFP practices and earnings forecast width in Table 9. If more sophisticated RBFP practices give firms a greater understanding of the risks they face and the potential implications of these risks for earnings, and efforts are taken to ensure that the accepted risks fall within the organization's risk appetite and tolerances, firms may generate forecasts within smaller ranges. On the other hand, greater understanding of a wide variety of potential risks may lead firms to generate wider earnings forecasts that take into account the probability that some of the more extreme risks may materialize. This may be especially true when firms generate probabilistic earnings distributions that take into account a broader range of scenarios than single- or multi-point forecasting methods (Deloitte 2012).

Given the potential impact of probabilistic modeling and distributions on the amount of uncertainty contained in the earnings forecasts, we include *Distribs.* and its interaction with one of the other RBFP components as additional independent variables in each *Width* model. This specification allows us to examine whether the relations between the other RBFP components and *Width* differ depending upon whether or not the firm uses distributions and/or stochastic modeling techniques in the forecasting process.

The *Width* results are provided in Table 9. The coefficients on the RBFP main effects in these tests reflect the association between the component and *Width* in firms that do not use distributions in the forecasting process. We exclude the *Overall RBFP* measure from these analyses because *Distribs.* is a component of this aggregate variable. Instead, we examine *RBFP w/o Distribs.,* which is the average of the other RBFP components, excluding *Distribs.* The main effects on *RBFP w/o Distribs., Quant. Assess., Budgeting, Capital Invest,* and *Strategy* are all negative and statistically significant, with the coefficient on *Risk Drivers* negative but insignificant (p = 0.127, two-tailed). These results are consistent with managers forecasting within a narrower range when they integrate risk considerations into the forecasting process, but do not use more advanced modeling techniques when developing their forecasts. The coefficient on *RBFP w/o Distribs.* indicates that a one standard deviation increase in this variable is associated with a decrease of 0.099 in *Width,* or 23.3 percent of its mean value. The estimated effects of the other significant RBFP components on *Width* are similar in magnitude. In particular, the similar estimated effects of *Budgeting, Capital Invest,* and *Strategy* on *Width* indicate that incorporating risk into the planning process reduces the width of forecasts, regardless of the planning horizon.

In contrast, the coefficients on the interaction terms are positive and significant in the *RBFP w/o Distribs,, Capital Invest.,* and *Strategy* models, and positive but marginally insignificant in the *Risk Drivers* model (p = 0.106, two-tailed). This evidence suggests that formally integrating greater uncertainty into the forecasting process using these modeling approaches may produce forecasts with wider ranges, relative to firms who do not use these forecasting techniques, reflecting the consideration of a broader set of potential outcomes.

Similar to the forecast accuracy tests in Table 6, we also examine how the association between RBFP and *Width* changed from the 2005-2007 period to the years following the survey's completion. We find no association between RBFP practices and *Width* during the 2005-2007 period, regardless of whether the firms use distributions in the forecasting process or not. However, during the post-implementation period, we find a significant negative association between *Overall RBFP w/o Distribs.* and *Width* in firms not using distributions, but continue to find no significant association between *Overall RBFP w/o Distribs.* and *Width* in firms using distributions.[11]

4.3 Alternative Explanations

Two alternative explanations for the significant associations between more sophisticated RBFP practices and management forecast accuracy observed in our tests is that we are simply picking up firms with better managers, or that firms with better internal information environments are better able to manage earnings in order to meet their earnings forecasts. We conduct two sets of additional untabulated tests to examine these alternative explanations. First, following Feng et al. (2009), we include CEO tenure as an additional control for managerial ability. We also include an indicator for whether or not the CEO changed between the pre-crisis period (2005-2007) and the post-crisis survey response period, which could explain the observed improvement in forecast accuracy between these periods in firms with more sophisticated RBFP practices. Neither variable is significantly associated with *Mgmt Error* or *Width*, and our other results have very similar magnitudes and significance levels as those reported in the tables.

[11] To offer evidence on how large an omitted variable's association with *Width* and *RBFP w/o Distribs.* would have to be to overturn the estimated negative association between these two variables, we again calculated the impact threshold for a confounding variable (ITCV). The ITCV for *Width* and *RBFP w/o Distribs.* is −0.119, indicating that an omitted variable would need a partial correlation with both these variables of 0.345 in magnitude (with one of the correlations negative) to overturn this result. Our included controls suggest associations of this magnitude are unlikely, as the impact of all of the control variables are far below this threshold. We also find that the results are robust to estimating a Heckman selection model. The coefficient on the main effect of *RBFP w/o Distribs.* remains negative and significant, the coefficient on the interaction between this variable and *Distribs*. remains positive and significant, and the estimated inverse mills ratio is insignificant.

Second, we examine whether the RBFP scores are significantly associated with the magnitude of discretionary accruals from a modified Jones model (Dechow et al. 1995) and with write-offs, both of which could be used to manage earnings in order to meet earnings targets. We find no significant association between discretionary accruals (either signed or unsigned) and any of our RBFP variables. We also find no significant association between RBFP practices and the probability that a firm took a goodwill writeoff in the years it was included in the sample, but we do find that firms with higher *Overall RBFP, Risk Drivers, Quant. Assess., Capital Invest.,* and *Strategy* are significantly more likely to have taken a non-goodwill writeoff. However, when we include goodwill and non-goodwill writeoffs (both as a percent of prior year assets) as additional control variables, we find no significant association between these variables and *Mgmt Error* or *Width*, with our other results remaining unchanged.

4.4 RBFP and Non-Earnings Forecasts

The primary focus of our analysis is management earnings forecasts, which other researchers have used as a proxy for internal information quality. However, some firms disclose other financial forecasts that may also be influenced by internal information quality and risk-based forecasting and planning practices. We therefore extend the analyses to examine the relations between RBFP and two of the other forecasts included in the IBES database: sales and capital expenditures.

Table 10 provides results from these analyses. The dependent variables are *Sales Error,* defined as the absolute value of actual sales less management's forecast as a percentage of actual sales, and *CapEx Error*, defined as the absolute value of actual capital expenditures less management's forecast as a percentage of actual capital expenditures. As shown in Panel A, *Overall RBFP* is negatively associated with *Sales Error*, with the estimated coefficient implying that a one standard deviation increase in *Overall RBFP* is associated with a *Sales Error* that is 14.7 percent lower than its mean value. *Quant. Assess.* and *Distribs*. are also associated with smaller sales forecast errors. The coefficient on *Quant. Assess* indicates that a one standard deviation increase in this variable is associated with a decrease in *Sales Error* of 7.2 percent from its mean, while the coefficient on *Distribs.* implies that firms using distributions or stochastic modeling are associated with a 33.4 percent decrease in *Sales Error,* relative to its mean. Across the different planning horizons, only *Budgeting* is significantly associated with *Sales Error*, with a one standard deviation increase in this variable associated with a *Sales Error* that is 10.6 percent lower than its mean.

