Additional Information in Accounting Reports: Effects on Management Decisions and Subjective Performance Evaluations Under Causal Ambiguity

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14 October 2014

We thank Ted Christensen, Christine Denison, Steve Smith, Bill Tayler, Jeff Wilks, Alan Webb, two anonymous reviewers, participants at the 2011 AAA annual meeting and 2011 Management Accounting Section midyear conference, and workshop participants at Brigham Young University, Georgia State University, Monash University, Northeastern University, University of Bern, and University of Missouri for their comments on our paper. We would also like to thank Bill Tayler for the use of his experimental materials, Karen Sedatole for help in recruiting participants, Steven Cornfield for programming assistance, and Jennifer Dedo for assistance with the experimental materials and data. The financial support of the Department of Accounting and Information Systems at Michigan State University is gratefully acknowledged.
ABSTRACT: Organizations have often been criticized for reliance on a single item of accounting information (e.g., profit) in evaluating performance, because of its incompleteness. We provide theory-based experimental evidence that under frequently occurring performance-evaluation conditions (subjective performance evaluation, causal ambiguity, and individual differences in ability, knowledge, and/or motivation that lead to different interpretations of information), reliance on a single item of accounting information (profit), rather than profit plus additional (e.g., nonfinancial or external) information, can provide two potential benefits which offset the costs of information incompleteness. First, subordinates are more likely to make the management decisions that superiors will evaluate and reward highly—that is, there are fewer coordination failures in management decisions. Second, even after controlling for the presence or absence of coordination failures, subordinates experience less negative surprise about their performance evaluations.

Keywords: Accounting reports, management decisions, motivated reasoning, subjective performance evaluation
1. Introduction

In many organizations integrated information systems link internal financial information, internal nonfinancial (e.g., quality, time) information, and external (e.g., competitor, customer, supplier) information, producing accounting reports that include broad-scope, often strategy-linked information in addition to traditional accounting information like cost and profit. This additional information is intended to increase organizational performance; but research aiming to document performance increases has provided mixed results, and attempts to predict the settings in which improvements will and will not occur have also had mixed results (Chenhall 2003; Ittner, Larcker and Randall 2003a). Better predictions of the effects of additional information in accounting reports will require a more complete identification of its costs and benefits, as well as factors that influence the relative magnitude of these costs and benefits.

We identify and provide experimental evidence of previously unidentified costs of reporting additional information in settings where three conditions are present: subjective performance evaluation (PE), causal ambiguity,\(^1\) and individual differences in cognitive abilities, knowledge, and/or motivation that lead to individual differences in interpretations of information. Under these conditions, additional information can increase agency costs by reducing the effectiveness of subjective PE in motivating subordinates. Specifically, additional information can increase the probability that subordinates will not make the management decisions that their superiors will evaluate and reward highly: that is, additional information increases the probability of coordination failures.\(^2\) Moreover, regardless of whether coordination failures occur or not,
additional information makes it more likely that subordinates will receive lower PEs than they expect. The practitioner literature commonly regards such negative PE surprises as undermining the effectiveness of PE systems (Reh 2003; Biro 2011; Cioppa 2013; Greer 2013).

Additional information in shared accounting reports could, in principle, provide a basis for reducing coordination failures and negative PE surprises, because additional information could increase the amount of common knowledge and thus provide subordinates with a better basis for predicting superiors’ judgments and decisions. But given causal ambiguity, additional information can plausibly be interpreted in different ways, and individuals with initially different beliefs, based on differences in cognitive abilities, knowledge, and/or motivation, tend to interpret additional information as supportive of their initial beliefs when it is possible to do so. Thus sharing additional information can lead to more, not less, difference in individuals’ judgments and decisions (Darley and Gross 1983; Thompson and Loewenstein 1992). Moreover, subordinates are not always aware of how much their own interpretations of the additional information differ from those of their superiors, because false consensus effects can lead individuals to underestimate the differences between others’ beliefs and preferences and their own (Marks and Miller 1987; Brenner and Bilgin 2011). Such false consensus effects can exacerbate errors in subordinates’ expectations about which management decisions their superiors will evaluate more highly and what their actual PE will be.

To test our predictions of more coordination failures and more negative PE surprises with additional information, we use an experimental setting in which subordinates and superiors receive background information about an organization, as well as periodic accounting reports that include either profit only or profit plus additional (customer) information. The additional information is non-redundant: that is, it does not have exactly the same implications for management decisions which their superiors will evaluate and reward highly. Failures can occur when subordinates make incorrect judgments about what these decisions are.
and PE as profit does. Subordinates are profit-center managers whose goal is to maximize profits. Their strategy for doing so is to “delight the customer,” but there is uncertainty about the exact parameters relating subordinates’ actions, customer information, and outcomes like profits and appropriate PEs for subordinates (i.e., there is causal ambiguity). Profit alone provides inconclusive evidence of how well subordinates have performed, and thus subordinates can be uncertain about how their superiors will evaluate them. However, we predict and find that when the additional information is not reported, differences between subordinates’ and superiors’ judgments and decisions are relatively small (low level of coordination failures and PE surprises) in spite of the inconclusive profit performance. But when the additional information is included in accounting reports, more coordination failures occur in management decisions and PE surprises are more negative.

We contribute to the accounting literature in two ways. First, we provide a different perspective on subjective PE from much of the prior accounting research, which has investigated effects of subjectivity on the accuracy of superiors’ judgments. Costs of subjectivity, however, can also arise from its effects on subordinates’ judgments, in particular from subordinates’ uncertainty about how their superiors will evaluate them. We identify two types of costs of PE uncertainty—coordination failures and negative PE surprises—which have not previously appeared in the accounting literature on subjective PE. The only cost of PE uncertainty that has previously received attention, to the best of our knowledge, is reduced effort due to subordinates’ effort and risk aversion (Bol 2008).

Second, we provide theory and evidence about the influence of accounting information on the magnitude of these costs. Thereby, we identify a reason why some organizations make explicit attempts to limit the information that is to be used in subjective PE. Organizations have

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3 Organizations can limit the information used in subjective PE in a number of ways. They can limit the information that is reported, require evaluators to justify PEs (i.e., explain how they are based on the information that is designated by organizational policies as the basis for PE), or they
often been criticized for reliance on profit or accounting return alone in evaluating performance because of the incompleteness of this information (e.g., Kaplan and Norton 1996; Merchant 2007). We provide evidence of a benefit of reliance on a single accounting information item like profit—fewer coordination failures and less negative PE surprises—which can offset the costs of information incompleteness.

In Section 2 we review related literature and develop the hypotheses. Section 3 describes the experiment, and Section 4 reports results. Section 5 concludes.

2. Literature review and hypothesis development

This section presents the three conditions under which additional information in accounting reports generates potentially costly coordination failures and negative PE surprises: subjective PE, causal ambiguity, and individual differences in cognitive abilities, knowledge, and/or motivation that lead to individual differences in interpretations of accounting information. We first review the literature on the costs of subjective PE and develop an argument for previously uninvestigated costs that arise from errors in subordinates’ PE expectations. We then use the concepts of causal ambiguity and individual differences to develop two hypotheses about the effects of including additional information in accounting reports when PE is (at least in part) subjective.

Costs of subjective PE

Accounting research has identified a number of costly effects that arise from inaccuracies in superiors’ judgments when PE is subjective: for example, PE biases due to favoritism, leniency, performance-rating compression, asymmetric adjustments for risk, and anchoring on objective information or prior performance (Moers 2005; Bailey, Hecht, and Towry 2011; Bol 2011; Bol and Smith 2011; Woods 2012). Organizations often accept these potentially costly effects of can monitor subjective PEs and identify and modify PEs that appear inconsistent with organizational policies (Ding and Beaulieu 2011; Woods 2012).
subjective PE, either because they misestimate the relative costs of subjective compared to formulaic PE, or because the costs are in fact smaller in equilibrium than the costs of replacing subjective PE with formulaic PE, which is typically incomplete and sometimes rigid and vulnerable to gaming (Bol 2008).

Costs of subjective PE can arise from its effects on subordinates’ as well as superiors’ judgments. The more that PE depends on superiors’ subjective judgments rather than pre-announced formulas, the more uncertain subordinates are likely to be about the PE consequences of their management decisions (Bol 2008). The cost of subordinates’ PE uncertainty that the accounting literature has identified thus far is reduction of subordinate effort. If subordinates are both effort- and risk-averse, then more ex ante uncertainty about their PE will cause them to provide less effort, other things equal (Bol 2008). We argue that effort reductions are only a part of the costs created by subordinates’ uncertainty about their PE, and that subjective PE can have two other potentially costly effects. The first effect is coordination failure that can reduce the effectiveness of the PE system. Subjective PE is successful when subordinates’ management decisions and their PE “match”—that is, when subordinates make decision \( x \) in the belief that it will be highly evaluated and rewarded, and superiors actually highly evaluate and reward \( x \). But even when subordinates’ and superiors’ interests are well aligned through incentives and/or organizational culture, so that subordinates’ welfare is higher when they make the management decisions that their superiors will evaluate highly, subordinates can nevertheless fail to make these decisions because they are uncertain ex ante about which management decisions their superiors will in fact evaluate more highly.

