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The Effect of Risk Management Systems on Honesty in Managerial Reporting: An Experimental Examination

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THE EFFECT OF RISK MANAGEMENT SYSTEMS ON HONESTY IN MANAGERIAL REPORTING: AN EXPERIMENTAL EXAMINATION

BY

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ACCEPTANCE

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ABSTRACT

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An extension of the agency model of capital budgeting under private information shows that an owner's investment in a risk management system (RMS) exacerbates the owner's agency costs as it increases the expected slack available for managerial expropriation. This study experimentally examines the effects of an RMS on honesty in managerial reporting and the incremental effect of the owner's willingness to invest in an RMS. Applying insights from a model of social norm activation and behavioral economics, I predict that an RMS will increase managerial honesty in reporting by increasing common expectations for truthful reporting. Furthermore, I predict that the owner's willingness to invest will activate a trustworthiness social norm for managers that will strengthen the positive effect of an RMS. Consistent with my theory, I find that an RMS has a positive effect on managerial honesty in reporting, and this positive effect is greater when the RMS is the result of the owner's investment choice. An analysis of exit questionnaire responses confirms that the owner's investment in an RMS signaled trust and increased the manager's trustworthiness. The results suggest that an RMS can play a corporate governance role despite the potential increase in agency costs, and the salience of the owner's investment choice reinforces this role.

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I. INTRODUCTION

Business is inherently risky, and so, risk management is considered an integral part of a firm's internal controls framework (Camfferman 2012; Mikes and Kaplan 2014). The purpose of a risk management system (RMS, hereafter) is to reduce the likelihood and impact of unfavorable outcomes (Baxter et al. 2013). Despite the heightened interest about the prevalence and effectiveness of RMSs by academics and practitioners (Camfferman 2012), there is limited extant research on whether and how an RMS affects managerial behavior and the firms' motives for investing in an RMS. In this study, I first extend the agency model of capital budgeting under private information to demonstrate that an RMS has the potential to increase the owner's agency costs. Given this economic prediction, I experimentally investigate the behavioral implications of an RMS on managerial honesty in reporting, the willingness of an owner to invest in an RMS, and the effect of the owner's endogenous choice to invest on managerial honesty.

Risk management can be viewed as the process of identifying and measuring risks, determining methods for mitigating and transferring risks, and responding to damages caused by risks not mitigated or transferred. As the scope of corporate risk management has expanded from focusing on financial risks to focus on operational risks, there has been a growing consensus that risk management should be a critical aspect of business operations (Power 2009; Arena et al. 2010; Van Daelen and Van del Elst 2010). An effective RMS within operations should reduce the expected value of production costs for a manager as it reduces the likelihood of unfavorable outcomes. Therefore, an RMS can potentially improve resource allocation decisions and firm value. Due to information asymmetry and the misalignment of interests between the owner and the manager, however, an owner's investment in an RMS increases the owner's agency costs. That is, since an RMS reduces the likelihood of unfavorable outcomes, it increases the expected

value of rents available for managerial extraction. Therefore, an owner's investment in an RMS may not add value to the firm. This potential threat to the efficiency effects of an RMS can be present in different managerial contexts, yet, has largely been ignored in the literature.

Participative budgeting represents a unique setting to investigate the economic and behavioral effects of an RMS for two reasons. First, participative budgeting is a common production setting where decentralized firms elicit private information from lower level managers about production costs for planning and control purposes (Libby and Lindsay 2007). The accounting literature assumes that the demand for participative budgeting is mainly driven by a combination of information asymmetries between upper management and lower level managers and the presence of environmental and operational uncertainties (Shields and Young 1993; Shields and Shields 1998). Since an RMS favorably modifies the *ex-ante* distribution of production costs, researchers view an RMS as inherently tied to participative budgeting practices (Power 2009; Arena et al. 2010). Second, the interactive nature of participative budgeting provides researchers the ability to analyze the economic and behavioral effects of different controls on managers and owners within a clear agency relation (Brown et al. 2009).

In this study, I use a participative budgeting setting used by experimental researchers to examine (1) whether the presence of an RMS increases managerial honesty in reporting,[1] (2) whether an owner is willing to invest in an RMS despite the potential exposure to higher agency costs, and (3) whether the presence of an RMS as an owner's endogenous choice has an incremental effect on managerial honesty in reporting relative to the presence of an RMS as an exogenous organizational feature. Notably, the answer to the first question provides insights regarding the potential corporate governance role of an RMS, while the answers to the second

[1] Consistent with experimental studies (*e.g.*, Evans et al. 2001; Hannan et al. 2006; Rankin et al. 2008) and Antle and Eppen's (1985) model, I assume that managers learn the actual cost with certainty before submitting their budget requests. Therefore, managers' risk preferences should not affect their reporting behavior in this setting.

and third questions provide insights regarding the signaling effect of the owner's endogenous choice to invest on the relation between an RMS presence and managerial honesty in reporting.

I incorporate insights from Bicchieri's model of social norm activation (Bicchieri 2006; Bicchieri and Chavez 2010) and insights from behavioral economics research on trustworthiness (Cox et al. 2014) to draw my predictions. First, as an RMS reduces the *ex-ante* probability for production cost to fall within the unfavorable range, I predict that an RMS will increase common expectations of truthful reporting. Therefore, an RMS will act as a corporate governance mechanism that increases managerial honesty in reporting. Second, I predict that an owner's willingness to invest in an RMS will be positively associated with their belief that such investment will signal their trust and expectations of trustworthiness to the manager. Third, I predict that the owner's endogenous choice to invest in an RMS will activate a social norm of trustworthiness which in turn will reinforce the corporate governance role of an RMS. That is, I predict that the positive effect of an RMS on managerial honesty will be stronger when the RMS is endogenously chosen by the owner.

I test my predictions using a laboratory experiment with a 2x2 mixed design. I manipulate between-subjects whether RMS presence is exogenously assigned or endogenously chosen by owners. In addition, I manipulate within-subjects the presence of an RMS under either exogenous assignment or endogenous selection. When an RMS is present, the owner incurs an investment cost to decrease the probability of the production cost from the unfavorable cost range. Consistent with my predictions, I find that the presence of an RMS increases managerial honesty in reporting. I also find that a significant proportion of owners choose to invest in an RMS, and their investment positively correlates with their belief that an RMS will signal trust. Furthermore, I find that the positive effect of an RMS on managerial honesty is strengthened by

the owner's endogenous investment choice. In support of my theory, an examination of exit questionnaire responses suggests that the incremental positive effect of the endogenous RMS choice on honesty is positively associated with the manager's desire to reward the owner's trust.

This experimental study has characteristics that maximize its potential to contribute to the literature. First, the setting provides a clear economic prediction based on narrow self-interest that suggests an adverse effect for an owner's investment in an RMS. This approach maximizes the potential for this experimental study to contribute to both agency theory and the corporate governance literatures (Brown et al. 2009). Furthermore, the experimental design used in this study disentangles the effect of the endogenous selection of an RMS from the exogenous presence of an RMS. This experimental approach is in line with the recent call by Evans et al. (2015) to investigate the exogenous assignment and endogenous selection of control systems to provide a more complete understanding of the effect of the control. In addition, since firms operating in some industries face stricter regulatory requirements for risk management than others (Beasley et al. 2008), the reported results for the exogenous and endogenous treatments may reflect potential implications of RMSs under both strict and flexible regulatory regimes.

While existing empirical research has investigated the extent of RMS implementation and their performance effects (Gordon et al. 2009; McShane et al. 2011; Baxter et al. 2013), none of these studies have discussed the value relevance of implementing an RMS from an agency perspective. This study analyzes the economic implications of an RMS, then experimentally examines the role of behavioral effects. Overall, the findings of this study suggest that, although an RMS increases the owner's exposure to higher agency costs, it has a potential corporate governance role in that it can improve managerial honesty in reporting. In addition, the firm's willingness to invest in an RMS reinforces this corporate governance role. The behavioral effects

suggested by these findings are important because agency theory suggests that an RMS can increase the owner's agency costs. More broadly, this study adds to both the participative budgeting literature and the literature on corporate governance (Van Daelen and Van del Elst 2010; Camfferman 2012). In addition, as an RMS within operations theoretically changes the cost structure for a firm, this study contributes to the emerging management accounting research on the relations between risks, managerial choices, and cost behavior (Holzhacker et al. 2015; Krishnan 2015).

While some accounting researchers and professional organizations call for the integration of an RMS into operations and budgeting processes (COSO 2004; SMA 2007; 2010; Arena et al. 2010), professional surveys reveal concerns related to the value relevance of such integration from a cost-benefit perspective (Power 2009; RIMS 2013). This study provides experimental evidence regarding potential behavioral benefits of this integration that should be considered by upper management. In addition, since observing the effectiveness of RMS integration is prohibitive in practice (Nocco and Stulz 2006), using a controlled experiment provides a strong setting to examine the effect of such integration and make inferences about the underlying causality relations. To the best of my knowledge, this is the first study to experimentally examine the implications of integrating an RMS into operations, which is considered an under-investigated issue (Landsittel and Rittenberg 2010; Kaplan 2011).

This paper proceeds as follows: In Section II I provide a theoretical background, analyze the economic implications of implementing an RMS in a capital budgeting model, and develop my behavioral hypotheses. In Section III I describe the research design. In Section IV I report the experimental results. In section V I conclude and discuss the implications of my study for practice and theory.

II. THEORY AND HYPOTHESES DEVELOPMENT

Background

Firms are confronted with risks at many different levels inside and outside the business. Risk management is considered an integral part of a firm's internal controls framework (Camfferman 2012; Mikes and Kaplan 2014). As a broader construct, corporate risk management can be defined as a set of controls that maximizes the value of a firm by reducing cash flow volatility and unfavorable lower-tail outcomes (Stulz 1996; Baxter et al. 2013). Operational risks are inherent features of every organization (Soin and Collier 2013). Not until recently, however, have corporate risk management practices shifted from focusing on managing financial risks to include operational risks (Hayne and Free 2014).[2] With this shift, a call for an integration of RMSs into firms' operations has been raised by researchers and professional organizations (SMA 2007; Power 2009; Arena et al. 2010; SMA 2011). Managing operational risks includes reducing the likelihood of performance shocks, reducing avoidable losses, and improving the efficiency and effectiveness of controls and processes (Tattam 2011).[3]

Recent empirical accounting studies have given considerable attention to the level of RMS implementation, their value relevance, and their implications on firms' performance (e.g., Gordon et al. 2009; McShane et al. 2011; Paape and Speklè 2012; Baxter et al. 2013). Mikes and Kaplan's (2014) survey of this stream of literature, however, suggests that the empirical findings are mixed and inconclusive about the value relevance of RMSs. Mikes and Kaplan attribute the mixed findings to the inconsistent specification of risk types and how RMSs are used in practice.

[2] Enterprise risk management programs designed to integrate the management of risks from the three main sources (operational, strategic, and financial) represent a recent shift in corporate risk management (Hayne and Free 2014). Operational risks are inherent in the firm's operations, and can be technological, distributional, or informational. Strategic risks encompass macro factors related to economic or political events. Financial risks arise from adverse changes in interest rates, equity prices, and foreign currency (Fatemi and Luft 2002).

[3] Admittedly, the first development in RM was in the period between 1955 and 1960 and had the aim of minimizing firm costs (Gallagher 1956). Later on, there was a shift to focus on financial risks (Verbano and Venturini 2011).