The capital expenditure forecast results in panel B are weaker. *CapEx Error* has a mean of 19.25 percent, which is larger than the mean sales forecast error, and the adjusted R-squared statistics in the capital expenditures models are substantially lower than in the sales forecast models. Of the RBFP variables, only the longest-term planning component, *Strategy,* exhibits a significant association with *CapEx Error.* The coefficient of −4.859 suggests that a one standard deviation increase in this variable is associated with a decrease in *CapEx Error* of 20.4 percent from its mean value. Surprisingly, we find no association between greater incorporation of risk consideration in capital investment and project decisions (*Capital Invest*.) and the magnitude of capital expenditure forecast errors.

3 Conclusions

Risk-based forecasting and planning practices are aimed at helping firms navigate an increasingly volatile operating environment by helping integrate risk information into forecasting and planning. Using survey data, we examine whether these emerging internal management practices are associated with management's public earnings forecasts. We find that more sophisticated overall RBFP is associated with more accurate management earnings forecasts. [12] When examining individual RBFP practices, we find that using more sophisticated quantitative methods in risk analysis is related to lower earnings forecast errors. The use of probability distributions for internal forecasting is associated with smaller forecast errors but larger forecast widths, suggesting that firms using distributions take a larger set of risks into account when forecasting. Incorporating risk considerations into short-horizon activities such as budgeting or long-horizon activities such as strategic planning is also associated with better forecasting performance, suggesting that the benefits from more sophisticated RBFP do not decline as the planning horizon increases.

Our study is subject to several limitations. As with all survey research, our study suffers from potential response biases. However, the fact that the majority of respondents indicated that they do not employ sophisticated RBFP practices minimizes concerns that respondents presented their firms' RBFP practices in an overly favorable or desirable light. Our use of publicly-available outcome variables also helps mitigate concerns that our results are driven by response biases. Another limitation of our survey data is that we do not have time series data on RBFP practices. We assume that the sophistication of a firm's risk-based forecasting and planning practices, relative to other firms in the sample, remained reasonably stable over our sample

[12] Given the observed association between more sophisticated RBFP practices and higher earnings forecast quality, we examined whether the use of these more sophisticated practices is also associated with greater disclosure of risk management practices. We searched the firms' 10K and proxy statements for the number of times the following phrases were mentioned: risk_management, COSO, president_of_risk or risk_management or enterprise_risk_management, chief_risk_officer, risk_committee, strategic_risk_management, consolidated_risk_management, holistic_risk_management, or integrated_risk_management. We find no association between this word count and the firm's RBFP scores. One explanation for this result (in addition to the crudeness of this disclosure measure) is that risk disclosures are not credible and may simply reflect cheap talk. See Dobler (2008) for a discussion.

period. To offer some evidence that changes in risk-based forecasting and planning practices are associated with changes in forecasting performance, we assume that adoption of these practices was limited before the financial crisis, an assumption supported by prior survey evidence. We find evidence consistent with firms with more sophisticated post-crisis risk-based forecasting and planning practices also experiencing an increase in forecast accuracy following the crisis. Finally, we acknowledge that firms self-select into our sample, both by choosing to complete the survey and by providing an earnings forecast. However, our analyses indicate that selection on unobservables would have to be large to overturn our results. In addition, our sample firms do not demonstrate superior forecasting performance compared to a matched sample, suggesting that our sample firms are not systematically different. Finally, we find no evidence that responding firms with higher RBFP scores were more likely to provide management earnings guidance, with our results robust to using a selection model that incorporates this information.

Notwithstanding these limitations, our study makes a number of contributions. First, we extend studies on the relation between internal information quality and firms' communications with external stakeholders. Prior research has been hindered by the unobservability of internal firm practices. In contrast, our access to detailed data on firms' risk-based forecasting and planning practices allows us to provide stronger tests of theoretical predictions that the quality of external disclosures reflects internal information quality. Second, we begin to integrate the disparate literatures on financial planning, strategic planning, and risk management, thereby providing evidence on the benefits from more unified forecasting and planning approaches. Finally, we extend the enterprise risk management literature by moving beyond the examination of aggregate ERM sophistication and providing evidence on the mechanisms through which a specific risk management practice influences firm outcomes.

APPENDIX A

Survey Questions and Response Frequencies for Risk-Based Forecasting and Planning Constructs

Indicators for Risk Drivers

Risk drivers (i.e., causes of risk) are identified/documented: rarely or never (7%), inconsistently or on an ad-hoc basis for selected risks (35%), consistently for key risks (58%)

Risk drivers (i.e., causes of risk) are analyzed to identify common drivers between risks: rarely or never (14%), inconsistently or on an ad-hoc basis for selected risks (48%), consistently for key risks (38%)

Risk management activities are analyzed and mapped to specific risk drivers: rarely or never (19%), inconsistently or on an ad-hoc basis for selected risks (44%), consistently for key risks (38%)

Risk drivers (i.e., causes of risk) are analyzed in depth and support the identification of emerging risks through understanding of common risk drivers: rarely or never (25%), inconsistently or on an ad-hoc basis for selected risks (40%), consistently for key risks (35%)

The organization leverages common risk driver information to identify correlation/relationships between risks: N/A, analysis of correlation is not conducted (39%), informally in management discussions and perceptions of risk (48%), formally, and has documented the need for its consideration in risk assessment processes (13%)

Indicators for Quant. Assess.

Risk assessment scales at the organizational level are: not used in risk management exercises (7%), primarily qualitative criteria (i.e., High, Medium, Low) (51%), developed with both qualitative and quantitative criteria (42%)

Risk assessment criteria are developed to align with: N/A, risk assessment criteria are not developed (7%), management perceptions of risk tolerance (73%), a quantitative risk appetite and statements of risk tolerance (20%)

Is risk assessment analysis supplemented with additional quantitative evaluations of exposure? no (18%), yes, where perceived necessary (55%), yes, for risks that meet specific criteria/thresholds (27%)

Criteria for evaluation of risk management activity effectiveness for key risks are: not yet developed (19%), primarily qualitative (e.g., “adequate”, “weak”) (58%), quantitative, measuring change in risk exposure (24%)

Documentation of risk management effectiveness for key risks is: N/A, risk management effectiveness is not documented (19%), is primarily qualitative (i.e., commentary on results) (52%), incorporate both qualitative commentary and qualitative evidence (i.e., citing metrics or indicators) (26%)

Quantitative thresholds and tolerances have been established: no (32%), inconsistently or on an ad-hoc basis (39%), consistently for key risks (29%)

Any ranges of values or distributions used are developed: N/A, ranges or distributions are not used (11%), informally based on management judgment (39%), formally, with incorporation of historical data or other quantitative methods (51%)

Indicator for Distribs.