The second potential effect of PE uncertainty is subordinates’ failure to develop accurate expectations about the PEs they will receive, and their consequent surprise when they receive actual PEs that are not as high as they expect. The practitioner literature argues that such negative PE surprises undermine the effectiveness of PE (Reh 2003; Biro 2011; Cioppa 2013; Greer 2013).
If, as in conventional agency models, subordinates develop accurate expectations about the uncertainty in subjective PE (Bol 2008)—that is, if they realize that superiors might not have the same view of their performance as they themselves do—then they should not be particularly surprised at PEs that do not correspond with their expectations. Like gamblers who have bet on tails and see that heads turn up in a coin flip, they will be displeased about the outcome, but they will not be surprised because they understand the uncertainty in the coin flip.

We argue, however, that subordinates can develop positively biased expectations of the PE they will receive and can be imperfectly aware of the bias in their expectations. Subordinates have stronger motivation than superiors do to believe that their own performance is high (i.e., they are motivated to maintain their self-esteem), and on average they do evaluate themselves more highly than superiors do (Harris and Schaubroeck 1988; Heidemeier and Moser 2009). They can underestimate the degree to which this will create differences between their judgments and their superiors’ judgments, however, for two reasons. First, they are not fully aware of the extent to which their own judgments are biased by their motivation (Kunda 1990). Second, when individuals are uncertain about others’ beliefs and preferences, they tend to believe that others’ beliefs and preferences are more like their own than is actually the case (Marks and Miller 1987; Brenner and Bilgin 2011). These false consensus effects lead them to expect that their superiors’ judgments will be more like their own than they actually will be, thus creating additional error in subordinates’ expectations about which management decisions their superiors will evaluate more highly and what their actual PE will be.

Organizations will naturally attempt to reduce PE uncertainty among subordinates, but it is not surprising that some costly PE uncertainty persists in natural environments, just as some of the costs related to superiors’ judgment (e.g., favoritism, leniency) persist, either because the costs of eliminating PE uncertainty are higher than the costs of not eliminating it, or because organizations misestimate the costs. Organizations make choices about how much subjective PE
uncertainty to allow. For example, organizational policy can reduce PE uncertainty (but also reduce superiors’ ability to make use of relevant information) by implementing more restrictive ex ante guidelines for subjective PE and/or ex post reviews of PE. Superiors can communicate with their subordinates, providing information about how they are likely to interpret and weight indicators of performance. However, if either policy or communication eliminates ex ante uncertainty completely—that is, if organizations or superiors commit credibly ex ante to the exact measurement and weighting of performance indicators—then the PE system has become formulaic and is no longer subjective in the sense considered here. Hence if formulaic PE is not the preferred option, then some PE uncertainty will persist.

PE uncertainty can also be reduced by subordinates’ learning from experience how superiors are likely to evaluate them. However the time required for such learning can be considerable, and thus learning is often incomplete, particularly when organizations operate in complex, changing environments where the information relevant for PE and the appropriate weighting of it is likely to change over time. Subordinate-superior dyads can change frequently as well in such environments, preventing subordinates from fully learning their superiors’ subjective PE judgment models from experience.

In order to understand the choices organizations make between subjective and formulaic PE, it is necessary to identify factors that are likely to make the costs of PE uncertainty high. In the next subsection we argue that information reporting choices are one such factor.

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4 In the environment of auto sales, which is not exceptionally complex or changing and therefore should support effective learning, Gibbs et al. (2004) find results consistent with slow decreases in subordinates’ uncertainty about their subjective PEs over relatively long periods of time. Subjective PE has more positive effects on subordinates’ performance in Gibbs et al. (2004) as subordinate tenure increases; mean subordinate tenure is 8.7 years, and presumably learning is not yet complete at this mean length of time.
Additional information in accounting reports and PE uncertainty

Subordinates’ PE uncertainty and thus the costs described above are likely to vary depending on the information provided in accounting reports. In this section we first briefly note that under favorable common-knowledge conditions, additional information in accounting reports can decrease PE uncertainty. We then argue that conditions of causal ambiguity and individual differences in ability, knowledge, and/or motivation which preclude high levels of common knowledge often occur, and in these conditions additional information is likely to increase PE uncertainty and its costly consequences through individual differences in interpretations of the additional information.

As an example of the value of additional information when common knowledge is high, consider a setting in which profit is an important but noisy indicator of subordinates’ performance, and additional information $z$ can reduce superiors’ uncertainty about whether mediocre profit in a given period represents low performance by subordinates under favorable conditions or high performance given unfavorable conditions. If $z$ is not in the accounting reports that both subordinates and superiors receive, and if superiors might (or might not) have made private observations that gave them (possibly incomplete) indications of the conditions under which $z$ occurred, then subordinates will be uncertain about whether their superiors will evaluate their performance as low or high. In contrast, suppose $z$ is in the accounting reports that both subordinates and superiors receive. If subordinates and superiors have common knowledge of what $z$ indicates about the subordinates’ performance, then subordinates will be more certain of receiving high PEs if $z$ indicates high performance and more certain of receiving low PEs if $z$ indicates low performance.5

5 This example assumes that subordinates know superiors have incentives for accurate PEs. If superiors have different incentives—for example, only to adjust PE for some values of $z$ but not others—then subordinates’ expectations will be different, but their expectations will still be accurate as long as superiors’ incentives are common knowledge.
In natural environments, however, individuals are often uncertain about the magnitude and timing of the links between their own and others’ actions, outcomes like organizational payoffs, and additional information. That is, they experience causal ambiguity, which is different from the uncertainty represented in conventional agency models and thus can have different causes and effects. For example, in Feltham and Xie’s (1994) model, information in accounting reports appears as the vector \( y \) in the equation system \( y = \mu a + \varepsilon \), where \( a \) is the vector of agent’s actions, \( \mu \) is the matrix of parameters that capture the relations between actions and accounting information, and \( \varepsilon \) is the vector of terms representing influences on accounting information other than the agent’s actions, with mean zero and covariance matrix \( \Sigma \).

In conventional agency models, principals are unable to observe the values of \( a \) and \( \varepsilon \) in any particular instance, but principals and agents have common knowledge of \( \mu \) and \( \Sigma \). Under causal ambiguity, in contrast, both principals and agents can lack common knowledge about at least some values in \( \mu \) and \( \Sigma \). For example, they may be uncertain about the exact amount \( (\mu) \) by which product quality, production efficiency, and profits \( (y) \) should be expected to increase in a given period when agents make specific efforts \( (a) \) to improve quality and efficiency. They may also be uncertain about how much outcomes might reasonably deviate from their expectations \( (\Sigma) \). Additional information in accounting reports adds elements to the vector \( y \) but does not necessarily eliminate uncertainty about values of \( \mu \) and \( \Sigma \).

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6 Models with similar formulations of the relations between agents’ actions and accounting reports appear in more recent studies such as Datar, Kulp and Lambert (2001) and Feltham, Indjejikian and Nanda (2006).

7 Causal ambiguity can also affect the beliefs represented by the equation \( x = B(a) + \varepsilon_x \), where \( a \) is a vector representing the agent’s actions, \( x \) is the principal’s gross payoff given these actions, \( B \) is a vector of parameters relating agents’ actions to principals’ payoffs, and \( \varepsilon_x \) is the random uncontrollable component in the principal’s payoff. In the model, both principal and agent have ex ante uncertainty about \( x \), but they know with certainty the parameter values that make up \( B \) and the covariance matrix of \( \varepsilon_x \). Under causal ambiguity, they are uncertain about at least some of these values.
Under conditions of subjective PE, causal ambiguity, and individual differences that can lead to different interpretations of information, we expect that additional information will increase rather than decrease PE uncertainty and its negative consequences. Figure 1 represents how additional information increases coordination failures. Psychology research provides evidence that if individuals have initial differences in knowledge and/or motivation (or, presumably, cognitive ability) that lead to different initial beliefs or preferences about a stimulus, then they interpret subsequent information differently, as long as the information is not redundant with what they already know and is open to multiple interpretations (Darley and Gross 1983; Thompson and Loewenstein 1992). In consequence, there is a larger difference between their judgments after than before they have examined identical additional information. The implication for our setting is that, given causal ambiguity and individual differences in subordinates’ and superiors’ cognitive ability, knowledge, and/or motivation (Box 1), additional information (Box 2) will increase the difference in subordinates’ and superiors’ interpretations of the information reported (Box 3).

Subordinates are not likely to know all the relevant individual characteristics of their superiors with certainty, nor are they likely to be certain exactly how all relevant characteristics will influence their superiors’ judgments. Thus, when different interpretations of the information reported are more likely (Box 3), subordinates’ lack of complete knowledge creates more uncertainty for them about their PE (Box 4).