Risk Management Systems: Value-Adding Effects *versus* Exacerbation of the Owner's Agency Costs

Several academic papers establish the potential theoretical gains from implementing an RMS including improving the firm's capital structure, reducing expected deadweight costs, and protecting optimal investments (Nocco and Stulz 2006; Dionne 2013).[4] While risk management offers benefits and enhances value, there has been very little discussion of the potential agency conflicts associated with RMS implementation. The literature referred to above implicitly assumes an agency setting with a first-best world where the interests of the manager and the firm (*i.e.*, the owner of investment) are perfectly aligned and/or information asymmetry between the manager and the firm is not an issue. Therefore, advocates of RMSs implicitly assume that the enhancement in value will always accrue to the firm rather than the manager. In a broader context, however, Fatemi and Luft's (2002) discussion of the benefits and costs of RMSs suggests that the resulting enhancement in value from an RMS may accrue to the firm, the manager, or both. Specifically, an effective RMS will only benefit both parties when the manager's incentives are aligned with those of the firm.

Alternatively, if we assume that the interests of the firm are not aligned with those of the managers, managers may pursue risk management strategies to enhance their own personal wealth and insulate it from the effects of changes in environmental risk (Fatemi and Luft 2002; Fauver and Naranjo 2010). The most notable theoretical example of how implementing an RMS can exacerbate the agency conflict is presented by Tufano (1998) in the context of cash flow hedging. Tufano argues that cash flow hedging can be used to facilitate the protection of managers' pet projects that enhance their welfare but reduce shareholder value. Specifically, if

[4] The benefits of RMSs also feature prominently in presentations by the American Institute of Certified Public Accountants (AICPA), the Institute of Internal Auditors (IIA), and the Institute of Management Accountants (IMA), and in periodicals like the Risk Magazine, the Economist, and Fortune (see Hayne and Free 2014 for a review).

projects that managers seek to protect are negative-NPV investments to shareholders but managers support them nevertheless because of private benefits, the lack of manager oversight can lead to improper resource allocation and the destruction of shareholder value. Therefore, an RMS can be transformed into a vehicle that delivers excess free cash flow to managers at the expense of shareholders. Similarly, in an empirical study of the association between agency costs and derivative usage, Fauver and Naranjo (2010) find that firms with higher agency conflict (*i.e.,* larger information asymmetry and monitoring problems) exhibit negative association between derivative usage and firm value. In other words, Fauver and Naranjo (2010) find that derivative usage results in a value loss to firms with higher agency conflict. Overall, if an RMS results in benefits that are totally accrued by the manager, ultimately an RMS will reduce firm value and leave the owner worse-off compared to a no-RMS strategy. Therefore, when misalignment of interests exists, an RMS should not be implemented by the firm unless the expected benefits to the firm outweigh the costs, and such costs reflect implicit agency costs in addition to explicit transaction and implementation costs.

While the discussion of potential agency conflicts associated with risk management policies has been addressed in earlier studies in the context of hedging financial risks (Tufano 1998; Fatemi and Luft 2002), to the best of my knowledge, this discussion has not been extended to a context where an RMS is integrated into firms' operations. In particular, this discussion has not been extended to a setting in which information is decentralized and better informed managers have a preference for slack or rents consumption. With the recent call for implementing RMSs into operations, there is an essential need to investigate both the economic and the behavioral implications of such implementation given the potential agency conflict between self-interested managers and the firm.

In the next subsection, I present an extension of Antle and Eppen's (1985) model of capital budgeting under private information to demonstrate the economic implications of implementing an RMS for the firm.

The Model of Capital Budgeting under Private Information: Economic Effects of a Risk Management System

The model presented below is an extension of the owner-manager model with linear production technology in Antle and Eppen (1985) and Antle and Fellengham (1995). In that model, the owner of a production function has the property rights to the cashflow it produces. The owner hires a manager whose comparative advantage is required to implement production.

Production requires cash in addition to the manager's presence. If a cash flow of *x* is to be produced, cash of *cx* is required, where $c < 1$ is the cost per dollar of cash flow. Only the manager can put the cash into production. At the time he does so, he knows the actual cost, *c*. The owner does not. The owner knows the underlying distribution of possible costs $c \in C$, where $C = \{c_1, c_2 \dots c_n\}$ with uniform distribution and respective probabilities $P = \{p_1, p_2 \dots p_n\}$, $c_1 < c_2 < \dots < c_n < 1$, and $\sum_{i=1}^{n} p_i = 1$. All cash must come from the owner. Let *y* denote the amount of cash transferred from the owner to the manager. The manager consumes cash above what he puts into production. Therefore, the manager's utility for cash transferred, *y*, production requirement, *x*, with cost per dollar *c* is $U(y, x; c) = y - cx$. The owner's objective is to maximize expected profits from production: $\sum_{i=1}^{n} p_i[x_i - y_i]$.[5]

[5] The constraints on the participative budgeting model are (Antle and Fellingham 1985):

1. Let θ be the manager's transaction cost in utility terms, the manager's contract must satisfy: $\sum_{i=1}^{n} p_i[y_i - c_i x_i] \geq \theta$, where the manager's expected utility must be at least as high as his next-best alternative.
2. The contract must respect the manager's lack of cash, so that $[y_i - c_i x_i] \geq 0, i = 1, \dots, n$.
3. The contract must induce a manager who knows the cost is c_i to select (x_i, y_i): $y_i - c_i x_i \geq y_j - c_i x_j$, $i, j = 1, \dots, n$.
4. Cash produced must not be negative: $x_i \geq 0, i = 1, \dots, n$.

Following Antle and Eppen (1985), if we assume that the owner prefers a certain upper bound, $\bar{x}$, for the cash flows available from the project, which corresponds to a cost level c_k, we can define the k^{th} level as follows:

$$x_i \geq \bar{x}, \qquad i = 1, \ldots\ldots, k,$$

$$x_i < \bar{x}, \qquad i = k+1, \ldots\ldots, n.$$

In Antle and Eppen's optimal solution, they define *k*-cost level as a simple hurdle strategy.[6] If the reported cost is above c_k, nothing is produced and no resources are given. If the reported cost is c_k or below, $\bar{x}$ is produced and cash of $c_k\bar{x}$ is given to the manager. The c_k hurdle produces an expected profit to the owner of $\sum_{i=1}^{k} p_i(1-c_k)\bar{x}$. The manager's expected slack is $\sum_{i=1}^{k} p_i(c_k-c_i)\bar{x}$. Summing the owner's expected profits and the manager's expected slack, we see the total expected surplus produced with a c_k hurdle strategy is $\sum_{i=1}^{k} p_i(1-c_i)\bar{x}$. This solution displays the trade-off between productive efficiency and distributional consequences. That is, reducing the hurdle rate below c_k gives up valuable production, but allows the owner to capture more of the surplus by reducing the resources he provides the manager when production occurs. Raising the hurdle rate above c_k increases production but gives more of the surplus to the manager in the form of excess resources. Therefore, when the owner provides resources for costs of c_k or lower, the owner reduces the manager's surplus (a distributional effect) by reducing the amount of resources available, but this also reduces the amount of resources produced (an efficiency effect) (Antle and Fellingham 1995).

Figure 1 depicts the trade-off between productive efficiency and distributional consequences under the predictions of conventional economic theory. In the four panels of Figure 1, costs and cash flow produced are plotted on the horizontal axis and cumulative

[6] A hurdle contract which maximizes the owner's expected profits should set the hurdle rate (*i.e.*, hurdle cost) equal to 0.50 and achieves owner's expected profit of 0.25.

probabilities of costs are plotted on the vertical axis. In panels A and B, costs are uniformly distributed on [0, 1], as shown by the relation between costs and cumulative probabilities, and maximum production equals one. Since the production cost is always less than or equal to revenue derived from production, it is productively efficient to produce in all cases (i.e., not set a hurdle rate, or equivalently, set the hurdle rate equal to one). In this case, Panel A shows that the owner's profits would be zero because the hurdle cost of one will always be the amount of resources transferred to the manager. All the gains from production are captured by the manager in the form of slack.[7] To retain some of the surplus, the owner can reduce the hurdle cost below one. Panel B, reproduced from Antle and Fellingham (1995, 46), shows the effects of setting the hurdle cost equal to 0.25. When the hurdle is set at 0.25, the owner's expected profit increases from zero to 0.187, and the manager's expected slack decreases to 0.03. However, the expected total surplus decreases to 0.217, which reflects the loss in operating efficiency due to the hurdle.[8]

In the proposed risk management model, we can assume that the total set of possible costs, C, consists of two partitions: C^F and C^U. The subset $C^F = \{c_1, c_2, \dots c_k\}$ includes cost elements that generate favorable outcomes, while the subset $C^U = \{c_{k+1}, \dots c_n\}$ includes cost elements that generate unfavorable outcomes. Consider the situation where the owner has an action choice, in the form of a costly investment in an RMS, that influences the probability distribution of the set of costs, C, by changing the relative likelihood of occurrence of the two partitions C^F and C^U. If the owner invests in an RMS, he incurs an investment cost, *IC*. The RMS influences the probability distribution of costs so that the cost elements of the subset C^F have respective probabilities $P^F = \{p_1^f, p_2^f \dots p_k^f\}$ uniformly distributed within P^F, and the cost

[7] The setting of Figure 1 Panel A is defined as a trust contract by Evans et al. (2001) and is the basic setting used by prior experimental studies to investigate the behavioral effects of different forms of informal controls on managerial reporting (*e.g.*, Hannan et al. 2006; Rankin et al. 2008; Douthit and Stevens 2015; Abdel-Rahim and Stevens 2015).
[8] In my illustrations, I follow Antle and Fellingham's (1995) numerical illustration by setting the hurdle rate at 0.25 to generate a comparable view for the effect of implementing an RMS.

elements of the subset C^U have respective probabilities $P^U = \{p^u_{k+1}, p^u_{k+2} \dots p^u_n\}$ uniformly distributed within P^U, where $P^F + P^U = 1$ (*i.e.*, $\sum_{i=1}^{k} p_i^f + \sum_{i=k+1}^{n} p_i^u = 1$), and $P^F > P^U$ (*i.e.*, $\sum_{i=1}^{k} p_i^f > \sum_{i=k+1}^{n} p_i^u$). The effectiveness of an RMS is based on the extent of its ability to reduce P^U and/or narrow the range of C^F.[9] The timelines in Figure 2 Panel A and B show the sequence of events when an RMS is absent and when an RMS is present.

To display the effect of the owner's investment in an RMS on the tradeoff between productive efficiency and distributional consequences, Figure 1 Panel C and Panel D depict the two cases in which an RMS implementation is either not accompanied with a hurdle contract (*i.e.*, hurdle rate equals one), or accompanied with a hurdle contract (*i.e.*, hurdle rate equals 0.25 similar to the above example). Relative to a case with no RMS, the RMS in this example increases the cumulative probability of favorable costs [0,.. 0.25] from 25 percent to 75 percent, and reduces the cumulative probability of unfavorable costs [0.26,.. 1] from 75 percent to 25 percent, with uniform distribution within each of these two cumulative probabilities, as shown by the steeper (flatter) cumulative probability line for costs from 0 to 0.25 (0.26 and 1).

As demonstrated in Panel C under no hurdle contract, as the RMS decreases the probability of the unfavorable cost range from 75 percent to 25 percent, it significantly improves the expected total surplus from 0.5 to 0.745 (minus *IC*), which reflects the value adding effect of an RMS implementation.[10] However, if we consider the distributional consequences of RMS implementation under no hurdle contract, the increase in the surplus is totally captured by the manager, whose expected slack increases from 0.50 to 0.745, while the owner incurs the *IC* from implementing the RMS. Therefore, this case demonstrates the exacerbation of the agency

[9] Solving for the optimal level of effectiveness of an RMS and the boundaries of the *IC* are beyond the scope of this model. This model's focus is to demonstrate the effect of including an RMS that modifies the probability distributions of future production costs on the firm's surplus, the manager's slack, and the owner's profits.