The firm uses distributions and/or stochastic modeling techniques in developing forecasts (29%).

Indicators for Budgeting

The organization's budget/resource allocation processes explicitly reference results of established risk assessment and analysis plans: rarely or never (40%), yes, inconsistently or on an ad-hoc basis (45%), yes, consistently through a defined process (15%)

The organization's budget/resource allocation process includes evaluation of risk management spend for effectiveness (i.e., cost savings vs. exposure reduction): rarely or never (38%), yes, inconsistently or on an ad hoc basis (44%), yes, consistently through a defined process (19%)

Are different (i.e., higher, lower) risk-based return expectations set for different business units and functions? No (27%), yes, but the information is not explicitly considered in budget decisions (42%), yes, and the different return expectations are incorporated into budget decisions and resource allocation decisions (31%)

Indicators for Capital Invest.

Risks are primarily identified and assessed in significant project or investment decisions: N/A, risks are not identified (9%), through SWOT (Strengths, Weaknesses, Opportunity, Threat) analysis or similar (44%), through a special and dedicated risk identification and assessment methodology separate from SWOT (47%)

The focus of risk identification activities for projects or investments: N/A, no risk identification process exists (13%), is on existing risks (29%), is on both existing and emerging risks (58%)

Significant project or investment decisions are made with explicit reference to quantified risk appetite and tolerance: rarely or never (34%), yes, inconsistently (36%), yes, consistently (29%)

In making significant capital investment decisions, the project risk profile is evaluated against/compared to the organization's overall risk profile: rarely or never (13%), yes, inconsistently or informally (54%), yes, consistently as part of a defined process (33%)

Management uses project risk information to adjust the hurdle rates for significant capital investment decisions: rarely or never (22%), informally, or based on management judgment or previous experience (44%), formally, using quantitative analysis of project risk (34%)

Indicators for Strategy

The Board and executive management highlight the alignment of risk management strategy with overall strategy when communicating strategic direction: no, communications do not highlight alignment (31%), yes, and include informal references to concepts of risk appetite and tolerance (53%), yes, and include formal references to concepts of risk appetite and tolerance (16%)

Executive management applies concepts of risk appetite and/or tolerance to strategy development: rarely or never (29%), yes, on an ad hoc basis (51%), yes, through a formal process (20%)

How does information from the risk management process inform the strategic planning process? N/A, key risk information is not included (12%), key risk information is informally incorporated (56%), key risk information is formally incorporated and integrated (32%)

Risk identification exercises during the strategic planning process are used to develop an emerging risk profile: N/A, risk identification is not conducted during strategic planning (26%), no (36%), yes (38%)

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TABLE 1
Industry Composition by Firm

	Percentage of Sample	
	Sample	Compustat
Consumer Non-Durables	9.48	7.12
Consumer Durables	0.47	2.91
Manufacturing	19.91	11.33
Energy	1.42	0.96
Chemicals	3.79	3.45
Business Equipment	13.27	21.74
Telecommunications	0.00	1.12
Utilities	10.90	7.22
Wholesale/Retail	16.11	13.73
Healthcare	8.06	11.97
Financial	3.79	6.96
Other	12.80	11.49
Total	100.00	100.00

TABLE 2
Survey Firm Descriptives

Panel A: Job Title of Survey Respondents

	Count	Percent	Cum.
Risk Manager/Dir. of ERM	55	64.71	64.71
Chief Financial Officer	7	8.24	72.94
Chief Risk Officer	6	7.06	80.00
Other	6	7.06	87.06
Treasurer/VP Finance	5	5.88	92.94
Internal Audit Head	3	3.53	96.47
General Counsel/Corp. Secretary	2	2.35	98.82
Chief Operating Officer	1	1.18	100.00
Total	85	100.00	

Panel B: Risk-Based Forecasting and Planning Components

	Mean	Median	Std.Dev.
Overall RBFP	0.019	-0.008	0.623
Risk Drivers	-0.041	-0.244	0.866
Quant. Assess.	0.035	-0.007	0.697
Distribs.	0.313	0.000	0.465
Budgeting	0.053	0.214	0.841
Capital Invest.	0.042	-0.014	0.750
Strategy	0.066	-0.001	0.809

Panel C: Risk-Based Forecasting and Planning Correlations

	Overall RBFP	*Risk Drivers*	*Quant. Assess.*	*Distribs.*	*Budgeting*	*Capital Invest.*
Overall RBFP	1.00					
Risk Drivers	0.82	1.00				
Quant. Assess.	0.80	0.65	1.00			
Distribs.	0.52	0.22	0.31	1.00		
Budgeting	0.85	0.67	0.62	0.34	1.00	
Capital Invest.	0.79	0.62	0.53	0.16	0.67	1.00
Strategy	0.80	0.61	0.60	0.18	0.61	0.70

All correlations are significant at $p<0.05$

All risk-based forecasting and planning variables are constructed from survey responses. Appendix A gives the underlying survey questions. *Overall RBFP* captures the sophistication of the overall risk-based forecasting and planning process. *Risk Drivers* captures the consistency with which the firm identifies risk drivers and their interdependencies and links risk management activities to these drivers. *Quant Assess.* captures the extent to which risk assessment criteria and thresholds are quantified and quantitative data are used in evaluating risk exposures. *Distribs.* is an indicator variable taking a value of one if the firm uses distributions and/or stochastic modeling techniques in developing forecasts. *Budgeting* measures the incorporation of risk considerations in budgeting decisions. *Capital Invest.* measures the incorporation of risk-related practices in project and capital investment decisions. *Strategy* measures the incorporation of risk appetite, tolerances, and assessments in the development and communication of strategic plans and directions. Panels B and C are based on 211 firm-year observations.