The higher PE uncertainty created by additional information under conditions of causal ambiguity will lead to more frequent errors in subordinates’ expectations about which

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8 It is not necessarily irrational for them to interpret the shared additional information differently, as shared additional information can reasonably have different implications when combined with different prior knowledge. Kim and Verrecchia (1994) make a similar point, arguing that public disclosures of accounting information can result in different judgments about firm value by individuals with different private information, and thus can sometimes increase rather than decrease information asymmetry.
management decisions their superiors will evaluate more highly (Box 5) and thus to more coordination failures (Box 6). This will be the case even when subordinates have unbiased expectations of their superiors’ judgments. Judgment biases, however, can increase coordination failures further when PE uncertainty is high: false consensus effects (Marks and Miller 1987; Brenner and Bilgin 2011), in which subordinates underestimate the difference between their own preferences and beliefs and their superiors’, can lead to additional error in subordinates’ expectations about which management decisions their superiors will evaluate more highly, and thus to additional coordination failures. (See online Appendix A for details and numerical examples.)

HYPOTHESIS 1. Coordination failures are more likely when profit and additional information are reported than when only profit is reported.

Many individual differences in subordinates’ and superiors’ cognitive abilities, knowledge, and/or motivations are not systematic by role. For example, subordinates and superiors cannot be expected in general, by virtue of their roles, to have different levels of statistical-reasoning ability, general business knowledge, or effort preferences. Thus at least some of the differences between subordinates’ management decisions and the decisions that superiors will evaluate more highly will be random. But role as such leads to one specific motivation difference and consequently to systematic differences in subordinates’ expected and actual PEs. Subordinates’ preferences for receiving high PEs will typically be stronger than superiors’ preferences for giving them to their subordinates, both when coordination failures occur and when they do not. Even when subordinates have made the management decisions that their superiors prefer, they can still believe that they deserve a higher PE for making these decisions than their superiors do. Motivated by a desire to maintain their self-esteem, subordinates can believe that their management decisions are more important and/or more difficult, or that the decision outcomes were better (given the circumstances) than their superiors believe. Large-scale survey studies in the personnel psychology literature find that employees’ self-evaluations are typically
higher than the PEs they receive from their superiors (Keeping and Levy 2000; Heidemeier and Moser 2009).

It is not clear from the personnel psychology literature how sensitive this positive self-evaluation bias is to the information in accounting reports; nor is it clear how this bias influences subordinates’ expectations about their PEs. High self-evaluations by subordinates do not automatically entail expectations of high PEs from their superiors. In principle, subordinates could be aware that their superiors tend to be more critical of them than they are of themselves; or they could discount their expectations for uncertainty, avoiding high expectations when they are especially uncertain about how their superiors will evaluate them.

We predict, however, that under conditions of subjective PE and causal ambiguity, additional information in accounting reports will lead to upward bias in subordinates’ expectations about the PE they will receive from their superior (Figure 2). Subordinates’ motivation to maintain their self-esteem and thus believe their performance is high (Box 1) can create a self-enhancing bias in their interpretations of information, and thus in their judgments of their own performance, via motivated reasoning (Kunda 1990; Tayler 2010). When the additional information in accounting reports (Box 2) is reported under conditions of subjective PE and causal ambiguity, then self-enhancing biases in the interpretations of information reported (Box 3) are likely to be larger—that is, subordinates’ self-esteem motivation and additional information interact—because the additional information creates more latitude for motivated reasoning processes like selective interpretations and uses of information (e.g., Dunning, Meyerowitz, and Holtzberg 1989). Because motivated reasoning is not a fully conscious process (Kunda 1990; Hales 2007), subordinates tend to believe that their positive self-evaluations are accurate; hence they expect properly motivated superiors to evaluate them highly. Superiors, however, have less motivation to bias their interpretations and uses of the information in ways that favor their subordinates. Hence subordinates’ expectations of high PEs will lead to negative PE surprises (Box 4).
There is some reason to question whether an increased self-enhancement effect like that in Dunning et al. (1989) will occur in our PE task, however. Self-enhancing biases are significantly smaller (sometimes nonexistent) in settings like ours where individuals evaluate their own performance only, rather than make an explicit comparison of their own and others’ performance. In addition, self-enhancing biases are significantly smaller when individuals evaluate performance on specific tasks rather than evaluating traits like ability (Heidemeier and Moser 2009).

We expect, however, that common characteristics of subjective PEs in natural environments, which are reproduced in our experiment, will offset the limiting factors. Subjective, verbally anchored rather than numerically anchored scales (i.e., from “Unsatisfactory” to “Outstanding,” rather than from “profit < $300 million” to “profit > $400 million) tend to increase self-enhancement biases (Moore and Small 2007). Information that is open to multiple interpretations also tends to increase the self-enhancement and motivated reasoning effects of performance-based incentives and the threats to self-esteem that PE can create (Moore 2007). These factors have strong effects in prior studies. We therefore predict that the additional information in accounting reports will increase subordinates’ tendency to expect higher PEs than their superiors give them.

**HYPOTHESIS 2.** *PE surprises will be more negative when profit and additional information are reported than when only profit is reported.*

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9 Much of the bias in comparative PEs comes from misestimating or underweighting the comparable performance, not from misestimating one’s own performance (Moore 2007; Moore and Small 2007).
3. Experimental method

Participants and design

Participants in the experiment are 94 full-time MBA students currently taking a management accounting course. Their average age is 28 (range 22 – 48), and 86 percent have prior experience evaluating subordinates’ performance. Participants receive performance-dependent compensation (see below for details) and earn an average of $12.31 for their participation in the experiment, which takes about 45 minutes to complete.

The experiment is a 2 x 2 between-subjects design. The two independent variables are role (subordinate or superior) and information reported (profit only or profit plus additional information).

Task and procedure

The task is based on an experiment by Tayler (2010), in which subordinates make a management decision (a choice of management initiatives to increase profit at a restaurant chain). We extend Tayler (2010) by adding a superior who subjectively evaluates and rewards his or her subordinate’s performance after both subordinate and superior have received accounting reports about the outcomes of the subordinate’s management decision. We are primarily interested in subordinates’ PE uncertainty that arises from the structure of the situation—from the fact that the subordinates and superiors are different individuals with unavoidably different cognitive abilities, knowledge, and/or motivations—rather than from differences in the information reported, which could in principle be eliminated easily by better information sharing. Hence for purposes of experimental control we match the information provided to subordinates and superiors for each judgment and decision. Figure 3 provides a graphic representation of the sequence of events and participants’ judgments and decisions; the judgments and decisions used in testing hypotheses appear in bold.
The experiment is conducted in a university computer lab, where a program randomly assigns participants to roles, subordinate-superior dyads, and information conditions. Although most judgments and decisions made by participants are entered in a computer and electronically transmitted to the other member of their dyad, we collect some information on sheets of paper that remain with the participants until the end of the experiment as a way of assuring them that this information is private and will not influence the judgments and decisions of the other member of their dyad. For example, subordinates’ written expectations of their PEs remain private so as not to influence the PEs their superiors give them.

In the following sections we describe the subordinates’ task and then indicate differences in the superiors’ task. Subsequently, we present the information manipulation in detail.

**Subordinates**

Subordinates assume the role of a manager in charge of a restaurant chain called Big-10 Pizza, a subsidiary of National Dining, Inc., in October 2010. They receive background information that briefly describes Big-10 Pizza and states that its goal is to maximize operating income by a strategy of “delighting the customer.” Subordinates learn that they will receive a salary for each period (“year”) in the experiment and that, “Additional earning opportunities may occur if your performance as a manager is high.” (Incentive-compensation details are provided later, at a point nearer the management decision on which subordinates’ incentive compensation is based.) They then decide which of two initiatives to pilot-test as a step toward achieving this goal, either offering a free side order or using higher-quality ingredients. Participants are told that neither pilot initiative is expected to create significant additional fixed costs and that both initiatives will generate about the same level of variable costs per sales dollar. To assure attention and commitment to their management decision, we ask subordinates to write a brief justification of their decision, which remains private.
The chosen initiative is pilot tested during 2011 at seven randomly selected restaurants in the chain. Subordinates then decide whether to implement the initiative firm-wide,\textsuperscript{10} based on performance at the pilot restaurants and at a control group of seven restaurants that do not pilot the initiative but are matched pairwise with the pilot restaurants and “selected to be as similar as possible to the seven pilot restaurants.”

In January 2012 subordinates receive accounting reports about the outcome of the pilot test at the seven pilot and seven matched control restaurants for 2011. In the profit-only condition, the information reported consists of operating income for each restaurant. In the profit-plus condition, the information reported consists of the same operating income as well as customer delight information. The profit-plus version of this information is shown in Table 1.\textsuperscript{11} For purposes of experimental control, we provide the same information to participants who choose the free side-order initiative and to those who choose the higher-quality ingredients initiative. Subordinates write an explanation, which remains private, of why they think the pilot was or was not a success.

[Table 1]

Subordinates then receive information about their PE and incentive plan for 2012. In addition to a $3 annual base salary ($9 total over three experimental years), they can receive a bonus for 2012 that ranges from $0 to $5, depending on their superiors’ evaluation of their performance on a six-point scale that ranges from 0 (= Unsatisfactory) to 5 (= Outstanding). Subordinates’ 2012 PEs translate automatically into bonuses for 2012: a PE of 1(5) results in a

\textsuperscript{10} “Firm-wide” means at all the restaurants in the Big-10 Pizza chain, not all of the restaurants in the parent company, National Dining.