[10] The basic assumption is that an RMS will not be invested in if the *IC* offsets the improvement in total expected surplus.

conflict when an owner implements an RMS. On the other hand as demonstrated in Panel D, under a hurdle contract, an RMS implementation improves the outcomes for both the owner and the manager relative to when no RMS is implemented. That is, under the 0.25 hurdle rate the manager's expected slack increases from 0.0625 to 0.09 when an RMS is implemented, and the owner's profit increases from 0.187 to 0.5625 (minus *IC*). While the owner's profit increases when an RMS implementation is accompanied by a hurdle rate, the total expected surplus decreases to 0.6525 (minus *IC*) relative to when no hurdle contract is used, which again reflects the loss in operating efficiency due to the hurdle.

The above illustration demonstrates that an RMS has a value adding effect on the expected value of productive efficiency which is maximized when there is no hurdle contract. However, absent a hurdle contract, conventional economic theory predicts that the value adding effect of the RMS is totally reaped by the manager at the expense of the owner who simultaneously incurs the investment cost of the RMS. Therefore, this setting represents the exacerbation of the owner's agency costs as a result of an RMS implementation.

While the use of a hurdle contract in this illustration can be a potential economic solution for the potential increase in the owner's agency costs, a hurdle contract can be a costly solution for a number of reasons. First, from a practical perspective, it is not always feasible or cost-effective to anticipate and contract on all possible contingencies when setting a hurdle contract. Furthermore, as the firm's environment and its cost structure can experience frequent changes, implementing a hurdle contract can become more costly while a need for an RMS becomes more pronounced. To illustrate, Figure 1 Panel E provides an example of three different forms of an RMS with different combinations of P^F and C^F which allow the firm to achieve the same level of expected total surplus. In this illustration, if RMS specifications change, or if the owner decides

to shift from one RMS form to another, there will be a simultaneous need to change the hurdle rate which could impose additional contracting costs for the owner. Second, as the hurdle contract assumes that managers will always report the highest possible cost, the hurdle contract restricts profitable production even if a manager communicates truthfully that the actual cost is above the hurdle. In addition, prior studies suggest that the hurdle contract disallows the owner from benefiting from the manager's other-regarding preferences, like preferences for honesty or reciprocity. That is, under a hurdle contract, even if the requested cost is below the hurdle, managers will still be allocated resources equal to the hurdle (Evans et al. 2001; Kwang and Moser 2009; Krishnan et al. 2012).

Due to the above reasons, it is important to investigate the effects of an RMS absent a hurdle contract. This paper experimentally investigates the behavioral effect of an RMS when there is no hurdle contract. Therefore, Figure 1 Panel A and Panel C represent the two settings in which an RMS is either absent or present. The paper investigates the two conditions in which an RMS is an exogenous organizational feature and an endogenous investment choice by the owner. In the next subsections, I present the behavioral implications of an RMS on managers' honesty in reporting, the owners' motives for investing in an RMS, and the incremental effect of the endogenous selection of an RMS by the owner.

[Insert Figure 1 and Figure 2 about here]

The Presence of a Risk Management System: The Corporate Governance Role

In the above model, an effective RMS within operations decreases the likelihood of the unfavorable production cost range, and therefore increases the expected value of productive efficiency. Importantly, as the RMS changes the probability distribution of costs, it simultaneously improves the *ex-ante* common information shared by the owner and the manager

about possible production costs. That is, while an effective RMS doesn't eliminate costs from the unfavorable cost range, it modifies the owner's and manager's information about the likelihood for the production cost to fall within the unfavorable range. In this sense, as an RMS increases the firm's productive efficiency, it systematically works as an *ex-ante* mechanism that reduces the manager's informational advantage by updating the common information about the likelihood of future costs from the unfavorable range.

Prior experimental accounting studies in participative budgeting have investigated the effect of the full and the partial elimination of information asymmetry between the owner and the manager. Studies document that providing the owner with an exact signal (*e.g.*, Young 1985; Chow et al. 1988; Stevens 2002) or a probabilistic signal (Hannan et al. 2006) about the manager's private information *ex-post* (i.e., after the manager learns the actual cost but prior to budget report submission) increases managerial honesty in reporting. The common theme for explaining this effect is based on the assumption that managers feel a social pressure to report more honestly when the owner is more informed (see Brown et al. 2009 for a review).[11] More recently, Abdel-Rahim and Stevens (2016) find that the certainty level of the owner's signal is an important informational cue in budget reporting. In particular, they incorporate a setting in which the owner receives an estimate from an independent information system about the manager's private information. By manipulating estimate precision (the width of the estimate) and estimate uncertainty (the likelihood that the estimate is inaccurate), they document that increasing the uncertainty of an owner's estimate about the manager's private information offsets the positive effect of estimate precision on managerial honesty. Using Biccheiri's model of social norm

[11] All of the referenced studies which investigate the effects of reducing information asymmetry use face-to-face reporting in their experiments which is consistent with the general theory of increased social pressure. As I discuss later, however, in my experiment participants were separated by partitions and interacted anonymously over a computer network. Therefore, my experimental setting works against finding results based on an argument of increased social pressure when information asymmetry decreases.

activation (Bicchieri 2006), Abdel-Rahim and Stevens (2015) argue that high estimate uncertainty can provide ample opportunity for managers to evade the honesty norm by hiding behind the uncertainty when the owner's signal is more precise.

Bicchieri defines a social norm as a behavioral rule that may arise and affect behavior in a given social setting (Bicchieri 2006). A social norm is activated when individuals know that the social norm exists and become aware that the social norm is relevant to the current social setting. Compliance with an activated social norm is conditional on the extent to which an individual expects other individuals in a similar situation to comply with it (*i.e., empirical expectations*), and believes that others expect him to obey the norm and may sanction behavior inconsistent with the norm (*i.e., normative expectations*). Non-compliance with a social norm may occur because normative expectations are absent, or they are present but one can violate them without being observed (*i.e., norm evasion*). That is, the more ambiguous the choice situation, the higher will be the likelihood of noncompliance with the norm by individuals since the outcome of their behavior cannot be clearly interpreted as intentional by others (Bicchieri and Chavez 2010).

In a context in which an RMS is absent, the *ex-ante* common information shared by the owner and the manager indicates that there is a nontrivial likelihood for the future production cost to fall in the unfavorable range. Based on this informational cue, Biccheiri's model of social norm activation and norm evasion suggests that managers are more likely to evade the honesty norm and claim a budget in the unfavorable range even if their private information indicates otherwise. Therefore, the absence of an RMS facilitates managers' misreporting of a high cost since it will less likely be interpreted as dishonest by owners. On the other hand, when an RMS is present, the *ex-ante* common information indicates that, although a future production cost from the unfavorable range is still possible, its likelihood has considerably decreased. Therefore, the

presence of an RMS increases common expectations for truthful reporting and reduces the likelihood for managers to claim a cost in the unfavorable range. Based on this argument, an RMS can work as a corporate governance mechanism that increases managerial honesty by demotivating managers from reporting budgets within the unfavorable range when the actual cost realized is not within that range. Therefore, I predict that when managers realize a cost within the favorable cost range, they are more likely to report within the favorable cost range when an RMS is present than when an RMS is absent. More formally, I make the following prediction:

H1: When managers realize a cost within the favorable cost range, managers' cost reports are more likely to fall within the favorable cost range when a risk management system is present than when a risk management system is absent.

Owners' Motives for Endogenously Choosing to Invest in a Risk Management System

Since an RMS only decreases rather than eliminates the likelihood of costs from the unfavorable range, it only provides an *ex-ante* probabilistic rather than guaranteed improvement to the firm's efficiency. In addition, the potential improvement in the firm's efficiency is not directly observable by the owner due to the information asymmetry inherent in the budgeting process. Besides, the owner can benefit from the potential improvement in the efficiency only to the extent that the manager reports honestly. Therefore, economic theory predicts that an owner's investment in an RMS may not be optimal from a profit-maximizing perspective.

When we consider the motives of an owner to invest in an RMS, studies on trust and trustworthiness are of particular relevance. Prior literature normally defines trusting as a choice of becoming vulnerable to benefit the trustee, and trustworthiness as a form of gift-responsiveness where trustees react to the trustors' choice to benefit them. Experimental economics studies on investment games consistently find trusting behavior on the part of the

first-mover (*i.e.,* trustor) and trustworthiness behavior on the part of the second-mover (*i.e.,*trustee).[12] Hence, a potential motive for the owner to invest in an RMS could be an expectation of gift-responsiveness by the manager. A fundamental difference, however, between a trusting motive in an investment game and an owner's investment in an RMS relies on the clear communication of a direct benefit to the second mover. Specifically, an owner's investment in an RMS makes her more vulnerable to managerial opportunism but doesn't clearly communicate a direct benefit to the manager as it doesn't guarantee an improvement in the firm's efficiency. Therefore, a gift-exchange motive might be less applicable in an RMS investment context.

More recently, Cox et al. (2014) compare the two settings in which the trustor's action either makes him vulnerable without improving the trustee's payoff, or doesn't make him vulnerable but improves the trustee's payoff. Cox et al. (2014) document that trustees' trustworthiness driven from vulnerability-responsiveness is stronger than trustee's trustworthiness driven from gift-responsiveness. Therefore, Cox et al.'s (2014) finding suggest that the owner's RMS investment can clearly signal trust to the manager as it increases the owner's vulnerability even in the absence of a communication of direct benefit.

Based on the above discussion, to the extent that owners believe that an investment in an RMS will signal trust and activate a social norm of trustworthiness, they will decide to invest in an RMS.[13] That is, I predict the owners' willingness to invest to be positively correlated with their view of an RMS investment as a signal of trust. Therefore, I make the following prediction:

[12] In the original investment game developed by Berg et al. (1995), a trustor and a trustee are endowed with equal funds, and the trustor decides how much of the initial endowment to transfer to the trustee and how much to keep. The amount transferred to the trustee triples and then the trustee decides how much of the tripled amount to return to the trustor and how much to keep. The trustor's final payoff equals the portion of the initial endowment not transferred plus any amount subsequently returned by the trustee.

[13] This prediction is consistent with Davidson and Stevens's (2013) argument that the investor's decision on the amount to transfer in an investment game is based on a desire to signal trust in an expectation of activating a social norm for trustworthiness.

H2: Owners' investment in a risk management system will be positively correlated with their belief that a risk management system is a signal of trust.

Effect of the Endogenous Choice of a Risk Management System: The Signaling Role

When the presence of an RMS is exogenous, the owner doesn't have a choice. However, when an owner has the opportunity to invest in an RMS, the two possible choices are investment or noninvestment. Assuming that the probability distribution of production costs before the owner's investment choice represents the firm's status-quo, an owner's investment choice can be viewed as an act of commission which can potentially improve the firm's status-quo (by potentially improving firm efficiency). However, an owner's noninvestment choice can be viewed as an act of omission which upholds the firm's status-quo.

The distinction between acts of commission which improve the status-quo and acts of omission which uphold the status-quo has been explored in the behavioral economics literature. In particular, using two-player investment games, Cox et al. (2008) theorize and document that second-movers' reactions are stronger to first-movers' acts of commissions than comparable acts of omissions, but the weakest when there is no opportunity to act.[14] Therefore, managers' honesty in reporting is predicted to be higher when the presence of an RMS is attributed to the owner's choice to invest than when the presence of an RMS is viewed as an exogenous organizational feature not directly attributed to the owner's choice. Similarly, as discussed in Hypothesis 2 above, an owner's choice to invest in an RMS is expected to signal trust and expectations of trustworthiness as a response to the increased owner vulnerability. Based on Bicchieri's model of social norm activation (2006), when an owner signals trust and her expectations of trustworthiness through the investment choice, she activates a social norm for

[14] Cox et al. (2013) also design fairness games in which acts of commission and acts of omission result in equivalent economic payoffs. They find that acts of commission induce stronger reciprocal responses than acts of omission.

trustworthiness.[15] The activation of the trustworthiness norm will, in turn, reinforce the role of an RMS as a corporate governance tool that increases common expectations of truthful reporting.