TABLE 3
Summary Statistics

	Sample			Compustat			Diff. in Means		Matched Sample			Diff. in Means	
	Mean	Median	Std.Dev.	Mean	Median	Std.Dev.	Diff.	t-stat	Mean	Median	Std.Dev.	Diff.	t-stat
Mgmt Error	0.761	0.353	1.448	1.269	0.475	3.565	-0.51**	(-2.06)	0.890	0.350	2.497	-0.26	(-1.06)
Width	0.423	0.332	0.406	0.538	0.340	1.944	-0.12	(-0.86)	0.403	0.315	0.378	0.04	(1.08)
Size	8.780	8.657	1.535	7.845	7.779	1.541	0.93***	(8.53)	8.759	8.628	1.538	0.04	(0.27)
MTB	4.106	2.576	7.720	4.699	2.380	32.661	-0.59	(-0.26)	3.883	2.578	6.138	0.45	(0.75)
R&D	0.017	0.000	0.027	0.032	0.002	0.060	-0.01***	(-3.48)	0.016	0.000	0.027	0.00	(0.74)
HHI	0.289	0.249	0.210	0.262	0.195	0.204	0.03*	(1.87)	0.286	0.236	0.217	0.01	(0.33)
Ownership	0.710	0.720	0.192	0.740	0.765	0.197	-0.03**	(-2.14)	0.710	0.719	0.181	0.00	(0.01)
Lit. Risk	0.284	0.000	0.452	0.324	0.000	0.468	-0.04	(-1.20)	0.296	0.000	0.457	-0.02	(-0.53)
Segments	0.864	1.099	0.723	0.711	0.693	0.718	0.15***	(2.99)	0.864	1.099	0.737	-0.00	(-0.01)
Age	36.981	34.277	24.483	25.421	18.853	20.421	11.56***	(7.85)	36.370	30.610	24.496	1.22	(0.51)
Following	2.583	2.708	0.637	2.338	2.398	0.688	0.25***	(5.03)	2.598	2.708	0.608	-0.03	(-0.51)
Horizon	5.722	5.796	0.325	5.688	5.775	0.355	0.03	(1.38)	5.717	5.793	0.321	0.01	(0.37)
Return Vol.	0.016	0.015	0.007	0.020	0.018	0.009	-0.00***	(-6.64)	0.016	0.015	0.007	0.00	(0.15)
Analyst Uncert.	0.004	0.002	0.006	0.005	0.003	0.011	-0.00**	(-2.12)	0.004	0.002	0.006	-0.00	(-0.06)
Analyst Error	0.892	0.404	1.677	1.386	0.525	3.552	-0.49**	(-2.01)	0.998	0.393	2.691	-0.21	(-0.81)
Strategy Change	0.507	1.000	0.501										
	211 firm-years			3,132 firm-years					211 firm-years				

* p<0.10, ** p<0.05, *** p<0.01 (for two-tailed tests)

Mgmt Error is the absolute value of actual EPS less management's forecast as a percentage of stock price. *Width* is the upper bound of management's forecast less the lower bound, as a percentage of stock price. *Size* is the logarithm of the market value of equity. *MTB* is the market value of equity divided by the book value of equity. *R&D* is research and development expense divided by total assets. *HHI* is the Herfindahl–Hirschman Index for the firm's two-digit SIC industry. *Ownership* is the percentage of the firm held by institutional owners. *Lit. Risk* is an indicator variable taking a value of one if the firm is in SIC industries 2833-3836, 3570-3577, 3600-3674, 5200-5961, or 7370-7374. *Segments* is the logarithm of the number of business segments. *Age* is the number of years the firm has had price data on CRSP. *Following* is the logarithm of the number of analysts with earnings forecasts outstanding at the time of the management forecast. *Horizon* is the logarithm of the numbers of days between management's forecast and the end of the period. *Return Vol.* is the standard deviation of daily returns over the previous year. *Analyst Uncert.* is the standard deviation of analyst earnings forecasts outstanding at the time of the management forecast. *Analyst Error* is the absolute value of actual EPS less the median analyst forecast at the time of the management forecast as a percentage of price. *Strategy Change* is an indicator variable taking a value of one if the firm responded that they changed strategy because of new information or understanding of a major risk.

TABLE 4
Correlations

	Overall RBFP	*Mgmt Error*	*Width*	*Size*	*MTB*	*R&D*	*HHI*	*Owner.*	*Lit. Risk*	*Segs.*	*Age*	*Follow.*	*Horiz.*	*Return Vol.*	*Analy. Uncert.*	*Analy. Error*
Mgmt Error	**-0.19**	**1.00**														
Width	-0.09	**0.31**	**1.00**													
Size	**0.20**	**-0.22**	**-0.34**	**1.00**												
MTB	-0.08	-0.08	-0.09	0.09	**1.00**											
R&D	**-0.18**	**-0.12**	**-0.16**	**0.18**	-0.06	**1.00**										
HHI	**0.15**	-0.07	-0.11	**0.14**	0.03	-0.10	**1.00**									
Ownership	0.00	**-0.25**	0.10	**-0.29**	0.10	0.09	0.06	**1.00**								
Lit. Risk	-0.09	0.07	-0.05	0.11	0.01	**0.27**	-0.10	0.04	**1.00**							
Segments	-0.11	0.06	0.10	-0.07	0.01	-0.04	**-0.15**	**-0.14**	**-0.30**	**1.00**						
Age	0.07	**-0.21**	-0.08	**0.35**	-0.06	-0.01	0.03	**-0.17**	0.02	**0.31**	**1.00**					
Following	**0.13**	-0.07	**-0.33**	**0.73**	0.10	**0.21**	0.02	-0.09	**0.23**	**-0.16**	0.08	**1.00**				
Horizon	**0.13**	0.02	**0.13**	-0.03	0.05	0.06	-0.09	0.07	-0.03	0.09	0.03	-0.08	**1.00**			
Return Vol.	**-0.26**	**0.36**	**0.26**	**-0.50**	-0.02	0.01	-0.01	**0.17**	0.11	0.04	**-0.35**	**-0.23**	-0.03	**1.00**		
Analyst Uncert.	-0.04	**0.19**	**0.23**	**-0.17**	-0.08	-0.08	-0.06	-0.11	-0.02	0.08	-0.10	-0.05	0.02	**0.41**	**1.00**	
Analyst Error	**-0.14**	**0.90**	**0.36**	**-0.28**	-0.10	**-0.15**	-0.08	**-0.24**	0.01	0.05	**-0.23**	**-0.14**	0.03	**0.48**	**0.48**	**1.00**
Strategy Change	**0.26**	0.11	**0.12**	**0.18**	**-0.15**	0.01	-0.01	**-0.26**	**-0.16**	**0.18**	**0.12**	0.09	**0.17**	0.00	**0.20**	**0.14**