\textsuperscript{11} We use the profit and customer information in Tayler (2010) with modifications appropriate to our setting. For example, we label profit as operating income rather than gross margin, because operating income is a more plausible basis for the compensation of the business-unit manager, and we rescale the profit numbers accordingly.
$1($5) bonus, etc. Subordinates are told that their superiors have “an incentive to evaluate you accurately, in a way that she believes would best motivate you to achieve Big-10’s goal.”

Next, subordinates express the strength of their preference for implementing the initiative at all of the Big-10 Pizza restaurants in 2012, using a scale from 1 (= Definitely would not implement the initiative) to 10 (= Definitely would implement the initiative). They are told that a response of 6 – 10 will translate into a decision to implement firm-wide, and a response of 1 – 5 will translate into a decision not to implement. They are also told that the results of implementing (not implementing) the initiative firm-wide are expected to be very similar, but not identical, to the results of the pilot test. Subordinates’ management decisions (the binary implementation decisions, not the preference strengths) are electronically communicated to their superiors, along with the pilot-test outcome information on which the decisions were based.

The firm-wide implementation decision goes into effect in January of 2012, and in January of 2013 subordinates receive accounting reports for 2012 (presented in Table 2). The format and the information reported are the same as for the 2011 pilot, and the pattern of 2012 results is similar to the pattern of results for 2011.\textsuperscript{12} After reviewing this information, subordinates privately state their expectation of the PE that their superiors will give them for 2012, using the same six-point scale that the superiors will use for the PE.

\textbf{Table 2}

Subordinates then receive an electronic communication from their superiors giving their 2012 PE and bonus. If they are not satisfied, then they can request a review of their PE at a cost of $1, making whatever arguments they think are appropriate. After receiving a response to their

\textsuperscript{12} In 2012, however, the seven observations represent mean results for seven regions rather than individual results for seven restaurants. Firm-wide results of implementation (non-implementation) are statistically indistinguishable (ps > .90) from the results at pilot (control) restaurants in the pilot test.
review request (if any), subordinates answer post-experiment questions providing demographic information and explanations of their judgments and decisions.

Superiors

Superiors begin by answering five questions about subjective PE, intended to capture superiors’ beliefs about the appropriate effects on PE of factors like sampling error and uncontrollable influences on performance measures. (See online Appendix B for the text of these questions.) The questions have three purposes. First, they occupy the superiors’ time while the subordinates decide which pilot initiative to implement and then whether to implement their chosen initiative firm-wide. Second, these questions prompt the superiors to begin thinking about PE. Third, the similarity of superiors’ responses in the two information-reporting conditions provides some additional assurance that any difference in superiors’ PE between the two conditions is driven by the information manipulation and not by pre-existing differences in superiors’ beliefs or attitudes about PE.

Superiors begin in January 2013 and receive the same background information about Big-10 Pizza that subordinates receive at the beginning of their task, including the stated goal of maximizing operating income by a strategy of “delighting the customer.” Superiors learn which of the two initiatives their own subordinates chose for pilot testing, and they receive the results of the one-year pilot test in 2011 (Table 1). Superiors then privately indicate whether they believe the subordinate should implement the initiative firm-wide, using the same 1 – 10 scale that the subordinates used in deciding on firm-wide implementation.

Next, superiors learn whether their subordinates decided on firm-wide implementation for 2012 or not, and then they receive accounting reports for 2012 (Table 2). Superiors whose subordinates decided to implement the initiative firm-wide receive only the information resulting from implementation (Table 2, panel A), and superiors whose subordinates decided not to implement receive only the information resulting from no implementation (Table 2, panel B).
Superiors receive a fixed salary ($9) plus a bonus ranging from $0 to $5. They are told that their bonus depends on senior managers’ evaluations of how their decisions “have contributed to helping the restaurant-chain managers achieve their assigned goal of maximizing their restaurant chains’ operating income.” The incentive for superiors provides motivation for high-quality PE. The benchmark for high-quality PE is subjective PE by knowledgeable third parties, rather than a formula-based benchmark, since the setting is one in which the organization has chosen subjective PE as the preferable alternative.13 A panel of six management accounting faculty from two research universities agreed to participate as the experts representing the “senior managers’ committee” and determining what PEs would be best for motivating subordinates, given the information in the reports.14

Superiors then evaluate their subordinates’ performance (which determines the subordinates’ bonus) on the six-point scale described earlier. If subordinates request a review, then superiors are informed of the request, receive the subordinates’ supporting arguments, and decide whether to change their original PEs.15 Final PEs (whether changed or not) are sent to the subordinates, and superiors then answer post-experiment questions similar to those answered by subordinates. Superiors whose subordinates do not request a review proceed directly to the post-experiment questions.

13 If a PE formula were provided to superiors, then it would not be appropriate to withhold it from subordinates.

14 Three faculty members evaluated decisions to implement and not to implement the initiative firm-wide in the profit-only condition and three evaluated decisions to implement and not to implement the initiative in the profit-plus condition. The closer a superior’s evaluation of his or her subordinate’s performance is to the expert panel’s median PE, the higher the bonus the superior receives. The panel’s median PEs for subordinates in the four conditions are: 1 for profit-only / implement, 4 for profit-only / not implement, 1 for profit-plus / implement, and 3 for profit-plus / not implement.

15 Forty-two of the forty-seven subordinates did not request reviews. All five review requests were rejected by superiors. Because of the small number of review requests, we do not analyze these requests further.
Information manipulation

The reports of profit only and profit plus additional information are designed to operationalize theory and enhance experimental control in three specific ways. First, because there is only one item of additional information (customer delight), it is unlikely that information overload rather than the psychological mechanisms we propose in the hypothesis motivation will be the source of any additional judgment errors that occur.

Second, the information provided is subject to causal ambiguity. The pilot data (along with participants’ prior experience with pizza restaurants) provides a basis for judging the relations among subordinates’ actions and operating income. But with only seven matched pairs of restaurants, the results of the pilot are not entirely conclusive. Mean and median operating income increase at the pilot restaurants but they increase more at the control restaurants.\footnote{16} The balance of the evidence is against the success of the initiative in the pilot test; but especially if subordinates have strong prior beliefs in the value of their chosen initiative, they might not regard the small pilot as decisive evidence against it. Moreover, differences in statistical reasoning ability and/or motivation to regard the initiative as a success can result in differential attention to the larger income growth at control than pilot restaurants from year to year.\footnote{17}

Third, the potential for diverse responses to the pilot results increases when customer information is included in the accounting report. Customer delight (as measured) increases more at

\footnote{16}{The difference in operating-income change in favor of the control restaurants approaches but does not reach a conventional level of statistical significance ($p = .13$, two-tailed). Median levels of operating income are not significantly different at pilot and control restaurants ($p = .87$). The tests are two-tailed related-samples Wilcoxon signed rank tests.}

\footnote{17}{Psychology research finds that individuals often judge correlation by whether two variables co-occur (e.g., in our setting, income growth and the pilot initiative) without attending to evidence of what happens to one of the variables when the other does not occur (income growth in the absence of the pilot initiative). This is especially the case when the individuals expect a correlation to exist (Alloy and Tabachnik 1984).}
pilot than at control restaurants, although operating income does not. The experimental materials inform participants that, consistent with the short repeat-business cycle of the pizza restaurants, all performance effects of the pilot initiative should be evident before the end of the pilot test. That is, if increased customer delight in January has not increased operating income by December of the same year, then it cannot be expected to do so later. Customer information is valuable to managers because it can play a decision-facilitating role, but in this setting it is not unambiguously obvious that it provides incremental information to superiors about subordinates’ contributions to operating income. Plausible explanations for the lack of association between the customer and income information are that revenues do not increase as a result of customer delight increases in the observed range, increased revenues do not exceed the incremental costs of the initiative, the customer information is flawed, or the observed lack of profit increase is simply sampling error.

As is often the case in natural environments, it is not possible in the short term to be certain which explanations best account for the observed outcomes, given the information reported. Individual differences in cognitive abilities, knowledge, and/or motivation are thus likely to lead to different interpretations of the information. Subordinates without particularly strong priors in favor of the initiative are more likely to conclude that the initiative is not a profit-maximizing choice and should not be implemented firm-wide. Subordinates with stronger priors in

18 Median measured customer delight in 2011 and the change in customer delight from 2010 are significantly higher at pilot than at control restaurants ($p = .02$ and .03 for the two measures; tests are two-tailed related-samples Wilcoxon signed rank tests).

19 For example, in natural environments, if managers wanted to diagnose the cause of less-than-expected profit increases at the pilot restaurants, then the observed increase in customer delight would tell them that it was not the unpopularity of the initiative with customers. Thus they could then turn their attention to questions of whether the relation between customer delight and revenue is weaker than anticipated or whether the initiative is too costly.

20 We do not measure individual differences in cognitive ability, knowledge, and motivation or model their relation to individuals’ judgments and decisions in the experiment. But it is reasonable to assume that such differences exist, particularly in light of the different initial decisions that participants make when presented with the same information (i.e., different initiative choices by subordinates and different PE decisions in pre-experiment cases by superiors).
favor of the initiative can draw different conclusions, however. The favorable customer information could lead them to put more credence in the sampling-error explanation than the other explanations for the unsatisfactory profit at the pilot restaurants, or to focus more on the profit increases at the pilot restaurants and less on the differences between pilot and control samples.