On the other hand, when an owner chooses not to invest in an RMS, this is viewed as an act of omission which upholds the firm's status-quo. The manager may consider the owner's noninvestment choice as a failure to potentially improve the firm's status-quo. In addition, while a choice to invest by the owner makes the owner more vulnerable to the manager's opportunism, a choice not to invest can signal the owner's unwillingness to be vulnerable. In this situation, a noninvestment choice can be interpreted as a signal of distrust by the manager which can further increase managerial dishonesty. Therefore, while the absence of an RMS increases the likelihood of claiming a cost within the unfavorable range, when the absence of an RMS is a result of a noninvestment choice by the owner, honesty in reporting may decrease even further.

It is also possible, however, that managers' honesty in reporting will not be affected by whether the absence of an RMS is exogenous or endogenous. First, Cox et al. (2008) and Cox et al. (2013) theorize and provide experimental evidence that second movers in an investment game are more sensitive to first mover's acts of commission than comparable acts of omission. Based on this finding, a manager may be less likely to react negatively to an owner's decision not to invest in an RMS. Second, although an owner's noninvestment choice may be interpreted as an unwillingness to trust the manager, prior literature suggests that a manager may be less likely to punish the owner by reporting more dishonestly. For example, Bicchieri et al.'s (2011) experiment has investigated individuals' expectations of second movers' reactions to trusting versus distrusting investors. They find that although there is an expectation of a trustworthiness norm where a trusting investor should be rewarded, they didn't find a similar expectation that an

[15] Trustworthiness can be an innate personal characteristic (Coletti et al. 2005) or a conditional preference that can be activated by situational cues or information signals (Bicchieri 2006). Depending on the social setting, trustworthiness can entail behavior consistent with other norms such as honesty, fairness, and reciprocity.

untrusting investor should be punished. Therefore, as prior literature suggests that managers are unlikely to punish the owners who decide not to invest in an RMS, I predict that honesty in reporting will not differ when an RMS absence is viewed as an exogenous organizational feature than when an RMS absence is attributed to the owner's choice.

In summary, Hypothesis 3 predicts an ordinal interaction in which the positive effect of an RMS presence will be stronger when the presence is attributed to the owner rather than exogenously assigned. The ordinal interaction pattern is graphically presented in Figure 3.

H3: The presence of a risk management system positively affects manager's honesty in reporting to a greater extent when the presence is endogenously chosen by the owner than when the presence is exogenously assigned.

[Insert Figure 3 about here]

III. Experimental Methodology

Participants and Experimental Design

Eighty undergraduate students were recruited from the experimental economics laboratory of a large southeastern university. The average age of participants is about 20 years. Sixty-five percent of participants were business major, and forty-eight percent were females. Participants were randomly assigned to one of two experimental treatments created by a mixed 2x2 experimental design that incorporates two manipulations. The first between-subjects manipulation is the determinant of an RMS presence (*Exogenous RMS Assignment* and *Endogenous RMS Choice*), and the second within-subjects manipulation is the presence of an RMS (*No* and *Yes*). This design results in four main conditions: Exogenously Absent RMS, Exogenously Present RMS, Endogenously Absent RMS, and Endogenously Present RMS. The experimental design is presented in Table 1.

Two experimental sessions were conducted per experimental treatment for a total of four 150-minute experimental sessions. Participants in each experimental session interacted for ten periods and, therefore, a third (within-subjects) factor is period. Each of the ten periods is independent. That is, each manager was assigned to one owner, to whom he or she reported his or her cost for the period, and participants were rematched after each period, so that managers never reported to the same owner more than once. The roles of owner and manager were randomly assigned and fixed throughout the session. Participants were separated by partitions and interacted anonymously through a computer network. The experiment was administered using z-tree software package (Fischbacher 2007). The experiment involved no deception of any kind.

Setting

To test my hypotheses, I utilized a participative budgeting setting that is similar to that adopted by earlier experimental studies (Hannan et al. 2006, Rankin et al. 2008), and is based on the agency model in Antle and Eppen (1985). The setting involves a manager who has private information regarding the cost of production. The owner elicits a cost report from the manager and funds production on the basis of the manager's report.[16] Any overstatement of the cost increases the manager's payoff but decreases the owner's payoff by the same amount. To rule out any strategic behavior, the owner was required to accept all cost reports from the manager.

Risk Management System Presence Manipulation

The experimental task involved an owner's firm that produced 1,000 units each period, which were sold for 6.50 lira, an experimental currency. Production costs fell within the range of 4.00 lira to 6.00 lira per unit in increments of .05 lira. The range of possible unit costs was split at 5 lira into two ranges: the lower (favorable) cost range {4.00, 4.05…5.00}; and the higher

[16] In the experiment, managers and owners were labeled "division manager" and "corporate headquarters manager."

(unfavorable) cost range {5.05, 5.10…6.00}. Actual unit cost each period initially had a uniform probability distribution with an equal likelihood to be randomly drawn from the lower or the higher cost range. When an RMS was present, it increased the probability for the actual cost to be randomly drawn from the lower cost range (90 percent), and decreased the probability for the actual cost to be drawn from the higher cost range (10 percent). Regardless of whether an RMS was absent or present, actual cost in a given period was always the manager's private information. Therefore, before reporting the cost to the owner, the manager knew with certainty the actual unit cost. The owner never learnt the actual cost, thus, never knew whether the reported cost equaled the actual cost. Furthermore, each manager's cost report was fully funded at whatever cost the manager reported to the owner.

The manager received a salary of 1,000 lira. Besides, he or she kept for himself or herself any difference between the reported cost (*i.e.*, resources received) and actual cost. Thus, the manager's payoff function was

γ = [(reported unit cost - actual unit cost) X 1,000] + 1,000 (1).

The owner received an initial endowment of 910 lira. When an RMS was present, 410 lira was deducted from the owner's endowment as the investment cost of the RMS.[17] Besides his endowment, the owner kept the net profits after the cost of production and the manager's salary. Thus, if an RMS was absent, the owner's payoff function was

Π_{No-RMS} = 910 + [(6.50 - reported unit cost) X 1,000] – 1,000 (2a).

While, if an RMS was present, the owner's payoff function was

Π_{RMS} = [910 – 410] + [(6.50 - reported unit cost) X 1,000] – 1,000 (2b).

[17] The investment cost of 410 lira completely offsets the expected improvement in firm efficiency from the RMS. That is, 410 lira equals the expected value of the firm's surplus when the RMS is present minus the expected value of the firm's surplus when the RMS is absent. I intentionally set this parameter to reflect an extremely high cost for the owner. Therefore, this parameter provides a strong test of Hypothesis 2.

Therefore, when an RMS was present, the realization of any cost equal to or smaller than 5 lira makes the owner's payoff equal to or greater than 1,000 lira if the manager reports the cost honestly.

Determinant of Risk Management System Presence Manipulation

In the *Exogenous RMS Assignment* treatment, the owner clicked a button on his/her computer screen to make an automated coin flip at the beginning of each period. The outcome of the automated coin flip determined whether the RMS would be absent or present. In the *Endogenous RMS Choice* treatment, the owner chose whether the RMS would be absent or present at the beginning of each period. In both of the *Exogenous RMS Assignment* and the *Endogenous RMS Choice* treatments, managers indicated their budget reports using the strategy method prior to learning whether an RMS was absent or present. Specifically, for each period, after the owner made the automated coin flip (or his/her RMS investment decision), managers first observed the actual cost assuming that the RMS was absent and indicated the budgeted cost they wished to report. Then, they observed the actual cost assuming that the RMS was present and indicated the budgeted cost they wished to report.[18] After indicating both budgets, managers learned whether the RMS was absent or present and submitted to the owner their budgeted cost that corresponded to the RMS presence outcome/decision.

Procedures

Upon arrival at the laboratory, participants were provided with experimental identification numbers and were randomly seated at private computer terminals. After signing the informed consent forms, participants began by reading through a set of instructions. After successfully completing a quiz about the instructions, participants worked through two practice

[18] In each period, before managers observed each of the two actual costs, a 15-second wait screen with flashing text indicated that the computer was generating the actual cost assuming that an RMS was absent (present).

periods. The practice periods were structured similar to the regular periods of the experiment with the exception that participants made decisions for both roles themselves without the use of the strategy method. The use of the practice periods allowed me to ensure that participants understood how the RMS changed the probability distribution of costs and the incentives tied to each role without requiring the use of complicated (and potentially leading) numerical examples in the instructions. After finishing the two practice periods, participants read the rest of the experimental procedures which described the strategy method used for eliciting managers' budget reports. After reading the procedures, participants went through one additional practice period that was identical in all respects to the regular period with the exception that they played both roles. This additional practice period allowed me to ensure that participants understood how the strategy method would work in the experiment. After finishing the practice period, participants were informed of the role to which they had been randomly assigned and started the experiment for ten periods. After each experimental period, each participant was rematched with another participant of the opposite role. Experimental procedures are presented in Figure 4.

Actual costs were randomly determined in advance following the corresponding distributions. Each manager participant received the same set of actual costs for all the ten periods.[19] When the RMS was absent, managers realized costs from the lower cost range in five decision periods (4.90, 4.50, 4.65, 4.60, 4.85), and realized costs from the higher cost range in five decision periods (5.80, 5.15, 5.45, 5.30, 5.75). When the RMS was present, managers realized costs from the lower cost range in nine decision periods (4.60, 4.85, 4.10, 4.70, 4.20, 4.40, 4.70, 4.90, 4.50), and realized a cost from the higher cost range in one decision period

[19] To control for potential order effects, the order of the actual costs was counterbalanced at two levels in the Endogenous Selection Treatment. In the Exogenous Assignment treatment, a software issue interrupted the order counterbalance. Analysis suggests that order has no effect on results, and thus is excluded from further discussion.

(5.15). Hence, costs (4.50, 4.60, 4.85, 4.90, and 5.15) were realized by managers when an RMS was absent and when an RMS was present.

I use two main dependent variables: (a) the proportion of managers' cost reports that are within the favorable cost range when realized costs were within the favorable range, and (b) average percent honesty. Average percent honesty = 1 – slack claimed/slack available, where the ''slack claimed'' is the amount of sack the manager earns based on the manager's cost report, and the ''slack available'' is the amount that a manager could earn by reporting the highest possible cost (Evans et. al 2001). Since the total slack available across the ten periods is different when an RMS was absent than when an RMS was present, in my formal hypotheses testing I control for total available slack across the four conditions by using the above dependent variables for the periods in which the realized costs were equal across conditions (*equal-cost periods*).

Compensation

Participants received a five dollar show-up fee for participating in the experimental session. In addition, earnings made during the experiment from one randomly selected period were paid to participants at the rate of 75 lira = $1. After completing an online post-experimental questionnaire hosted by Qualtrics at the end of each session, participants were paid in cash and then dismissed. Average total compensation was $23 and ranged from $5.00 to $43.

[Insert Figure 4 and Table 1 about here]

IV. RESULTS

Manipulation Checks

As discussed earlier, when an RMS is present, it improves the *ex-ante* common information shared by the owner and manager about possible production costs. I measured the *perceived* reduction in information asymmetry when the RMS was present using the item "When

the probability distribution of costs was 90% for the cost range {4.00,..5.00} and 10% for the cost range {5.05,..6.00}, owners would think that a reported budget cost in the cost range {5.05,..6.00} was not true" on a 7-point Likert scale with 1 labeled "strongly disagree", 7 labeled "strongly agree". Average participants' responses to this item across the two treatments was 5.54 which is significantly higher than the neutral response of 4 ($t = 9.32$, p-value < 0.01, two-tailed). I also measured the salience of the Exogenous RMS Assignment treatment using the item "Although the owners were asked to make an automated coin flip on their screens each period, they did not have any control over the automated coin flip outcome" on a 7-point Likert scale with 1 labeled "strongly disagree", 7 labeled "strongly agree". Average participants' responses to this item was 6.07 which is significantly higher than the neutral response of 4 ($t = 8.9$, $p < 0.01$, two-tailed). Collectively, this evidence suggests that my manipulations were successful.