p<.10 in **bold.** *Overall RBFP* captures the sophistication of the overall risk-based forecasting and planning process. Appendix A gives the underlying survey questions. *Mgmt Error* is the absolute value of actual EPS less management's forecast as a percentage of stock price. *Size* is the logarithm of the market value of equity. *MTB* is the market value of equity divided by the book value of equity. *R&D* is research and development expense divided by total assets. *HHI* is the Herfindahl–Hirschman Index for the firm's two-digit SIC industry. *Ownership* is the percentage of the firm held by institutional owners. *Lit. Risk* is an indicator variable taking a value of one if the firm is in SIC industries 2833-3836, 3570-3577, 3600-3674, 5200-5961, or 7370-7374. *Segments* is the logarithm of the number of business segments. *Age* is the number of years the firm has had price data on CRSP. *Following* is the logarithm of the number of analysts with earnings forecasts outstanding at the time of the management forecast. *Horizon* is the logarithm of the numbers of days between management's forecast and the end of the period. *Return Vol.* is the standard deviation of daily returns over the previous year. *Analyst Uncert.* is the standard deviation of analyst earnings forecasts outstanding at the time of the management forecast. *Analyst Error* is the absolute value of actual EPS less the median analyst forecast at the time of the management forecast as a percentage of price. *Strategy Change* is an indicator variable taking a value of one if the firm responded that they changed strategy because of new information or understanding of a major risk.

TABLE 5
Forecast Accuracy and Risk-Based Forecasting and Planning

Dependent Variable = *Mgmt Error*

Risk Management Practice =	*Overall RBFP*	*Risk Drivers*	*Quant. Assess.*	*Distribs.*	*Budgeting*	*Capital Invest.*	*Strategy*
RBFP Component	-0.197***	-0.064	-0.141***	-0.204***	-0.132***	-0.076*	-0.136***
	(-3.23)	(-1.64)	(-2.77)	(-3.36)	(-2.83)	(-1.77)	(-2.90)
Size	-0.058	-0.060	-0.063*	-0.047	-0.064	-0.058	-0.061*
	(-1.57)	(-1.61)	(-1.74)	(-1.28)	(-1.62)	(-1.53)	(-1.76)
MTB	-0.002	-0.001	-0.002	-0.001	-0.001	-0.002	-0.001
	(-0.93)	(-0.49)	(-0.69)	(-0.60)	(-0.32)	(-0.70)	(-0.76)
R&D	-1.652	-1.019	-1.192	-1.344	-1.789	-0.675	-1.360
	(-1.36)	(-0.77)	(-1.01)	(-1.12)	(-1.54)	(-0.59)	(-1.22)
HHI	0.193*	0.151	0.149	0.182	0.227**	0.129	0.143
	(1.98)	(1.42)	(1.45)	(1.61)	(2.01)	(1.19)	(1.48)
Ownership	-0.009	-0.031	0.024	-0.121	-0.044	-0.060	0.039
	(-0.03)	(-0.10)	(0.08)	(-0.41)	(-0.16)	(-0.21)	(0.14)
Lit. Risk	0.251**	0.263**	0.269**	0.255**	0.229**	0.235**	0.272***
	(2.40)	(2.22)	(2.45)	(2.31)	(2.05)	(2.09)	(2.69)
Segments	0.130**	0.142**	0.119**	0.144**	0.138**	0.145**	0.137**
	(2.43)	(2.45)	(2.19)	(2.52)	(2.35)	(2.40)	(2.53)
Age	-0.002**	-0.002*	-0.003*	-0.002	-0.002*	-0.002*	-0.002*
	(-2.01)	(-1.82)	(-1.99)	(-1.49)	(-1.92)	(-1.74)	(-1.92)
Following	0.215***	0.213***	0.203***	0.172**	0.239***	0.210***	0.204***
	(3.00)	(2.77)	(2.65)	(2.35)	(2.99)	(2.76)	(2.84)
Horizon	0.045	0.029	0.021	0.005	0.049	0.019	0.023
	(0.60)	(0.34)	(0.27)	(0.08)	(0.60)	(0.24)	(0.31)
Return Vol.	-15.114	-12.086	-15.102	-11.353	-13.616	-11.458	-14.820
	(-1.50)	(-1.18)	(-1.42)	(-1.14)	(-1.38)	(-1.14)	(-1.47)
Analyst Uncert.	-70.870**	-71.688**	-70.903**	-72.389**	-72.024**	-71.005**	-70.551**
	(-2.56)	(-2.53)	(-2.52)	(-2.59)	(-2.53)	(-2.45)	(-2.56)
Analyst Error	0.899***	0.902***	0.903***	0.899***	0.899***	0.901***	0.907***
	(15.82)	(15.73)	(16.58)	(15.93)	(15.70)	(15.65)	(16.60)
Strategy Change	0.139*	0.090	0.136*	0.092	0.133*	0.097	0.123*
	(1.81)	(1.15)	(1.83)	(1.20)	(1.71)	(1.22)	(1.70)
Adj. R-Sq	0.89	0.89	0.89	0.89	0.89	0.89	0.89
N	211	211	211	211	211	211	211

* p<0.10, ** p<0.05, *** p<0.01 (for two-tailed tests)

The dependent variable in all models is *Mgmt Error,* the absolute value of actual EPS less management's forecast as a percentage of stock price. All risk-based forecasting and planning variables are constructed from survey responses. Appendix A gives the underlying survey questions. *Overall RBFP* captures the sophistication of the overall risk-based forecasting and planning process. *Risk Drivers* captures the consistency with which the firm identifies risk drivers and their interdependencies and links risk management activities to these drivers. *Quant Assess.* captures the extent to which risk assessment criteria and thresholds are quantified and quantitative data are used in evaluating risk exposures. *Distribs.* is an indicator variable taking a value of one if the firm uses distributions and/or stochastic modeling techniques in developing forecasts. *Budgeting* measures the incorporation of risk considerations in budgeting decisions. *Capital Invest.* measures the incorporation of risk-related practices in project and capital investment decisions. *Strategy* measures the incorporation of risk appetite, tolerances, and assessments in the development and communication of strategic plans and directions. The control variables are defined as follows: *Size* is the logarithm of the market value of equity. *MTB* is the market value of equity divided by the book value of equity. *R&D* is research and development expense divided by total assets. *HHI* is the Herfindahl–Hirschman Index for the firm's two-digit SIC industry. *Ownership* is the percentage of the firm held by institutional owners. *Lit. Risk* is an indicator variable taking a value of one if the firm is in SIC industries 2833-3836, 3570-3577, 3600-3674, 5200-5961, or 7370-7374. *Segments* is the logarithm of the number of business segments. *Age* is the number of years a firm has had price data on CRSP. *Following* is the logarithm of the number of analysts with earnings forecasts outstanding at the time of the management forecast. *Horizon* is the logarithm of the numbers of days between management's forecast and the end of the period. *Return Vol.* is the standard deviation of daily returns over the previous year. *Analyst Uncert.* is the standard deviation of analyst earnings forecasts outstanding at the time of the management forecast. *Analyst Error* is the absolute value of actual EPS less the median analyst forecast at the time of the management forecast as a percentage of price. *Strategy Change* is an indicator variable taking a value of one if the firm responded that they changed strategy because of new information or understanding of a major risk. T-stats (in parentheses) are based on standard errors clustered at the firm-level. Year fixed effects are included.