4. Results

This section first presents tests of our two hypotheses. We then present supplemental analyses to provide additional evidence on participants’ judgment processes and to exclude alternative explanations for the results.

*Hypothesis tests*

H1 predicts that coordination failures will be more likely in the profit-plus than in the profit-only condition. We use two measures of the dependent variable to test H1. Because coordination failure means that subordinates make management decisions that their superiors will not evaluate highly, our first measure of the extent of coordination failure is the frequency of low PEs. Table 3, panel A shows the frequency distribution of PEs in the profit-only and profit-plus conditions. Across both information conditions, the median PE is 3 and the modal PE is 4. PEs of 0, 1 or 2, which appear in the shaded box in Table 3, panel A, can thus be classified as indicators of decision performance that superiors evaluate relatively unfavorably. These low PEs are more common in the profit-plus (eight cases, or 33 percent) than in the profit-only (three cases, or 13 percent) condition, and the difference is significant ($\chi^2 = 2.70, p = .05$ one-tailed). These results provide support for H1.

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21 Note that the *level* of PE given by superiors—a measure used to test H1—is not the same measure as the subordinate-superior *difference* in PEs that is used to test H2.

22 As expected, given random assignment, mean responses to the questions about PE that superiors answered at the beginning of the experiment (see online Appendix B for text) do not differ significantly between information conditions ($p > .05$). To test for possible influences on the dependent variable in H1, we perform logistic regressions with these question responses, information reported, and their interactions as independent variables and low PE as the dependent variable. (One model includes all independent variables but has multicollinearity problems; hence
In principle, low PE could occur for other reasons than subordinates’ failure to anticipate correctly which management decision will be preferred and highly evaluated by their superiors. For example, some superiors can be more inclined than others to attribute low profit performance to uncontrollable factors, or some can be more predisposed than others to give low PEs because they experience less disutility from the resulting negative reactions by their subordinates. Hence we also provide additional information on coordination failures by testing for differences between the implementation decisions subordinates make and the decisions that superiors prefer. Although this measure captures the subordinates’ success or failure at anticipating which decision their superiors will prefer, it does not capture an important part of the coordination failure in which we are interested because it does not distinguish between non-preferred decisions that have strong negative consequences for PE and reward and non-preferred decisions that have only trivial consequences.

Subordinates and superiors both rate the desirability of firm-wide implementation on a ten-point scale. If participants in a subordinate-superior dyad give responses on opposite sides of the response scale (1 – 5 versus 6 – 10 on the scale), then we code the result as an indicator of coordination failure.23 Such responses on opposite sides of the scale occur in 30 percent of the we also estimate separate models which each include one question and its interaction with information.) None of the questions or their interactions with information are significantly associated with the dependent variable (all \( p_s > .05 \)).

23 We do not use interval distance on the scale as a measure of coordination failure, because intervals of the same sign and magnitude can be experienced by participants as either coordination failures or successes. Consider, for example, two subordinate-superior dyads that choose ratings of (9, 6) and (7, 4) respectively. The subordinate implements in both cases, but in the first case the superior believes implementation is the right decision and in the second case the superior believes it is not. It would be inappropriate to treat these two cases as identical, simply because they both have interval distances of 3. (Superiors only know whether subordinates chose implementation. They do not know the exact strength of their subordinates’ private preferences, so they cannot experience a small interval distance as “almost a success” when preferences are on opposite sides of the midpoint.)
dyads in the profit-only condition and 50 percent of the dyads in the profit-plus condition (Table 3, panel B). The difference is marginally significant ($\chi^2 = 1.87$, one-tailed $p = .085$), thus providing additional support for H1.

H2 predicts that PE surprises will be more negative in the profit-plus than in the profit-only condition, and experimental results are consistent with this prediction (means of −0.79 in profit-plus and 0.13 in profit-only) (Table 4, panel A). The mean PE surprise is not significantly different from zero in profit-only ($t = .55, p = .59$, two-tailed), although it is significantly different from zero in profit-plus ($t = 3.65, p = .001$, two-tailed). Panel B of the table provides a breakdown of PE surprises by subordinates’ implementation decisions and superiors’ implementation preferences. These descriptive statistics indicate that PE surprises are (qualitatively) more negative in profit-plus for every implementation combination that occurs.

To test whether PE surprises are significantly more negative in profit-plus than in profit-only, we use a general linear model in which the dependent variable is the signed difference between actual and expected PE. The independent variable is information reported (profit-only or profit-plus). We include two implementation-related variables to control for the incremental effects of variation in subordinates’ and superiors’ management decisions and provide evidence that the effect of additional information on PE surprises is not simply another measure of

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24 We use the signed rather than absolute difference, because a PE that is one point higher than the subordinate expects is not likely to prompt costly conflict in the same way as a PE that is one point lower than the subordinate expects. In an alternative test, all instances in which the superior’s PE is higher than the subordinate’s expectation are recoded as zero to indicate no PE surprise. Inferences are unchanged when we perform the hypothesis test using the recoded rather than the original data.

25 Panel B also shows that, consistent with the analysis in online Appendix A, superiors with “minority” preferences (i.e., those who prefer “Yes” in profit-only and “No” in profit-plus) are relatively more likely than those with “majority” preferences (“No” in profit-only and “Yes” in profit-plus) to have a subordinate who makes the non-preferred choice. See online Appendix A for more on the effects of majority and minority preferences on the distribution of PE surprises.
implementation-decision effects. First, we control for whether subordinates chose to implement their initiative firm-wide; and second, we control for whether the subordinates failed to make the implementation decisions that their superiors preferred (coordination failures). Table 4, panel C presents the results of the general linear model. The effect of additional information is significant (two-tailed \( p = .03 \)), and firm-wide implementation and coordination failure are not significant (two-tailed \( ps > .40 \)), thus providing support for H2.\(^{26}\) Consistent with analysis in the hypothesis development, negative PE surprises occur both when coordination failures occur and when they do not.\(^{27}\) (The supplementary analyses provide further analysis of the implementation variable.)

**Supplementary analyses**

To provide further understanding of the hypothesis tests, we perform three sets of additional analyses. First, we provide evidence that our test results are not driven by between-treatment differences in several demographic characteristics of participants. Second, we provide additional analysis of the expected and actual PEs, indicating that behavior in the experiment is consistent with characteristics of PEs observed in organizations and with analysis in the hypothesis development. Third, we provide evidence that the results are not due to role-based

\(^{26}\) We also estimate a larger model that includes interactions among the control and manipulated variables. No two-way interactions are significant (\( ps > 0.25 \)), neither control variable is significant (\( ps > 0.80 \)), and information reported is significant (\( p = .06 \) in the general linear model, or \( p = .03 \) in a one-tailed contrast test). The observed frequencies of implementation choices and coordination failures do not populate all the cells that would be necessary to test a three-way interaction.

\(^{27}\) In additional models, we add superiors’ responses to the questions at the beginning of the experiment and their interactions with information reported to the model shown in panel C of Table 4. As with H1, one model includes all independent variables but has multicollinearity problems; hence we also estimate separate models which each include one question and its interaction with information. None of the questions or their interactions with information reach conventional levels of significance (all \( ps > .05 \)), with one somewhat unstable exception: responses to question 4 are significantly associated with PE surprise if the (insignificant) interaction is included in the model, but not if the interaction is omitted. The weak or nonexistent relations between PE surprise and superiors’ general beliefs about PE are consistent with the theory presented in the hypothesis motivation, which ascribes negative PE surprise primarily to characteristics of the judgments of subordinates rather than superiors.
differences in preferences for profit versus customer information. For brevity, we focus on the analysis of negative PE surprises—the last judgment participants make in the experiment—and do not discuss the intermediate step of the firm-wide implementation decisions.

**Demographic characteristics**

We test for mean differences between experimental conditions in participants’ age, the number of times they have evaluated the performance of others and others have evaluated their performance prior to the experiment, and the subordinates’ choices of the initiative to pilot-test (free side order versus higher-quality ingredients). These variables do not differ significantly between information or role conditions (all $p$s > .10). Including age, experience measures and initiative choice as control variables in the tests of negative PE surprise does not qualitatively change the inferences.

Post-experiment questions also ask participants to rate their satisfaction with their PEs of other people and their satisfaction with others’ PEs of them. These responses differ significantly ($p$s < .05) across experimental conditions, possibly because different conditions prompt different memories of previous PEs. However, including these responses as covariates in the general linear model used for hypothesis testing does not qualitatively change the inferences.