Descriptive Statistics

The descriptive statistics for the four conditions are presented in Table 2 and Table 3. Table 2 reports summary statistics for all experimental conditions across the 10 decision periods, and Table 3 reports the same statistics for the equal-cost periods. Panel A of Table 2 reports the proportion of managers' cost reports within the favorable cost range (when the actual costs realized were within the favorable cost range). The proportion of cost reports within the favorable range was 5 percent and 13 percent for the Exogenously Absent RMS and the Endogenously Absent RMS, respectively. On the other hand the proportion of cost reports within the favorable range was 31.6 percent and 36.6 percent for the Exogenously Present RMS and the Endogenously Present RMS, respectively. This positive effect of an RMS on reporting within the favorable range is also apparent in Panel A of Table 3 which uses the equal-cost periods to control for the total available slack across the four conditions. To gain further insights, Figure 7

presents the proportion of cost reports reported within the favorable cost range by period for the four equal-cost periods in which the actual costs were realized within that range. For each realized cost, more managers reported within the favorable cost range when an RMS was present than when an RMS was absent. The positive effect of an RMS on reporting within the favorable cost range is evident under both the Exogenous RMS Assignment and the Endogenous RMS Choice treatments. Therefore, the reporting pattern in Figure 7 is consistent with the argument that an RMS plays a corporate governance role.

[Insert Table 2, and Table 3 about here]

Panel B of Table 2 reports the average percent honesty across the ten decision periods. The average percent honesty across the two RMS Present conditions (40.50%) is higher than the two RMS Absent conditions (29.40%). This suggests that the presence of an RMS had a positive effect on honesty in managerial reporting. Similarly, average percent honesty across the two Endogenous RMS Choice conditions (39.10%) is higher than average percent honesty across the two Exogenous RMS Assignment conditions (28.40%). Finally, consistent with my prediction of an ordinal interaction effect, the average percent honesty in the Endogenously Present RMS condition is higher than the three other conditions at 44.70 percent. Panel B of Table 3 also reports a similar pattern after controlling for the total available slack across the four experimental conditions. The graph in Figure 5 of average percent honesty across the equal-cost periods for the four conditions reflects a pattern consistent with the predicted ordinal interaction effect.

I also consider the pattern of reporting behavior by condition over all 10 periods to gain additional insights. The graph in Figure 6 presents the average percent honesty by period. The graph shows that in the Endogenously Present RMS condition average percent honesty was consistently higher than the three other conditions. Furthermore, while the presence of an RMS

increased average percent honesty under both the Exogenous RMS Assignment and the Endogenous RMS Choice treatments, the vertical distance between the two Endogenous RMS Choice conditions is bigger than the vertical distance between the two Exogenous RMS Assignment conditions. Overall, the descriptive data is consistent with the prediction that the presence of an RMS positively affects honesty in reporting, and this effect is stronger when an RMS is an endogenous investment choice.

Panel C of Table 2 shows the proportion of owner investment in the RMS. Proportion of owner investment across the ten periods was 52 percent. In untabulated results, I find that the proportion of owner investment is significantly higher than zero ($t = 7.98$, $p < 0.01$), but not significantly different from 0.50. This provides evidence that a significant proportion of owners decided to invest in an RMS despite the potential increase in agency costs.

[Insert Figure 5, Figure 6, and Figure 7 about here]

Test of Hypotheses

Test of H1

Hypothesis 1 predicts that an RMS will increase the likelihood of reporting a budget cost within the favorable cost range when the realized cost falls within that range. As reported in Table 4 Panel A, the test of repeated-measures ANOVA demonstrates that the presence of an RMS significantly increased the proportion of cost reports within the favorable cost range ($F = 13.99$, $p < 0.01$ two-tailed). In untabulated results, I find the effect of an RMS presence is positive for both the Exogenous RMS Assignment treatment ($F = 8.32$, $p < 0.01$ two-tailed) and the Endogenous RMS Choice treatment ($F = 6.13$, $p = 0.02$ two-tailed). Overall, these results provide evidence for a positive behavioral effect for the presence of an RMS on the likelihood of reporting within the favorable cost range. Thus Hypothesis 1 is supported.

To provide further insights, I compare managers' responses to the two exit questionnaire items "When an RMS is absent, how likely are managers to report an honest budget cost?" and "When an RMS is present, how likely are managers to report an honest budget cost?" on 11-point scale with 1 labeled "0% to report honest budget cost", and 11 labeled "100% to report honest budget cost". In an untabulated paired comparison test, I find that managers believed they should report costs more honestly when the RMS was present ($t = 1.87$, $p = .069$, two-tailed). Therefore, in support of the theory of Hypothesis 1, the presence of an RMS appears to increase common expectations for truthful reporting.

Test of H2

Hypothesis 2 posits that the owners' willingness to invest in an RMS will be positively correlated with their view that an RMS is a signal of trust to the manager. I measure whether owners viewed the choice to invest in an RMS as a signal of trust using the exit questionnaire item "When owners decided to deduct 410 lira from their endowment to change the probability distribution, they decided to trust the manager" on a 7-point Likert scale with 1 labeled "strongly disagree" and 7 labeled "strongly agree". Owner-participants' average response to this measure was 5.7 which is significantly higher than the neutral response of 4 ($t = 5.91$, $p < 0.01$). As reported in Panel B of Table 4, the owner-participants' responses to this item positively correlates with the proportion of investing in the RMS across the ten decision periods ($r = 0.41$, $p = 0.03$, one-tailed). This provides support for H2 that owners who viewed the RMS investment as a trusting signal were more willing to invest in the RMS. Importantly, the average responses of manager-participants to the same measure was 5.80, which is not significantly different from the owner-participants' responses. This suggests that an endogenous choice of an RMS was viewed as a signal of trust by both the owners and managers.

Test of H3

Hypothesis 3 posits that the positive effect of an RMS presence on honesty will be greater when an RMS presence is a result of an endogenous investment choice than when an RMS presence is a result of an exogenous assignment. I rely on a contrast coding test as a direct test of the theoretical form of my ordinal interaction (Buckless and Ravenscroft 1990). The contrast coefficients I use in this test are +3 for Endogenously Present RMS, +1 for Exogenously Present RMS and –2 for each of the other two conditions. As presented in Panel C of Table 4, the planned contrast interaction is significant, providing support for H3 ($F = 4.25$, $p = 0.02$, one-tailed). In untabulated results, the F-statistic of the residual variance in the contrast model is not significant, which suggests that the contrast is a good fit. To provide further evidence of the ordinal interaction prediction, I analyze the four simple-main effects as presented in Table 5 Panel A. I find that RMS Presence has a significant effect within both the Exogenous RMS Presence treatment ($t = 2.39$, $p = 0.01$, one-tailed) and the Endogenous RMS Choice treatment ($t = 3.73$, $p < .01$, one-tailed). On the other hand, I find that the Endogenous RMS choice treatment has a marginally significant effect when an RMS is present ($t = 1.50$, $p = .07$, one-tailed), but not when an RMS is absent ($t = 1.02$, $p = .31$, two-tailed).[20] Thus, the predicted ordinal interaction in H3 is fully supported in the data.

[Insert Table 4 about here]

Supplemental Analysis

The underlying theory for Hypothesis 3 is that as the RMS increases the owner's vulnerability to the manager's opportunism, an investment choice by the owner signals trust and activates a social norm for trustworthiness by the manager. I measure whether an RMS

[20] For within-subject treatment effects, the tests are paired t-tests where each participant counts as a single independent observation. However, for the between-subject treatment effects, a two-sample t-test is used where each participant counts as a single independent observation.

investment choice was perceived as increasing the owner's vulnerability using the exit questionnaire item, "Owners' decision to deduct 410 lira to change the probability distribution of costs was a risky decision to make" on a seven-point Likert scale with 1 labeled "strongly disagree" and 7 labeled "strongly agree". Average manager-participants' responses was 5.45 which is significantly higher than the neutral response of 4 ($t = 5.65$, $p < 0.01$, two-tailed). In addition, as mentioned earlier, average manager-participants' responses to whether they viewed the investment choice as a signal of trust was higher than the neutral response of 4 and not significantly different from owner-participants' responses. Collectively, managers' responses provide evidence that they perceived the RMS investment choice as increasing the owner's vulnerability and as a signal of trust. I estimate an ordinary least squares (OLS) regression of average percent honesty in the Endogenously Present RMS condition on the exit questionnaire item of whether managers desired to reward the owner's trust when they decides to invest. As reported in Panel B of table 5, the managers' average percent honesty when the RMS was endogenously present is positively associated with managers' desire to reward the owner's trust, and also with their belief that an investment choice is a signal of trust.

The underlying theory for H3 also suggests that a noninvestment choice by the owner could signal distrust, but a manager is predicted not to punish the owner's distrust by being less honest. I measured whether managers viewed a noninvestment choice as a signal of distrust using an exit questionnaire item and find that manager-participants' responses to this item was significantly higher than the neutral response of 4 ($t = 2.76$, $p = 0.012$, two-tailed). However, consistent with my theory, average manager-participants' responses to an exit questionnaire measure of the managers' desire to punish distrust is not significantly different from the neutral response of 4 ($t = -0.58$, $p = 0.56$, two-tailed). I estimate an ordinary least square (OLS)

regression of managers' average percent honesty in the Endogenously Absent RMS condition on the two measures of whether they view noninvestment as a signal of distrust, and on their desire to punish the owner's distrust. As reported in Panel B of table 5, the managers' average percent honesty when the RMS was endogenously absent is not associated with their belief that a noninvestment choice is a signal of distrust or with their desire to punish the owner's distrust.

[Insert Table 5 about here]

V. CONCLUSION

Firms are confronted with risks at many different levels inside and outside the business. The purpose of risk management is to reduce the likelihood and impact of unfavorable outcomes (Baxter et al. 2013). As the scope of corporate risk management has expanded to focus on managing operational risks, there has been a growing consensus that risk management should be a critical aspect of operations (Power 2009; Arena et al. 2010). However, it is an open question whether risk management systems (RMS) affect the managers' reporting behavior. This study first extends agency theory by analyzing the economic implications of implementing an RMS in a participative budgeting setting. An extension of the capital budgeting model under private information suggests that an RMS can exacerbate the owner's agency costs as it increases the expected value of slack available for managerial expropriation. Second, the study experimentally examines the behavioral effect of an RMS on honesty in managerial reporting, the owner's willingness to invest in an RMS, and the incremental effect of the owner's endogenous investment choice on managerial honesty.

Consistent with my theory, in a laboratory experiment I find that an RMS reduces the likelihood for managers to claim a high cost in their reports when their actual cost falls within a favorable cost range. In addition, I find that the owners' investment in an RMS is positively

correlated with their belief that an investment would signal their trust to the manager. Furthermore, the positive effect of an RMS on managers' average percent honesty is greater when the RMS is the result of an owner's investment choice than when the RMS is the result of an exogenous assignment. Supplemental analysis suggests that managers' honesty in the endogenously present RMS condition is positively associated with their desire to reward the owner's trust. On the other hand, while responses to an exit questionnaire item reveal that managers viewed an owner's noninvestment in an RMS as a signal of distrust, managers' average responses on the measure of whether they desired to punish the owner's distrust was not significantly different from neutral. My analysis suggests that the managers' honesty in the endogenously absent RMS condition is not negatively associated with the managers' desire to punish the owner's distrust. Therefore, this supplemental analysis provides support for the documented ordinal interaction effect.