TABLE 6
Changes in Forecast Accuracy and Risk-Based Forecasting and Planning

PANEL A: Indicator for post-implementation period
Dependent Variable = *Mgmt Error*

Risk Management Practice =	*Overall RBFP*	*Risk Drivers*	*Quant. Assess.*	*Distribs.*	*Budgeting*	*Capital Invest.*	*Strategy*
Post	0.019	0.018	0.031	0.050	0.027	0.027	0.029
	(0.34)	(0.29)	(0.53)	(0.71)	(0.47)	(0.46)	(0.50)
RBFP Component	0.019	0.039	0.046	-0.053	-0.005	0.027	0.007
	(0.34)	(0.94)	(0.92)	(-0.93)	(-0.10)	(0.60)	(0.17)
*Post*RBFP Comp.*	-0.179**	-0.083	-0.163**	-0.129	-0.095*	-0.091	-0.134**
	(-2.20)	(-1.36)	(-2.21)	(-1.45)	(-1.78)	(-1.48)	(-2.35)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adj. R-Sq	0.92	0.92	0.92	0.92	0.92	0.92	0.92
N	411	411	411	411	411	411	411

PANEL B: Time trend post-implementation
Dependent Variable = *Mgmt Error*

Risk Management Practice =	*Overall RBFP*	*Risk Drivers*	*Quant. Assess.*	*Distribs.*	*Budgeting*	*Capital Invest.*	*Strategy*
Trend	-0.003	-0.007	-0.004	0.007	-0.012	-0.001	0.018
	(-0.10)	(-0.24)	(-0.14)	(0.22)	(-0.42)	(-0.04)	(0.56)
RBFP Component	0.006	0.042	0.014	-0.079	-0.000	0.035	-0.007
	(0.11)	(1.04)	(0.32)	(-1.48)	(-0.01)	(0.86)	(-0.18)
*Trend*RBFP Comp.*	-0.075***	-0.041**	-0.049**	-0.037	-0.052**	-0.052**	-0.054**
	(-2.71)	(-2.02)	(-2.09)	(-1.23)	(-2.42)	(-2.31)	(-2.59)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adj. R-Sq	0.92	0.92	0.92	0.92	0.92	0.92	0.92
N	411	411	411	411	411	411	411

* $p<0.10$, ** $p<0.05$, *** $p<0.01$ (for two-tailed tests)

The dependent variable in all models is *Mgmt Error,* the absolute value of actual EPS less management's forecast as a percentage of stock price. *Post* is an indicator variable taking a value of one for fiscal years after the firm completed the survey and zero for fiscal years 2005-2007. *Trend* is an variable taking a value of one in the first fiscal year after the firm completed the survey and increments by one each year. *Trend* takes a value of zero for fiscal years 2005-2007. All risk-based forecasting and planning variables are constructed from survey responses. Appendix A gives the underlying survey questions. *Overall RBFP* captures the sophistication of the overall risk-based forecasting and planning process. *Risk Drivers* captures the consistency with which the firm identifies risk drivers and their interdependencies and links risk management activities to these drivers. *Quant Assess.* captures the extent to which risk assessment criteria and thresholds are quantified and quantitative data are used in evaluating risk exposures. *Distribs.* is an indicator variable taking a value of one if the firm uses distributions and/or stochastic modeling techniques in developing forecasts. *Budgeting* measures the incorporation of risk considerations in budgeting decisions. *Capital Invest.* measures the incorporation of risk-related practices in project and capital investment decisions. *Strategy* measures the incorporation of risk appetite, tolerances, and assessments in the development and communication of strategic plans and directions. *Controls* indicates the presence of the following control variables: *Size, MTB, R&D, HHI, Ownership, Lit. Risk, Segments, Age, Following, Horizon, Return Vol., Analyst Uncert., Analyst Error,* and *Strategy Change.* T-stats (in parentheses) are based on standard errors clustered at the firm-level. Year fixed effects are included.

TABLE 7
Potential Impact of Confounding Variables

Dep Var. = *Mgmt Error*	Coeff	t-Stat	ITCV	Partial correlation with *Mgmt Error*	Partial correlation with *RBFP*	Impact
Overall RBFP	-0.197***	(-3.23)	-0.214			
Size	-0.058	(-1.57)		-0.092	0.003	0.000
MTB	-0.002	(-0.93)		-0.010	-0.093	0.001
R&D	-1.652	(-1.36)		-0.034	-0.217	0.007
HHI	0.193*	(1.98)		0.053	0.120	0.006
Ownership	-0.009	(-0.03)		-0.022	0.085	-0.002
Lit. Risk	0.251**	(2.40)		0.203	-0.011	-0.002
Segments	0.130**	(2.43)		0.189	-0.107	-0.020
Age	-0.002**	(-2.01)		-0.092	-0.031	0.003
Following	0.215***	(3.00)		0.159	0.065	0.010
Horizon	0.045	(0.60)		0.002	0.123	0.000
Return Vol.	-15.114	(-1.50)		-0.093	-0.187	0.017
Analyst Uncert.	-70.870**	(-2.56)		-0.614	0.057	-0.035
Analyst Error	0.899***	(15.82)		0.923	-0.064	-0.059
Strategy Change	0.139*	(1.81)		0.071	0.256	0.018
Adj. R-Sq	0.89					
N	211					

* p<0.10, ** p<0.05, *** p<0.01 (for two-tailed tests)