**Characteristics of PE**

Consistent with many PE and reward distributions in organizations (Moers 2005; Bol 2008, 2011), the distribution of PEs in the experiment is somewhat compressed and lenient. Zero, the lowest possible PE, is never used, PEs of 1 or 5 are relatively uncommon (7 of 47 PEs), and the modal PE is 4 out of a possible 5. Figure 4 depicts the distributions of expected and actual PEs in the two information conditions. The distributions of expected and actual PEs in the profit-only condition are almost identical. The distributions in the profit-plus condition are visibly different, however. Most subordinates in the profit-plus condition expect PEs at the high end of the scale (4 or 5), while the PEs their superiors give them are more uniformly distributed.
In the hypothesis development, we argue that additional information gives subordinates more latitude to justify beliefs that their performance is high, regardless of whether they decide to implement their initiative firm-wide or not. Consistent with this argument, subordinates do not discount their expected PEs for the differences in judgments that the additional information can create. Instead, they expect higher PEs in the profit-plus condition (mean = 3.92) than in the profit-only condition (mean = 3.30), and they also display higher consensus about their (less accurate) expectations in profit-plus. The variance of expected PEs is lower in profit-plus (0.42) than in profit-only (1.49) (Levene’s $F = 4.53, p = .04$), and a $t$-test adjusting for these unequal variances indicates that the difference between expected PEs in the profit-plus and profit-only conditions is significant ($t = 2.13$, two-tailed $p = .04$).

Superiors, who do not have as much ego involvement in the success of their subordinates’ decisions as subordinates do, do not exhibit the kind of judgment distortions that subordinates do when additional information is reported. Mean actual PEs do not differ significantly between profit-only and profit-plus conditions ($t = 1.00, p = .32$), and the variance of superiors’ PEs is not significantly different in profit-only (1.08) than in profit-plus (1.15) (Levene’s $F = 0.23, p = .63$).

Role-based differences in information preferences

In the hypothesis development, we argue that PE surprises are more negative in the profit-plus than in the profit-only condition because subordinates interpret and use the reported information in self-enhancing ways. An alternative possibility is that profit is more salient to superiors while customer information is more salient to subordinates, perhaps because superiors believe they are more responsible for profit and will be rewarded themselves only for motivating profit increases, while subordinates feel closer to customers and thus put more weight on customer information when it is available.
If this alternative explanation accounts for the results, then most of the negative PE surprise in the profit-plus condition would come from dyads in which the subordinates decide to implement their initiative firm-wide, resulting in relatively high customer delight but not operating income. In fact, however, as indicated in Table 4, panel B, mean PE surprise in profit-plus is more negative for dyads with non-implementing subordinates (mean = −1.14) than for dyads with implementing subordinates (mean = −0.65). This difference between implementing and non-implementing dyads is in the wrong direction to support the alternative explanation, and as Table 4, panel C indicates, the implementation choice does not have a significant (p = .82) incremental effect on negative PE surprise.\(^{28}\)

5. Conclusion

The effectiveness of subjective PE depends not only on whether the PEs given by superiors are accurate (a focus of much of the prior literature, e.g., Moers 2005; Bailey et al. 2011; Bol 2011; Bol and Smith 2011; Woods 2012) but also on how accurate subordinates’ expectations are about their PEs and how their management decisions are influenced by their expectations. Our study responds to Bol’s (2011, 1572) call for research that goes beyond the typical investigation of biased PEs by superiors and addresses “additional concerns [arising from subjective PE], such as uncertainty about performance criteria.”

Our study makes two contributions to the accounting literature. First, we develop arguments for two kinds of potentially costly effects of subordinates’ PE uncertainty, in addition to the reduced effort by effort- and risk-averse subordinates that has already been identified in the literature (Bol 2008): coordination failures in management decisions and negative PE surprises.

\(^{28}\) These results are limited by the fact that in profit-plus, the cell in which neither superiors nor subordinates prefer implementation is empty. However, in order to support the alternative explanation (i.e., in order to make PE surprises less negative for non-implementing subordinates) there would have to be a very large mean positive PE surprise in the now-empty cell. Such a result seems unlikely. None of the populated cells display large mean positive PE surprises, and we are unaware of any theory that supports an expectation of large mean positive PE surprises in this cell.
Second, we provide theory and evidence that under conditions of causal ambiguity and individual differences, additional information in accounting reports can increase these effects of subordinates’ PE uncertainty, even when the quantity of the additional information (in our experiment, one item in addition to profit) is not sufficient to create information overload.

Prior studies have provided some evidence of differences between subordinates’ and superiors’ PE judgments (e.g., Malina and Selto 2001; Wong-on-Wing, Guo, and Yang 2007), but they do not address the questions that are central to our study. That is, prior research does not investigate negative PE surprises (differences between expected and actual PEs) or effects of PE uncertainty on subordinates’ management decisions. Moreover, prior studies do not investigate the accounting question of how these potentially costly outcomes are influenced by the reporting of additional information. Balanced scorecard studies (e.g., Wong-on-Wing et al. 2007) provide evidence that subordinates disagree about PEs when a large amount of information is reported—but they do not provide evidence that subordinates and superiors disagree any less when less information is reported.

Thus our study helps to explain why some organizations rely on a single relevant (but incomplete) item of information like profit for PE and neglect or discourage the use of other potentially relevant information in accounting reports. In some settings, the costs of PE uncertainty that we document might be large enough to outweigh the benefits of reporting additional information.

The costs of PE uncertainty are likely to vary with a variety of factors that we do not manipulate, including the pattern of relations between additional information and traditional accounting information like profit (for profit-center managers). In our experiment, the customer delight information appears to support firm-wide implementation of the subordinates’ initiative while operating income does not. If the sign of the relation between profit and customer information were reversed—if profit increased significantly more at restaurants with the initiative...
than without it, but customer delight decreased—then the potential for differing judgments and
decisions among subordinates and superiors would still exist, but the magnitudes of the
differences might vary.

Organizations often do include additional information in accounting reports, and further
research is needed to understand when and how these organizations compensate for or mitigate the
potentially costly consequences of additional information that we document. An important
limitation of our study is that it focuses only on providing evidence of the potentially costly
consequences of the inclusion of additional information in accounting reports. We do not examine
how organizations manage trade-offs between these costs and the benefits of the additional
information. Nor do we investigate ways of mitigating the costs caused by the additional
information. Evidence in Gibbs et al. (2004) indicates that long experience in an organizational
setting (mean of 8.7 years in that study) increases the effectiveness of subjective PE, but little is
known about the characteristics of additional information and its users that would influence the
success and speed of this learning. Further research on how managers reduce uncertainty and
increase consensus on the use of additional information in accounting reports should increase our
understanding of when and how the benefits of this information can be expected to exceed its
costs.
Appendix A [Online]
Uncertainty, bias, and coordination failures: examples

The numerical examples below illustrate three points. First, coordination failure occurs even when subordinates make unbiased judgments and rational decisions, but the likelihood of coordination failure is increased by judgment bias (false consensus). Second, coordination failures are more likely when there is more uncertainty about the management decision subordinates make, and this will be the case for both rational and biased subordinates. Third, when it is more likely that superiors will prefer Decision A to Decision B, the likelihood of coordination failure will be higher for superiors who prefer Decision B, for most levels of uncertainty about the decision to be made.

We consider two examples in which a number of subordinate-superior dyads are making decisions like those in our experiment. Subordinates do not know with certainty whether their own superiors will prefer (i.e., more highly evaluate) a “Yes” or a “No” decision. In one of the two examples (“pure rationality”), subordinates accurately judge the probability distribution of their superiors’ preferences and make their own management decisions rationally in response. In the other example (“pure bias”), subordinates simply act as if their superiors’ preferences were the same as their own (false consensus). To illustrate the effects of the level of uncertainty, we use two levels in the numerical examples: at the lower level of uncertainty there is an 80% chance that

29 We use categorical decisions in our hypothesis motivation and experiment for simplicity. Many management decisions are categorical: for example, which of three finalists to hire for an open position, or which of two competing technologies to choose for an organization’s information system. Many management decisions are continuous, however; and in these cases, biases in probability judgment can increase coordination failure even at lower levels of PE uncertainty.

30 A variety of related information-processing biases can come into play in the formation of the subordinate’s preference: for example, self-serving attributions or escalation of commitment if the subordinate has some prior involvement with one alternative and regards its performance favorably. Our hypothesis motivation focuses on the false consensus effect because it provides the link between the subordinate’s preferences and his prediction of the superior’s preference. Motivated reasoning is a common element in all of these biases (Kunda 1990; Boiney, Kennedy, and Nye 1997).
superiors will evaluate a “No” decision more highly, and at the higher level of uncertainty there is a 55% chance that they will do so.

**Pure rationality**

Suppose that subordinates do not know with certainty which management decision their own superiors prefer, but they believe that there is an 80% (55%) chance that a superior will prefer “No.” This belief is correct: out of 100 superiors, 80 (55) prefer “No” and 20 (45) prefer “Yes.” Uncertain subordinates all maximize their expected payoffs by choosing the decision that their superiors are more likely to evaluate highly (i.e., “No”). In this setting, subordinate management decisions and coordination failure rates are as follows:

<table>
<thead>
<tr>
<th></th>
<th>Low Uncertainty</th>
<th>High Uncertainty</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number out of 100 superiors who prefer “No”</td>
<td>80</td>
<td>55</td>
</tr>
<tr>
<td>Of their subordinates:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number who choose “No”</td>
<td>80</td>
<td>55</td>
</tr>
<tr>
<td>Number who choose “Yes”</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Number of superiors who prefer “Yes”</td>
<td>20</td>
<td>45</td>
</tr>
<tr>
<td>Of their subordinates:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number who choose “No”</td>
<td>20</td>
<td>45</td>
</tr>
<tr>
<td>Number who choose “Yes”</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Total number of coordination failures</td>
<td>20</td>
<td>45</td>
</tr>
<tr>
<td>% coordination failures when superiors prefer “No”</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>% coordination failures when superiors prefer “Yes”</td>
<td>100%</td>
<td>100%</td>
</tr>
</tbody>
</table>

Thus in this example, coordination failures are more common when subordinates’ uncertainty about superiors’ preferences is higher, and coordination failures are more common when superiors have minority (“Yes”) preferences.