This study has important theoretical implications. This study analyzes the economic implications of an RMS implementation in a participative budgeting setting, then experimentally examines the behavioral effects and firms' motives for investing in an RMS. Thus, this experimental study contains the characteristics that Brown et al. (2009) argue maximize its potential to contribute to agency theory. The experimental design used in this study addresses the effect of an RMS as a corporate governance mechanism and the incremental signaling effect of an RMS. The investigation of both the exogenous assignment and the endogenous selection of an RMS in also consistent with the recent call by Evans et al. (2015) to investigate the exogenous assignment and the endogenous selection of control systems to provide a more complete understanding of the issue.

This study also provides some important practical implications. First, although an RMS can increase the agency costs to the firm, the experimental findings suggest that an RMS could have a corporate governance role which can improve managerial honesty in reporting. In addition, the salience of the firms' willingness to invest increases the managers' trustworthiness and reinforces the corporate governance role of an RMS. Since firms operating in some industries face stricter regulatory requirements for risk management than others (Beasley et al. 2008), the reported results for the exogenous and endogenous treatments may reflect some potential implications of implementing RMSs under both strict and flexible regulatory regimes.

The results and implications of this study are subject to the same caveats associated with much experimental research. That is, although this experimental setting is designed to address organizational settings where an RMS changes the cost structure for the manager who subsequently observes and reports his cost to upper management, it still abstracts from such settings. To the extent that my experimental design captures important aspects of these organizational settings, however, I believe that the experimental results provide useful insights that may generalize to such settings. In addition, while the current study addressed a setting in which the firm uses a trust contract where no hurdle rate is specified (Evans et al. 2001), future research is needed to shed more light on whether managerial reporting behavior differs from the economic predictions under a hurdle contract.

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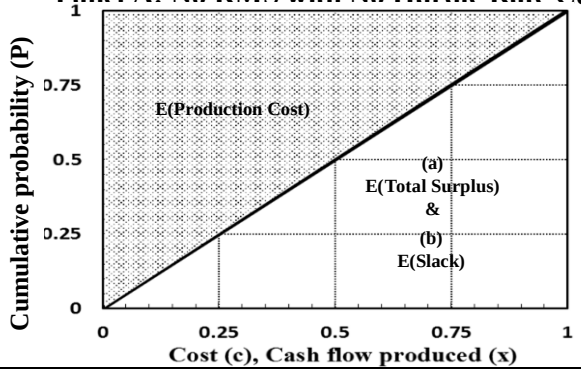
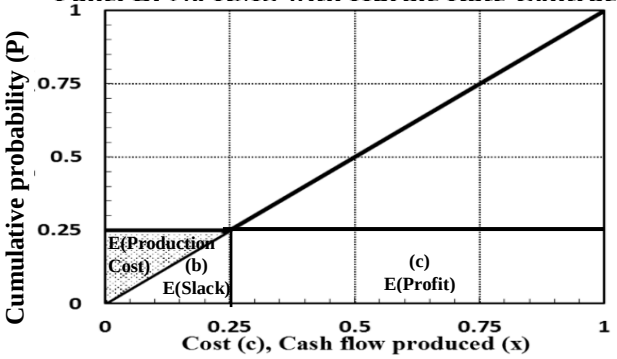
FIGURE 1

Economic Prediction for Firms with Combinations of an RMS (No, Yes) and Hurdle Rate (No, Yes)

Panel A: No RMS with No Hurdle Rate Contract



Panel B: No RMS with Hurdle Rate Contract



Discrete case:

(a) E(Total Surplus)=$\sum_{i=1}^{n} p_i(1-c_i)$,

(b) E(Slack) = $\sum_{i=1}^{n} p_i^n(c-c_i)$, **(c)** E(Net Profit)=0,

[*For shown case, at* $c=1$, $p_i=1/100$, $c_i=i*0.01$: $E(Slack)=0.5$, $E(Total\ Surplus)=0.495\approx 0.50.5$]

Continuous case:

(**a**) E(Total Surplus) = $\int_0^{p^f}(1-\frac{c_k}{p^f}p)\,dp$

(**b**) E(Slack) = $\int_0^{p^f}\left(c-\frac{c_k}{p^f}p\right)dp$, **(c)** E(Net Profit)=0

[*For shown case, at* $c=1$, $P=1$, $c_k=1$: E(Net Profit) = 0, E(Slack) = 0.5, E(Total Surplus = 0.5]

Discrete case:

(a) E(Total Surplus)=$\sum_{i=1}^{k} p_i(1-c_i)$,

(b) E(Slack)=$\sum_{i=1}^{k} p_i(c_k-c_i)$, **(c)** E(Net Profit)=$\sum_{i=1}^{k} p_i(1-c_k)$

[*For shown case*, at $k=25$, $p_i=\frac{0.25}{25}$, $c_i=i*0.01$: E(Net Profit)=0.1875, E(Slack)=0.030, E(Total Surplus)=0.2175]

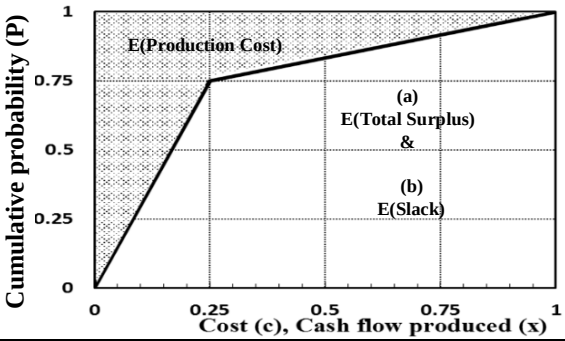
Continuous case:

(a) E(Total Surplus)=$(\int_0^{p^f}\left(1-\frac{c_k}{p^f}p\right)dp$,

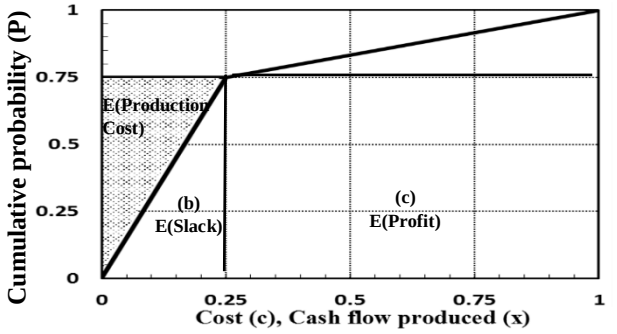
(b) E(Slack)=$\int_0^{p^k}(c-\frac{c_k}{p^k}p)\,dp$, (**c**) E(Net Profit) = $\int_0^{p^k}(1-\frac{c_k}{p^k}p)\,dp$

[*For shown case*, at $c_k=0.25$, $p^k=0.25$: E(Net Profit)=0.1875, E(Slack)=0.03125, E(Total Surplus)=0.21875]

Panel C: RMS with No Hurdle Rate Contract



Panel D: RMS with Hurdle Rate Contract



Discrete case:

(a) E(Total Surplus)=$\sum_{i=1}^{k} p_i^f(1-c_i)+\sum_{i=k+1}^{n} p_i^u(1-c_i)-IC$

(b) E(Slack)=$\sum_{i=1}^{k} p_i^f(c-c_i)+\sum_{i=k+1}^{n} p_i^u(c-c_i)$

(c) E(Net Profit)= $-IC$

[For shown case, at $c=1, p_i^f=\frac{0.75}{k}, p_i^u=\frac{0.25}{(n-k)}, c_i=i*0.01, k=25, n=100$:

E(Net Profit)=-IC, E(Slack)=0.745, E(Total Surplus)=0.745 - IC]

Continuous case:

(a) E(Total Surplus)=$(\int_0^{p^f}\left(1-\frac{c_k}{p^f}p\right)dp+\int_{p^f}^{1}(1-\frac{(p*(1-c_k)-(p^f-c_k))}{(1-p^f)})\,dp))$-IC

(b) E(Slack)=$(\int_0^{p^f}(c-\frac{c_k}{p^f}p)\,dp+\int_{p^f}^{1}(c-\frac{(p*(1-c_k)-(p^f-c_k))}{(1-p^f)})\,dp)$

(c) E(Net Profit)=$-IC$

[For shown case, at $c=1$, $p^f=0.75$, $c_k=0.25$:

E(Net Profit)=-IC, E(Slack)=0.75 , E(Total Surplus)=0.75-IC]

Discrete case:

(a) E(Total Surplus)=$\sum_{i=1}^{k} p_i^f(1-c_i)-IC$

(b) E(Slack)=$\sum_{i=1}^{k} p_i^f(c_k-c_i)$

(c) E(Net Profit)=$\sum_{i=1}^{k} p_i^f(1-c_k)-IC$

[For shown case, at $c=1, p_i^f=\frac{0.75}{k}$, $c_i=i*0.01, k=25, n=100$:

E(Net Profit)=0.562-IC, E(Slack)=0.09, E(Total Surplus)=0.652-IC]

Continuous case:

(a) E(Total Surplus)=$\int_0^{p^f}(1-\frac{c_k}{p^f}p)\,dp-IC$

(b) E(Slack)=$\int_0^{p^f}(c-\frac{c_k}{p^f}p)\,dp$

(c) E(Net Profit)=$\int_0^{p^f}(1-c_k)\,dp-IC$

[For shown case, at $c=0.25$, $p^f=0.75$, $c_k=0.25$:

E(Net Profit)=0.5625-IC , E(Slack)=0.0937,

E(Total Surplus)=0.6562-IC]

FIGURE 1 (Continued)

Panel E: Different Forms of an RMS that Can Generate Equal E(Total Surplus)

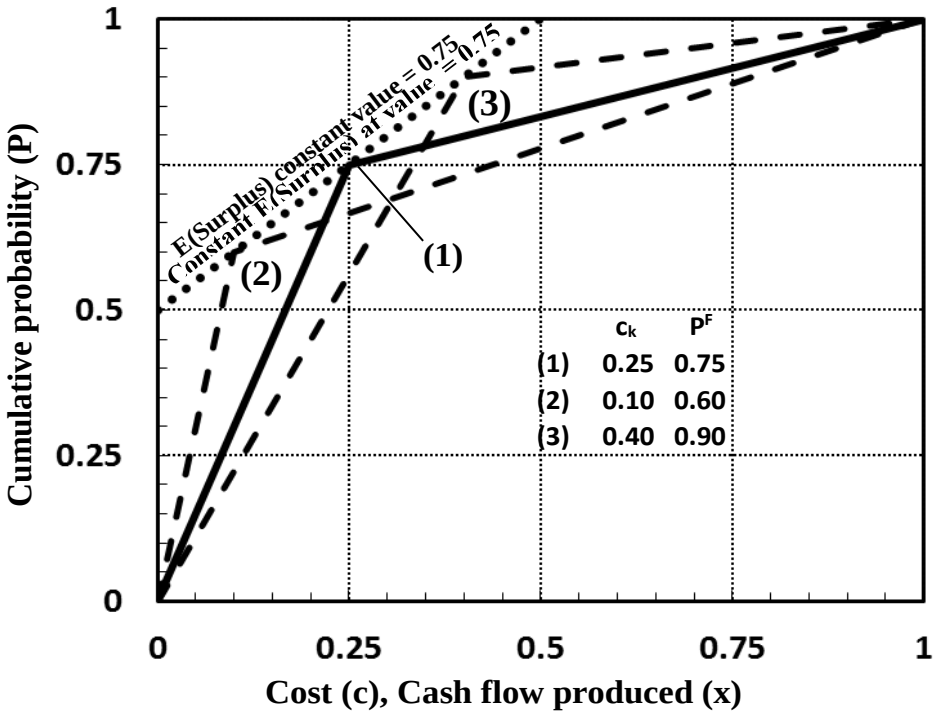


FIGURE 2

Panel A: Timeline when an RMS is Absent

Contract Signed

Manager learns cost, c_i

Manager reports cost, c

Owner supplies resources & *x is* produced

Common Knowledge:

$\mathbf{c_1 < c_2 < \ldots < c_n < 1}$

$c \in C$

$C = \{c_1, c_2 \ldots c_n\}$,

uniformly distributed with probabilities

$p = \{p_1, \ldots p_n\}$,

where,

$\sum_{i=1}^{n} p_i = 1$

Net Profit = $(1 - c)x$

E(Slack) = $\sum_{i=1}^{n} p_i (c - c_i)\, x$

Panel B: Timeline when an RMS is Present

Contract Signed

Owner invests in an RMS (incurs *IC*)

Manager learns cost, c_i

Manager reports cost, c

Owner supplies resources & *x is* produced

Common Knowledge:

$\mathbf{c_1 < c_2 < \ldots < c_n < 1}$

$c \in C$

$C = \{c_1, c_2 \ldots c_n\}$, → $C^F, C^U \subsetneq C$

→ $C^F = \{c_1, c_2 \ldots c_k\}$

→ $C^U = \{c_{k+1}, \ldots c_n\}$,

uniformly distributed with probabilities:

$p = \{p_1, \ldots p_n\}$, → with corresponding uniformly distributed prob.:

→ $P^F = \{p_1^f, \ldots p_k^f\}$,

→ $P^U = \{p_{k+1}^u, \ldots p_n^u\}$,

where,

$\sum_{i=1}^{n} p_i = 1$ → where,

→ $\sum_{i=1}^{k} p_i^f + \sum_{i=k+1}^{n} p_i^u = 1$

→ $\sum_{i=1}^{k} p_i^f > \sum_{i=k+1}^{n} p_i^u$

Net Profit = $(1 - c)x - IC$

E(Slack) = $\sum_{i=1}^{k} p_i^f (c - c_i)\, x + \sum_{i=k+1}^{n} p_i^u (c - c_i)\, x$

FIGURE 3

Theoretical Prediction (Hypothesis 3) – Ordinal Interaction Effect

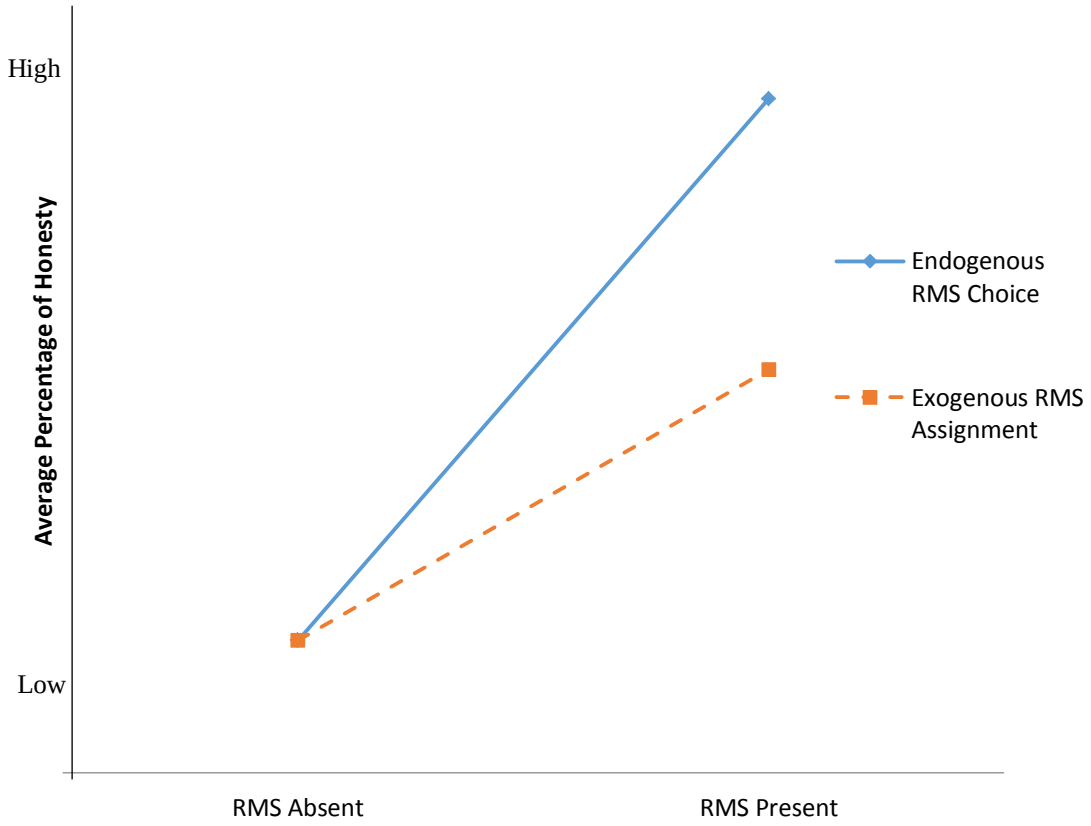


FIGURE 4

Experimental Procedures

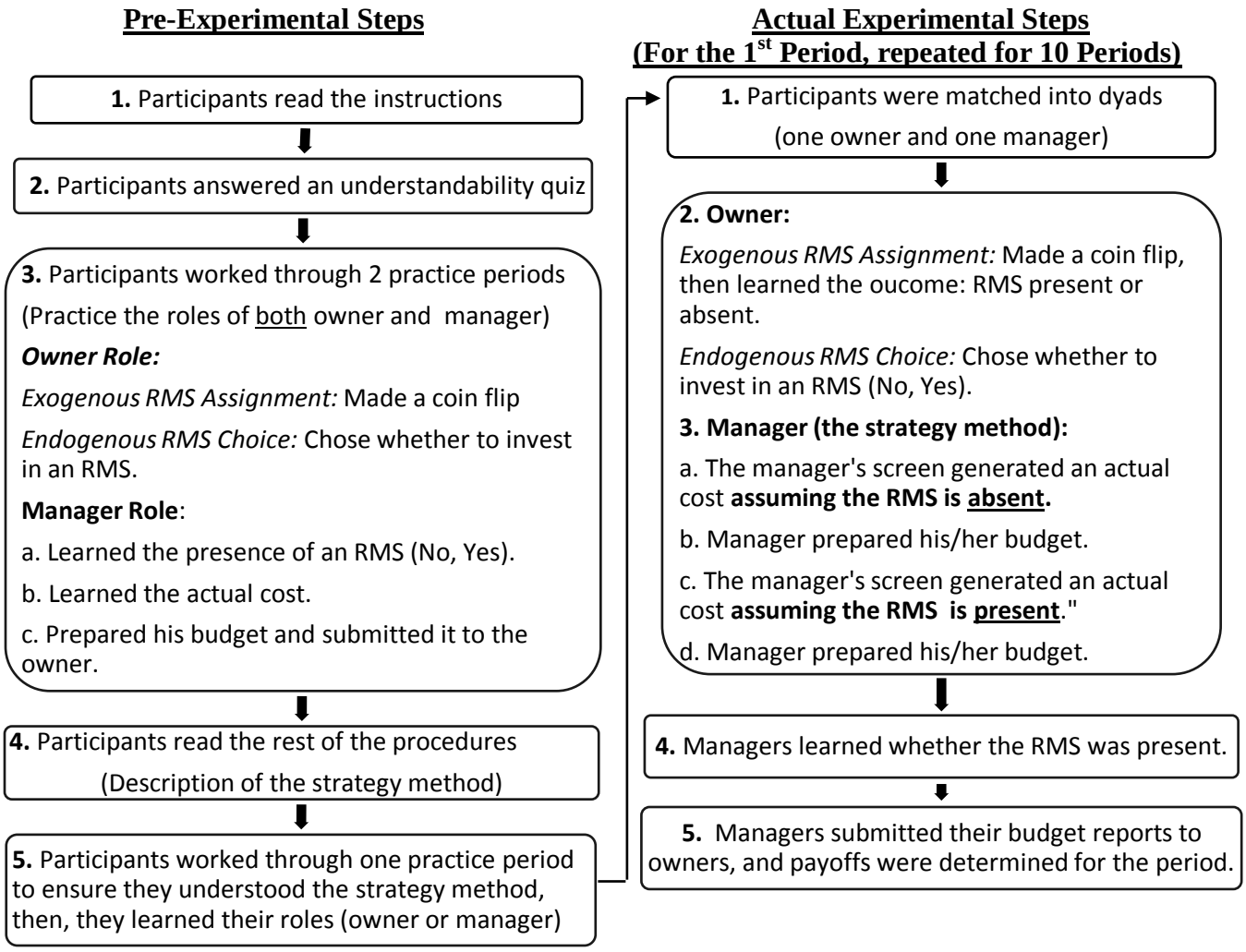


FIGURE 5

Average Percentage of Honesty for the Five Equal-Cost Periods by Condition (Controlling for the Total Available Slack across the Four Conditions)