The ITCV (impact threshold for a confounding variable) gives the threshold at which an omitted variable would make the coefficient *Overall RBFP* insignificantly different from zero at $p<0.10$. If the partial correlation of the omitted variable with *Mgmt Error* times the partial correlation of the omitted variable with *Overall RBFP* is less than -0.166, the coefficient on *Overall RBFP* would no longer be statistically negative if the variable were included in the regression. Impact is the partial correlation of a variable with *Mgmt Error* times the partial correlation with *Overall RBFP*. *Overall RBFP* captures the sophistication of the overall risk-based forecasting and planning process. Appendix A gives the underlying survey questions. *Mgmt Error* is the absolute value of actual EPS less management's forecast as a percentage of stock price. *Size* is the logarithm of the market value of equity. *MTB* is the market value of equity divided by the book value of equity. *R&D* is research and development expense divided by total assets. *HHI* is the Herfindahl–Hirschman Index for the firm's two-digit SIC industry. *Ownership* is the percentage of the firm held by institutional owners. *Lit. Risk* is an indicator variable taking a value of one if the firm is in SIC industries 2833-3836, 3570-3577, 3600-3674, 5200-5961, or 7370-7374. *Segments* is the logarithm of the number of business segments. *Age* is the number of years a firm has had price data on CRSP. *Following* is the logarithm of the number of analysts with earnings forecasts outstanding at the time of the management forecast. *Horizon* is the logarithm of the numbers of days between management's forecast and the end of the period. *Return Vol.* is the standard deviation of daily returns over the previous year. *Analyst Uncert.* is the standard deviation of analyst earnings forecasts outstanding at the time of the management forecast. *Analyst Error* is the absolute value of actual EPS less the median analyst forecast at the time of the management forecast as a percentage of price. *Strategy Change* is an indicator variable taking a value of one if the firm responded that they changed strategy because of new information or understanding of a major risk. T-stats (in parentheses) are based on standard errors clustered at the firm-level. Year fixed effects are included.

TABLE 8
Heckman Selection Model within Survey Firms

Model:	**Selection**		**Outcome**	
Dep Var:	*Guidance*		*Mgmt Error*	
	Coefficient	t-stat.	Coefficient	t-stat.
Overall RBFP	-0.243	(-1.35)	-0.178***	(-3.17)
Size	-0.085	(-0.77)	0.021	(0.92)
MTB	0.043	(1.43)	-0.002	(-0.76)
R&D	0.317	(0.13)	-1.495	(-1.27)
HHI	0.440	(0.89)	0.119	(1.06)
Ownership	1.128	(1.60)		
Lit. Risk	0.682***	(2.79)	0.271**	(2.56)
Segments	0.165	(1.12)	0.124**	(2.18)
Age	0.009*	(1.90)	-0.003***	(-2.68)
Following	0.109	(0.53)		
Return Vol.	-59.158***	(-2.65)	-10.290	(-1.00)
Analyst Uncert.	-50.395***	(-3.43)	-69.359**	(-2.51)
Analyst Error	0.277***	(3.71)	0.894***	(16.20)
Strategy Change	0.307	(1.43)	0.130*	(1.73)
Mills			-0.037	(-0.39)
N	486		211	

Guidance is an indicator variable taking a value of one if the firm issues a management forecast in the current fiscal year, and zero otherwise. *Mgmt Error* is the absolute value of actual EPS less management's forecast as a percentage of stock price. *Overall RBFP* captures the sophistication of the overall risk-based forecasting and planning process. Appendix A gives the underlying survey questions. *Size* is the logarithm of the market value of equity. *MTB* is the market value of equity divided by the book value of equity. *R&D* is research and development expense divided by total assets. *HHI* is the Herfindahl–Hirschman Index for the firm's two-digit SIC industry. *Ownership* is the percentage of the firm held by institutional owners. *Lit. Risk* is an indicator variable taking a value of one if the firm is in SIC industries 2833-3836, 3570-3577, 3600-3674, 5200-5961, or 7370-7374. *Segments* is the logarithm of the number of business segments. *Age* is the number of years a firm has had price data on CRSP. *Following* is the logarithm of the number of analysts with earnings forecasts outstanding at the time of the management forecast. *Return Vol.* is the standard deviation of daily returns over the previous year. *Analyst Uncert.* is the standard deviation of analyst earnings forecasts outstanding at the time of the management forecast. *Analyst Error* is the absolute value of actual EPS less the median analyst forecast at the time of the management forecast as a percentage of price. *Mills* is the inverse mills ratio. Year fixed effects are included.

TABLE 9
Forecast Width and Risk-Based Forecasting and Planning

Dependent Variable = *Width*

Risk Management Practice =	*RBFP w/o Distribs.*	*Risk Drivers*	*Quant. Assess.*	*Budgeting*	*Capital Invest.*	*Strategy*
Distribs.	0.016	0.030	0.030	0.082	0.002	0.004
	(0.18)	(0.35)	(0.36)	(0.72)	(0.03)	(0.05)
RBFP Component	-0.148**	-0.062	-0.127*	-0.108**	-0.111**	-0.094*
	(-2.49)	(-1.54)	(-1.93)	(-2.40)	(-2.56)	(-1.69)
*Distribs.*RBFP Comp.*	0.227**	0.130	0.165	0.012	0.249**	0.208**
	(2.20)	(1.35)	(1.62)	(0.13)	(2.57)	(2.03)
Size	0.003	0.005	-0.004	0.001	0.007	0.013
	(0.08)	(0.14)	(-0.10)	(0.03)	(0.18)	(0.33)
MTB	-0.004	-0.003	-0.003	-0.002	-0.004	-0.004
	(-0.98)	(-0.76)	(-0.78)	(-0.52)	(-1.03)	(-0.97)
R&D	-1.908*	-1.670	-1.504	-2.165**	-1.303	-2.010*
	(-1.82)	(-1.65)	(-1.41)	(-1.99)	(-1.27)	(-1.79)
HHI	-0.156	-0.161	-0.123	-0.101	-0.176	-0.229
	(-0.96)	(-0.97)	(-0.76)	(-0.61)	(-1.09)	(-1.43)
Ownership	0.574*	0.517*	0.546*	0.517*	0.512*	0.603*
	(1.82)	(1.67)	(1.73)	(1.72)	(1.68)	(1.91)
Lit. Risk	0.028	0.046	0.036	0.027	0.020	0.017
	(0.34)	(0.54)	(0.41)	(0.32)	(0.25)	(0.18)
Segments	0.036	0.029	0.013	0.014	0.050	0.043
	(0.60)	(0.49)	(0.21)	(0.20)	(0.84)	(0.74)
Age	0.000	0.000	0.000	-0.000	0.001	0.000
	(0.20)	(0.19)	(0.24)	(-0.05)	(0.35)	(0.12)
Following	-0.128	-0.147*	-0.149*	-0.133	-0.138	-0.148*
	(-1.64)	(-1.93)	(-1.96)	(-1.55)	(-1.65)	(-1.92)
Horizon	0.094	0.084	0.090	0.111*	0.076	0.079
	(1.55)	(1.29)	(1.51)	(1.77)	(1.38)	(1.36)
Return Vol.	-1.466	0.638	-2.532	-1.203	-0.207	0.302
	(-0.14)	(0.06)	(-0.26)	(-0.11)	(-0.02)	(0.03)
Analyst Uncert.	1.592	1.161	2.080	2.343	2.185	0.429
	(0.18)	(0.14)	(0.24)	(0.26)	(0.25)	(0.05)
Analyst Error	0.078**	0.076**	0.080***	0.075**	0.075**	0.082***
	(2.61)	(2.49)	(2.67)	(2.54)	(2.59)	(2.67)
Strategy Change	0.130*	0.098	0.124*	0.147*	0.129*	0.122
	(1.73)	(1.35)	(1.68)	(1.92)	(1.72)	(1.59)
Adj. R-Sq	0.24	0.23	0.23	0.24	0.25	0.24
N	211	211	211	211	211	211