**Pure bias (false consensus)**

In this example we assume, for simplicity, that the probability distribution of preferences is the same for subordinates and superiors: that is, when 80% of superiors prefer “No,” 80% of subordinates also prefer “No.” Each subordinate believes that his superior has the same preference that he does, but this is not always correct, because subordinates are not necessarily matched with
superiors on the basis of this particular preference. We first assume that subordinates and superiors are randomly matched with respect to this particular preference.

<table>
<thead>
<tr>
<th>Low Uncertainty</th>
<th>High Uncertainty</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number out of 100 superiors who prefer “No”</td>
<td>80</td>
</tr>
<tr>
<td>Of their subordinates:</td>
<td></td>
</tr>
<tr>
<td>Number who choose “No” (0.80 * 80; 0.55 * 55)</td>
<td>64</td>
</tr>
<tr>
<td>Number who choose “Yes”</td>
<td>16</td>
</tr>
<tr>
<td>Number out of 100 superiors who prefer “Yes”</td>
<td>20</td>
</tr>
<tr>
<td>Of their subordinates:</td>
<td></td>
</tr>
<tr>
<td>Number who choose “No” (0.80 * 20; 0.55 * 45)</td>
<td>16</td>
</tr>
<tr>
<td>Number who choose “Yes”</td>
<td>4</td>
</tr>
<tr>
<td>Total number of coordination failures (16+16; 25+25)</td>
<td>32</td>
</tr>
<tr>
<td>% coordination failures when superiors prefer “No” (16/80; 25/55)</td>
<td>20%</td>
</tr>
<tr>
<td>% coordination failures when superiors prefer “Yes” (16/20; 25/45)</td>
<td>80%</td>
</tr>
</tbody>
</table>

A comparison with the previous (pure rationality) example illustrates the higher frequency of coordination failures when subordinates are influenced by false consensus. The higher frequency of coordination failures for superiors with the “minority” preference (“Yes”) occurs in both of these examples (and in the experimental data). There are also more coordination failures when uncertainty is higher.

In natural environments we would expect coordination failure rates and their asymmetry to be reduced (but not eliminated) by non-random matching of subordinates and superiors. Superiors are likely to choose subordinates with beliefs similar to their own, and subordinates are likely to adopt superiors’ beliefs. Thus, in our example, superiors who prefer “No” would have a > 80% probability of being matched with a “No” subordinate, and “Yes” superiors would have a > 20% probability of being matched with a “Yes” subordinate. Thus, for example, if the probability of a “No” superior and “No” subordinate being matched was 90% rather than 80%, the outcomes under lower uncertainty (0.80) would appear as follows:

| Number out of 100 superiors who prefer “No” | 80 |
| Of their subordinates: |   |
| Number who choose “No” (0.90 * 80) | 72 |
Number who choose “Yes” 8
Number out of 100 superiors who prefer “Yes” 20
Of their subordinates:
  Number who choose “No” (0.90 * 20) 18
  Number who choose “Yes” 2
Total number of coordination failures (8 + 18) 26
% coordination failures when superiors prefer “No” 10%
% coordination failures when superiors prefer “Yes” 90%

Coordination failure rates are lower in total than in the case of random matching, but they are still highly asymmetric: they are much more common for superiors with a “minority” preference.

The only situations in which the percentage of coordination failures would not be conditional on superiors’ preferring “Yes” or “No” would be:

(a) perfect matching of beliefs (zero coordination failures) or
(b) 50-50 preferences for Yes/No (equal percentages of coordination failures for Yes and No).

These two situations are probably not very common. While a well-functioning subordinate-superior dyad should share many beliefs and preferences, perfect matching across a broad array of managerial decisions under conditions of changing uncertainty seems improbably extreme. A 50-50 probability for the Yes/No decision implies an information-poor setting in which a coin flip is as good a basis for the decision as the available information is.
Appendix B [Online]
Initial Questions for Superiors

While subordinates were choosing their pilot initiative and deciding whether to implement it firm-wide, superiors answered the following five questions about performance evaluations:

In the following scenarios, please indicate how you believe that evaluations should be made, assuming the goal of the evaluations is to reward managers for contributing to the achievement of an organization’s goals and thus to motivate them to make such contributions.

1. Suppose that the most important performance measure for a Human Resource manager in a large firm is employee satisfaction with HR performance in areas such as benefits administration, training, HR policy communication, etc. Satisfaction is measured by an annual survey of a sample of employees. Measured satisfaction is lower in the current year than in the previous year. The decrease probably represents a real decline in employee satisfaction, but there is also some chance that it is only sampling error, since only a sample of the firm’s employees are contacted to participate in the survey and not all of them respond. It is impossible to be certain whether any or all of the decline is due to sampling error. How would you evaluate the HR manager?

Definitely not a lower evaluation than last year

2. Suppose that the most important performance measure for a production manager is production cost, because the firm competes on price and must have low costs in order to make a profit. Production costs are considerably higher this year than last, and this has had a severe negative impact on profits. The main reason for the higher costs is an earthquake that disrupted the supply and raised the price of a raw material that is available from only a few locations in the world. How would you evaluate the production manager?

Definitely a lower evaluation than last year
3. Suppose that you are evaluating a regional marketing manager whose most important performance measure is regional sales revenue. The regional sales revenue for the most recent year is very high compared to the previous year. The most important reason for this positive result is an unexpected stumble by a usually competent competitor, which received bad publicity this year due to selling defective products. Your firm is the only other major supplier in the area, so a number of your competitor’s customers have switched their business to your firm. How would you evaluate the regional marketing manager?

Definitely not a 0 —1 —2 —3 —4 —5 —6 —7 —9 —10 Definitely a much higher evaluation than last year

4. Suppose that you are evaluating two regional managers with very similar jobs. The primary performance measure for these two managers is regional profit before taxes. In terms of this profit measure, the two managers appear to have performed equally well this year. Your evaluation is also supposed to include your judgment of the managers’ performance on the “soft” dimensions of teamwork and creativity, which will not always be fully captured by current-period profits. You know one of the managers well and think highly of this person on these “soft” dimensions. The other manager is new this year. The new manager shows a few indications of being even better in terms of teamwork and creativity, but you have had so little opportunity to observe the new manager yet that it is difficult to form a judgment with much confidence. How would you evaluate the new manager on these dimensions, relative to the other manager?

Much lower than the other manager 0 —1 —2 —3 —4 —5 —6 —7 —9 —10 Much higher than the other manager
5. Indicate your agreement or disagreement with the following statement. I believe that unless performance is very bad, employees should be given favorable evaluations in order to keep them motivated.

Disagree strongly 0 —1—2 —3 —4 —5 —6 —7 —9 —10 Agree strongly
REFERENCES


Box text in **bold** represents independent and dependent variables in the experiment. Other boxes represent conditions of the experimental setting (Box 1) and psychological processes posited in the motivation of Hypothesis 1 (Boxes 3–5).
Box text in **bold** represents independent and dependent variables in the experiment. Other boxes represent conditions of the experimental setting (Box 1) and psychological processes posited in the motivation of Hypothesis 2 (Box 3).
Figure 3  Experimental task event line

January 2013
Information on subordinates’ chosen pilot initiative and information on pilot test outcomes for 2011 are reported to superiors.

Superiors privately state whether the initiative should have been implemented firm-wide.

January 2013
Subordinates’ firm-wide implementation decisions and information for 2012 are reported to superiors.

Superiors evaluate subordinates’ performance, which determines subordinates’ bonuses.

January 2013
If subordinates appeal, then superiors review the appeal and decide whether to revise their PE.

October 2010
Subordinates decide which initiative to pilot-test.

January 2011
One-year pilot test of subordinates’ chosen initiative begins.

January 2012
Information about the pilot test outcomes is reported to subordinates.

Subordinates state their preference for whether to implement the initiative firm-wide.

January 2012
Information for 2012 is reported to the subordinates.

Subordinates privately state their expected PE.

January 2013
Subordinates view their PE and decide whether to appeal.