* p<0.10, ** p<0.05, *** p<0.01 (for two-tailed tests)

The dependent variable in all models is *Width,* the upper bound of management's forecast less the lower bound, as a percentage of stock price. All risk-based forecasting and planning variables are constructed from survey responses. Appendix A gives the underlying survey questions. *Distribs.* is an indicator variable taking a value of one if the firm uses distributions and/or stochastic modeling techniques in developing forecasts. *Risk Drivers* captures the consistency with which the firm identifies risk drivers and their interdependencies and links risk management activities to these drivers. *Quant Assess.* captures the extent to which risk assessment criteria and thresholds are quantified and quantitative data are used in evaluating risk exposures. *Budgeting* measures the incorporation of risk considerations in budgeting decisions. *Capital Invest.* measures the incorporation of risk-related practices in project and capital investment decisions. *Strategy* measures the incorporation of risk appetite, tolerances, and assessments in the development and communication of strategic plans and directions. The control variables are defined as follows: *Size* is the logarithm of the market value of equity. *MTB* is the market value of equity divided by the book value of equity. *R&D* is research and development expense divided by total assets. *HHI* is the Herfindahl–Hirschman Index for the firm's two-digit SIC industry. *Ownership* is the percentage of the firm held by institutional owners. *Lit. Risk* is an indicator variable taking a value of one if the firm is in SIC industries 2833-3836, 3570-3577, 3600-3674, 5200-5961, or 7370-7374. *Segments* is the logarithm of the number of business segments. *Age* is the number of years a firm has had price data on CRSP. *Following* is the logarithm of the number of analysts with earnings forecasts outstanding at the time of the management forecast. *Horizon* is the logarithm of the numbers of days between management's forecast and the end of the period. *Return Vol.* is the standard deviation of daily returns over the previous year. *Analyst Uncert.* is the standard deviation of analyst earnings forecasts outstanding at the time of the management forecast. *Analyst Error* is the absolute value of actual EPS less the median analyst forecast at the time of the management forecast as a percentage of price. *Strategy Change* is an indicator variable taking value of one if the firm responded that they changed strategy because of new information or understanding of a major risk. T-stats (in parentheses) are based on standard errors clustered at the firm-level. Year fixed effects are included.

TABLE 10
Sales and CapEx Forecast Accuracy and Risk-Based Forecasting and Planning

PANEL A: Management Sales Forecast Error
Dependent Variable = *Sales Error*

Risk Management Practice =	*Overall RBFP*	*Risk Drivers*	*Quant. Assess.*	*Distribs.*	*Budgeting*	*Capital Invest.*	*Strategy*
RBFP Component	-1.178**	-0.357	-0.513**	-1.669**	-0.633**	-0.558	-0.662
	(-2.48)	(-1.34)	(-2.11)	(-2.35)	(-2.24)	(-1.63)	(-1.62)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adj. R-Sq	0.88	0.88	0.88	0.88	0.88	0.88	0.88
N	171	171	171	171	171	171	171

PANEL B: Management CapEx Forecast Error
Dependent Variable = *CapEx Error*

Risk Management Practice =	*Overall RBFP*	*Risk Drivers*	*Quant. Assess.*	*Distribs.*	*Budgeting*	*Capital Invest.*	*Strategy*
RBFP Component	-2.683	1.678	1.207	-2.053	-2.019	-3.114	-4.859**
	(-1.23)	(1.01)	(0.61)	(-0.79)	(-1.34)	(-1.29)	(-2.09)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adj. R-Sq	0.44	0.44	0.44	0.44	0.44	0.45	0.46
N	227	227	227	227	227	227	227

* p<0.10, ** p<0.05, *** p<0.01 (for two-tailed tests)

The dependent variable in panel A is *Sales Error,* the absolute value of actual sales less management's forecast as a percentage of actual sales. The dependent variable in panel B is *CapEx Error*, the absolute value of actual capital expenditures less management's forecast as a percentage of actual capital expenditures. All risk-based forecasting and planning variables are constructed from survey responses. Appendix A gives the underlying survey questions. *Overall RBFP* captures the sophistication of the overall risk-based forecasting and planning process. *Risk Drivers* captures the consistency with which the firm identifies risk drivers and their interdependencies and links risk management activities to these drivers. *Quant Assess.* captures the extent to which risk assessment criteria and thresholds are quantified and quantitative data are used in evaluating risk exposures. *Distribs.* is an indicator variable taking a value of one if the firm uses distributions and/or stochastic modeling techniques in developing forecasts. *Budgeting* measures the incorporation of risk considerations in budgeting decisions. *Capital Invest.* measures the incorporation of risk-related practices in project and capital investment decisions. *Strategy* measures the incorporation of risk appetite, tolerances, and assessments in the development and communication of strategic plans and directions. *Controls* indicates the presence of the following control variables: *Size, MTB, R&D, HHI, Ownership, Lit. Risk, Segments, Age, Following, Horizon, Return Vol., Analyst Uncert., Analyst Error,* and *Strategy Change.* The controls *Following, Horizon, Analyst Uncert.*, and *Analyst Error* are constructed from sales forecasts in panel A and from capital expenditure forecasts in panel B. T-stats (in parentheses) are based on standard errors clustered at the firm-level. Year fixed effects are included.