Events in **bold** provide dependent variable measures.
Figure 4 Percentage of total PEs at each level expected by subordinates and given by superiors in profit-only and profit-plus conditions

Panel A: Profit-only

Panel B: Profit-plus
TABLE 1
Information reported about pilot test outcomes

<table>
<thead>
<tr>
<th>RESTAURANT #:</th>
<th>RESTAURANTS IN PILOT TEST</th>
<th>RESTAURANTS IN CONTROL GROUP</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Operating Income</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Results for 2011 (x 1,000)</td>
<td>$365</td>
<td>$401</td>
</tr>
<tr>
<td>Results for 2011 as a % of results for 2010</td>
<td>103%</td>
<td>95%</td>
</tr>
<tr>
<td>Customer Delight</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Results for 2011</td>
<td>69.48</td>
<td>68.15</td>
</tr>
<tr>
<td>Results for 2011 as a % of results for 2010</td>
<td>109%</td>
<td>112%</td>
</tr>
</tbody>
</table>

Participants in the profit-only condition receive only operating income information, and participants in the profit-plus condition receive both operating income and customer delight information.
TABLE 2
Information reported following the subordinate’s firm-wide implementation decision

Panel A: Information reported if the subordinate decided to implement the initiative firm-wide

<table>
<thead>
<tr>
<th>RESTAURANT REGION #:</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Operating Income Per Restaurant In Each Region</td>
<td>$330</td>
<td>$282</td>
<td>$401</td>
<td>$371</td>
<td>$369</td>
<td>$305</td>
<td>$368</td>
</tr>
<tr>
<td>Results for 2012 (x 1,000)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Results for 2012 as a % of results for 2011</td>
<td>99%</td>
<td>101%</td>
<td>100%</td>
<td>98%</td>
<td>99%</td>
<td>104%</td>
<td>98%</td>
</tr>
<tr>
<td>Average Customer Delight Per Restaurant In Each Region</td>
<td>67.64</td>
<td>70.3</td>
<td>65.36</td>
<td>67.85</td>
<td>70.85</td>
<td>69.78</td>
<td>73.67</td>
</tr>
<tr>
<td>Results for 2012</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Results for 2012 as a % of results for 2011</td>
<td>110%</td>
<td>111%</td>
<td>115%</td>
<td>107%</td>
<td>120%</td>
<td>112%</td>
<td>111%</td>
</tr>
</tbody>
</table>

(The table is continued on the next page)
TABLE 2 (continued)

Panel B: Information reported if the subordinate decided not to implement the initiative firm-wide

<table>
<thead>
<tr>
<th>RESTAURANT REGION #:</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average Operating Income Per Restaurant In Each Region</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Results for 2012 (x 1,000)</td>
<td>$325</td>
<td>$287</td>
<td>$372</td>
<td>$422</td>
<td>$323</td>
<td>$395</td>
<td>$319</td>
</tr>
<tr>
<td>Results for 2012 as a % of results for 2011</td>
<td>108%</td>
<td>97%</td>
<td>107%</td>
<td>99%</td>
<td>101%</td>
<td>103%</td>
<td>111%</td>
</tr>
<tr>
<td>Average Customer Delight Per Restaurant In Each Region</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Results for 2012</td>
<td>55.69</td>
<td>67.50</td>
<td>55.05</td>
<td>60.11</td>
<td>63.33</td>
<td>61.14</td>
<td>58.66</td>
</tr>
<tr>
<td>Results for 2012 as a % of results for 2011</td>
<td>101%</td>
<td>95%</td>
<td>104%</td>
<td>89%</td>
<td>99%</td>
<td>113%</td>
<td>100%</td>
</tr>
</tbody>
</table>

Subordinates and superiors receive the information in either panel A or panel B for the year following the subordinate’s firm-wide implementation decision. The data are based on all of Big-10 Pizza’s restaurants and are separated by region.

Participants in the profit-only condition receive only operating income information, and participants in the profit-plus condition receive both operating income and customer delight information.
TABLE 3
Coordination failures in firm-wide implementation decisions

Panel A: Frequency distribution of PE in profit-only and profit-plus conditions

<table>
<thead>
<tr>
<th>PE</th>
<th>Profit-only</th>
<th>Profit-plus</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>7</td>
<td>8</td>
</tr>
<tr>
<td>3</td>
<td>7</td>
<td>6</td>
<td>13</td>
</tr>
<tr>
<td>4</td>
<td>11</td>
<td>8</td>
<td>19</td>
</tr>
<tr>
<td>5</td>
<td>2</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Total</td>
<td>23</td>
<td>24</td>
<td>47</td>
</tr>
</tbody>
</table>

PEs in the shaded box are less than the overall median PE of 3 and are therefore classified as indicators of coordination failure.

Test for higher proportion of coordination failures in profit-plus than in profit-only:

\[ \chi^2 = 2.70, \text{ one-tailed } p = .05. \]

Panel B: Number of subordinate-superior dyads in which the subordinate fails to make the implementation decision the superior initially believes the subordinate should make (indication of coordination failure)

<table>
<thead>
<tr>
<th>Information Reported</th>
<th>Indication of coordination failure?</th>
<th>Total dyads</th>
<th>% Failure</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Profit-only</td>
<td>16</td>
<td>7</td>
<td>23</td>
</tr>
<tr>
<td>Profit-plus</td>
<td>12</td>
<td>12</td>
<td>24</td>
</tr>
<tr>
<td>Total</td>
<td>28</td>
<td>19</td>
<td>47</td>
</tr>
</tbody>
</table>

The judgments of a subordinate-superior dyad are coded as indications of a coordination failure if their responses to the implementation-preference question are on opposite sides (1–5 vs. 6–10) of the ten-point response scale.

Test for higher proportion of coordination failures in profit-plus than in profit-only:

\[ \chi^2 = 1.87, \text{ one-tailed } p = .085. \]
TABLE 4
Surprises in subjective PE

Panel A: Descriptive statistics: Cell means (standard deviations) of PEs expected by subordinates and given by superiors in profit-only and profit-plus conditions

<table>
<thead>
<tr>
<th></th>
<th>Profit-only</th>
<th>Profit-plus</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>PEs subordinates expect</td>
<td>3.30</td>
<td>3.92</td>
<td>3.62</td>
</tr>
<tr>
<td></td>
<td>(1.22)</td>
<td>(0.65)</td>
<td>(1.01)</td>
</tr>
<tr>
<td></td>
<td>n = 23</td>
<td>n = 24</td>
<td></td>
</tr>
<tr>
<td>Actual PEs superiors give</td>
<td>3.43</td>
<td>3.13</td>
<td>3.28</td>
</tr>
<tr>
<td></td>
<td>(1.04)</td>
<td>(1.08)</td>
<td>(1.06)</td>
</tr>
<tr>
<td></td>
<td>n = 23</td>
<td>n = 24</td>
<td></td>
</tr>
<tr>
<td>Mean signed PE surprise: Actual PE minus expected PE</td>
<td>0.13</td>
<td>−0.79</td>
<td></td>
</tr>
</tbody>
</table>

Panel B: Means and standard deviations of PE surprises by information-reported condition, subordinate implementation decision and superior implementation preference.

<table>
<thead>
<tr>
<th>Implement pilot initiative firm-wide?</th>
<th>Profit-only</th>
<th>Profit-plus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subordinate decision</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>−0.33</td>
<td>−0.58</td>
</tr>
<tr>
<td></td>
<td>(0.58)</td>
<td>(0.90)</td>
</tr>
<tr>
<td></td>
<td>n = 3</td>
<td>n = 12</td>
</tr>
<tr>
<td>No</td>
<td>0.67</td>
<td>−1.14</td>
</tr>
<tr>
<td></td>
<td>(1.16)</td>
<td>(1.22)</td>
</tr>
<tr>
<td></td>
<td>n = 3</td>
<td>n = 7</td>
</tr>
<tr>
<td>No</td>
<td>0.23</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>(1.24)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>n = 13</td>
<td>n = 0</td>
</tr>
<tr>
<td>Marginal means, PE surprise</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subordinate implements</td>
<td>−0.29</td>
<td>−0.65</td>
</tr>
<tr>
<td>Subordinate does not implement</td>
<td>0.31</td>
<td>−1.14</td>
</tr>
<tr>
<td>Coordination failure</td>
<td>0.14</td>
<td>−1.00</td>
</tr>
<tr>
<td>No coordination failure</td>
<td>0.13</td>
<td>−0.58</td>
</tr>
</tbody>
</table>
Panel C: General linear model: Dependent variable is PE surprise

<table>
<thead>
<tr>
<th></th>
<th>df</th>
<th>Mean square</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
<td>3</td>
<td>3.53</td>
<td>2.81</td>
<td>.05</td>
</tr>
<tr>
<td>Intercept</td>
<td>1</td>
<td>2.53</td>
<td>2.02</td>
<td>.16</td>
</tr>
<tr>
<td>Information reported</td>
<td>1</td>
<td>6.55</td>
<td>5.22</td>
<td>.03</td>
</tr>
<tr>
<td>Firm-wide implementation</td>
<td>1</td>
<td>0.07</td>
<td>0.06</td>
<td>.82</td>
</tr>
<tr>
<td>Coordination failure</td>
<td>1</td>
<td>0.58</td>
<td>0.47</td>
<td>.50</td>
</tr>
<tr>
<td>Error</td>
<td>43</td>
<td>1.26</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

All p-values are two-tailed. *Information reported* is the experimental manipulation, profit-only (coded as 0) versus profit-plus (coded as 1). *Firm-wide implementation* is a variable coded as 1 if the subordinate implemented the initiative firm-wide and as 0 if the subordinate did not. *Coordination failure* is a variable coded as 0 if the subordinate’s implementation decision was the decision preferred by his or her superior and as 1 if it was not.