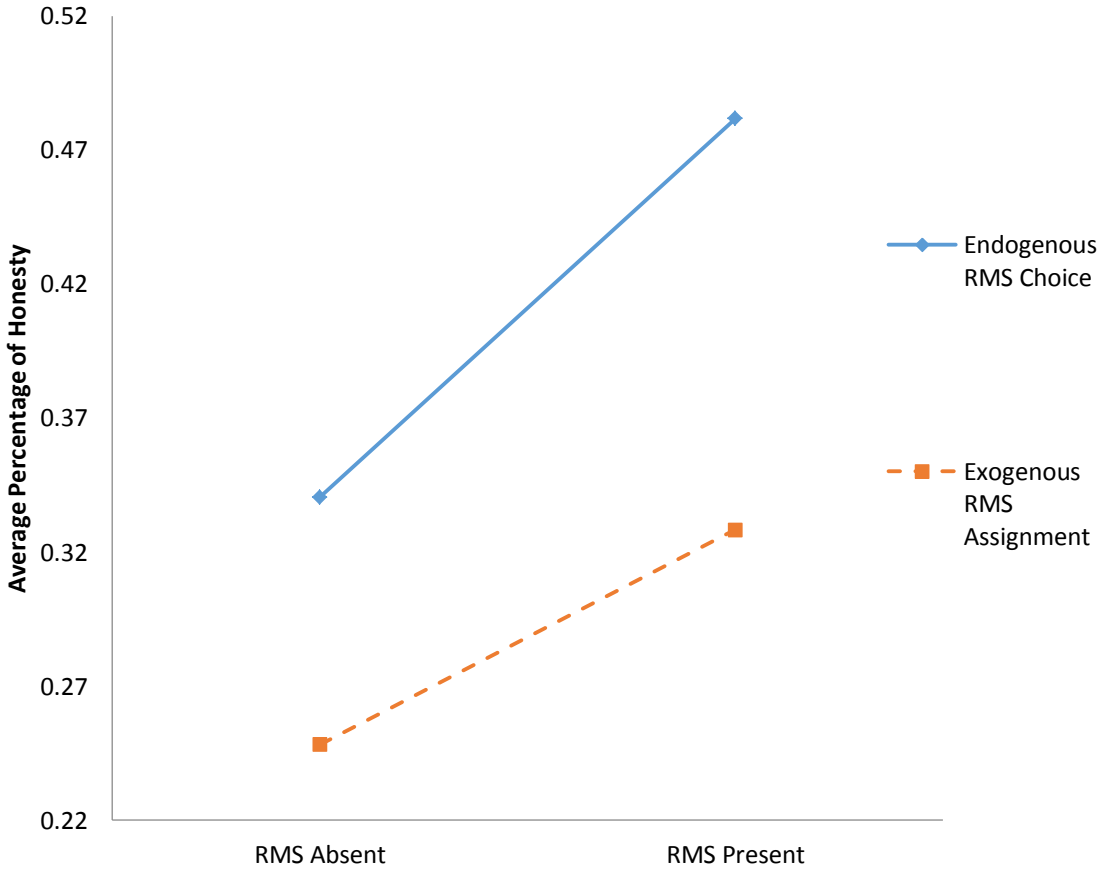


FIGURE 6

Average Percentage of Honesty by Period over Time

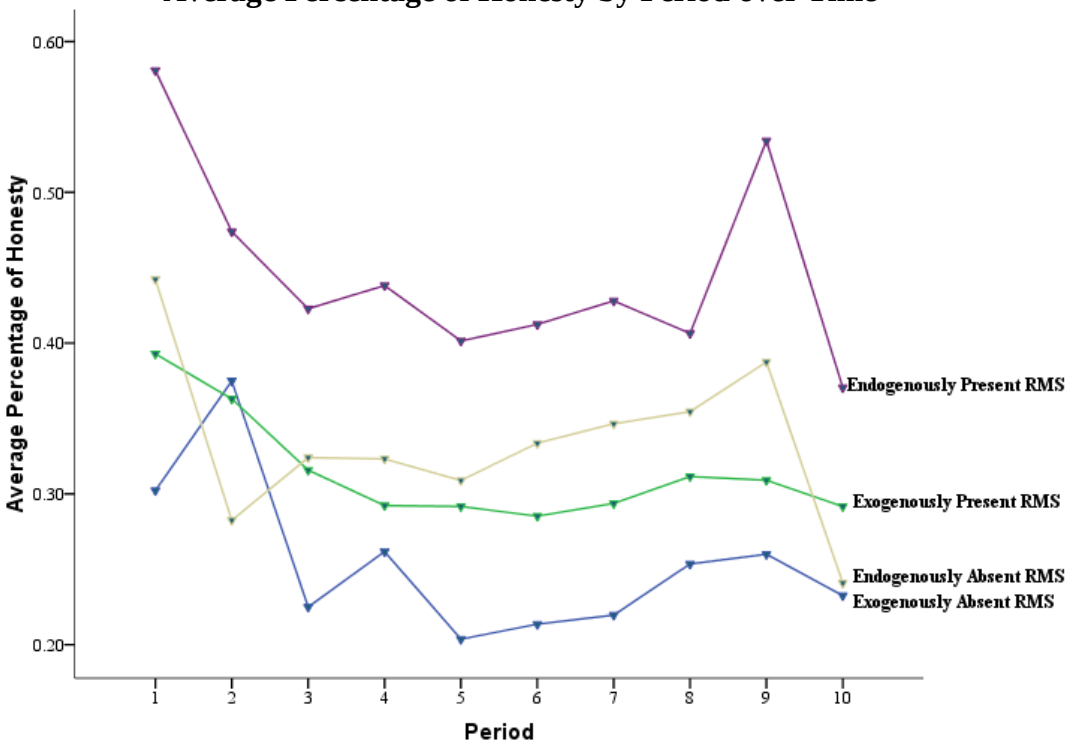
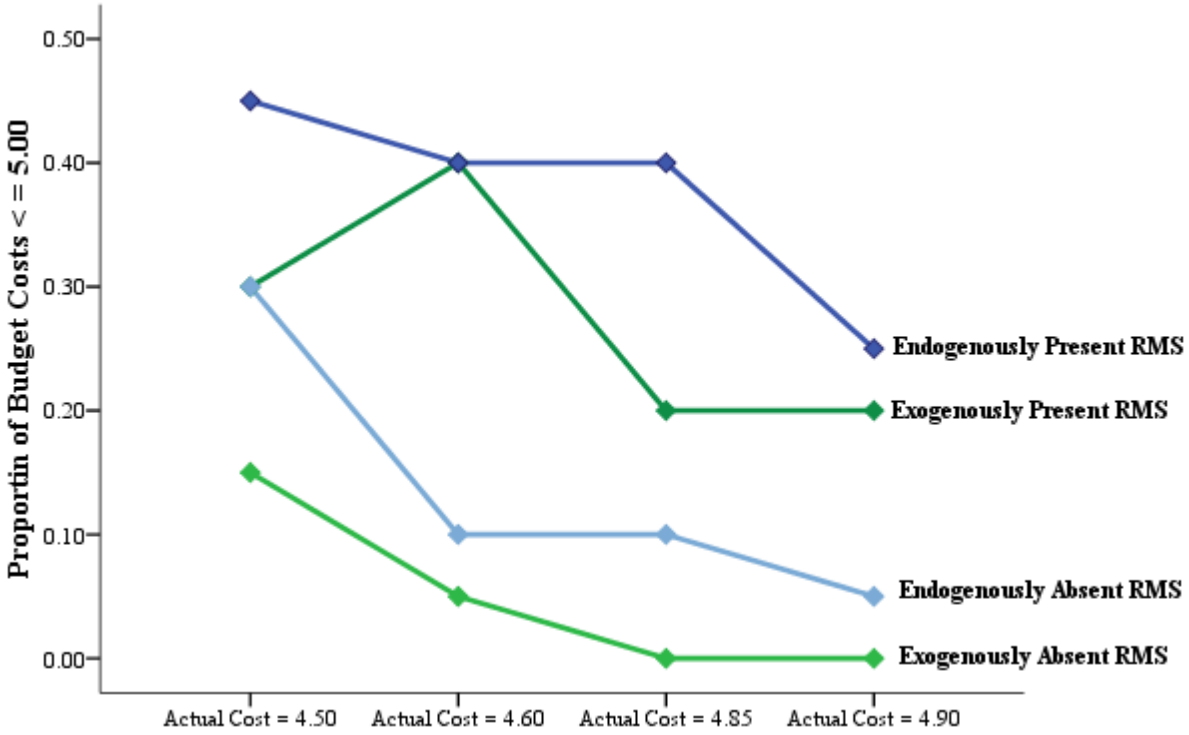


FIGURE 7

Proportion of Managers' Cost Reports within the Favorable Cost Range {4.00,..5.00} when the Realized Costs were within the Favorable Cost Range for Equal-Cost Periods (Controlling for Available Slack across the Four Conditions)



Actual costs ≤ 5.00 realized by managers in the four conditions

TABLE 1

Experimental Design

Presence of an RMS / Determinant of an RMS Presence	No	Yes
Exogenous Assignment (RMS presence is based on a within-subjects automated coin flip each period).	**Exogenously Absent RMS** { 50% Probability of the Lower Cost Range 50% Probability of the Higher Cost Range }	**Exogenously Present RMS** { 90% Probability of the Lower Cost Range 10% Probability of the Higher Cost Range }
Endogenous Choice (RMS presence is based on owner's investment choice each period).	**Endogenously Absent RMS** { 50% Probability of the Lower Cost Range 50% Probability of the Higher Cost Range }	**Endogenously Present RMS** { 90% Probability of the Lower Cost Range 10% Probability of the Higher Cost Range }

TABLE 2

Descriptive Statistics: All Decision Periods

Panel A: Proportion of Cost Reports within the Lower Cost Range {4.00,..5.00} when Realized Costs were within the Lower Cost Range

Treatment		RMS Absent	RMS Present	Total
Exogenous RMS Assignment	*n*	20	20	40
	mean	5%	31.6%	18.3%
	(s.d.)	(14.3)	(37.5)	(31.1)
Endogenous RMS Choice	*n*	20	20	40
	mean	13%	36.6%	24.8%
	(s.d.)	(21.7)	(39)	(33.4)
Total	*n*	40	40	80
	mean	9%	34.2%	21.6%
	(s.d.)	(18.6)	(37.8)	(32.2)

Panel B: Average Percentage of Honesty

Treatment		RMS Absent	RMS Present	Total
Exogenous RMS Assignment	*n*	20	20	40
	mean	25.5%	31.3%	28.4%
	(s.d.)	(33)	(13)	(33)
Endogenous RMS Choice	*n*	20	20	40
	mean	33.4%	44.7%	39.1%
	(s.d.)	(27)	(30)	(29)
Total	*n*	40	40	80
	mean	29.5%	40.5%	33.7%
	(s.d.)	(31)	(33)	(32)

Panel C: Owners' RMS Investment Choice in the Endogenous RMS Choice Treatment

	All Ten Periods (1-10)			Early Periods (1 – 5)			Later Periods (6 – 10)		
Condition	Not to Invest	Invest	% Invest	Not to Invest	Invest	% Invest	Not to Invest	Invest	% Invest
Endogenous Choice (*n* = 20)	96	104	52%	40	60	60%	56	44	44%

Notes:

Manipulation: The determinant of RMS presence is manipulated between subjects at two levels: exogenous assignment and endogenous owner choice. RMS presence is manipulated within subjects: absent and present.

Panel A: Proportion of cost reports within the lower cost range (participant-level measure) = number of cost reports within the lower cost range for all periods with realized costs within the lower cost range ÷ number of periods with realized costs within the lower cost range.

Panel B: Average % Honesty (participant-level measure) = 1- (slack claimed ÷ slack available) averaged across the ten decision periods. Higher values represent higher managerial honesty.

Panel C: Proportion of investment (% Invest) in the Endogenous RMS Choice treatment (participant-level measure) = total number of investments in the ten periods ÷ 10.

TABLE 3

Descriptive Statistics: Equal-Cost Periods[#]
(Controlling for the Total Available Slack across the Four Conditions)

Panel A: Proportion of Cost Reports within the Lower Cost Range {4.00,..5.00} when Realized Costs were within the Lower Cost Range

Treatment		RMS Absent	RMS Present	Total
Exogenous RMS Assignment	*n*	20	20	40
	mean	5%	27.5%	16.3%
	(s.d.)	(21.9)	(44.9)	(37)
Endogenous RMS Choice	*n*	20	20	40
	mean	13.7%	37.5%	25.2%
	(s.d.)	(34.6)	(48.7)	(42.9)
Total	*n*	40	40	80
	mean	9.4%	32.5%	20.9%
	(s.d.)	(29.2)	(46.9)	(40.7)

Panel B: Average Percentage of Honesty

Treatment		RMS Absent	RMS Present	Total
Exogenous RMS Assignment	*n*	20	20	40
	mean	24.8%	32.8%	28.8%
	(s.d.)	(29)	(34)	(32)
Endogenous RMS Choice	*n*	20	20	40
	mean	34.1	48.2%	41.1%
	(s.d.)	(27)	(29)	(29)
Total	*n*	40	40	80
	mean	29.4%	40.5%	34.9%
	(s.d.)	(28)	(33)	(31)

Notes:

Manipulation: The determinant of RMS presence is manipulated between subjects at two levels: exogenous assignment and endogenous owner choice. RMS presence is manipulated within subjects: absent and present.

#Equal-Cost Periods are the five periods in which managers observed the same cost signal across the four experimental conditions. Therefore, the total slack available for managers was equal across the equal-cost periods.

Panel A: Proportion of cost reports within the lower cost range (participant-level measure) = number of cost reports within the lower cost range for the four equal-cost periods with realized costs within the lower cost range ÷ 4. The use of the equal-cost periods controls for the total available slack across the four conditions.

Panel B: Average % Honesty (participant-level measure) = 1- (slack claimed ÷ slack available) averaged across the five equal-cost periods. Higher values represent higher managerial honesty. The use of the equal-cost periods controls for the total available slack across the four conditions in the analysis.

TABLE 4

Hypotheses Testing

Panel A: Test of H1 (Repeated-Measures ANOVA) - Managers' cost reports are more likely to fall within the favorable cost range when an RMS is present

Source	df	MS	F-stat	p-vaue
Intercept	1	14.028	45.880	.000
RMS Presence	1	4.278	13.992	**.000***
Endogenous RMS Choice	1	.703	2.300	.134
RMS Presence x Endogenous RMS Choice	1	.003	.010	.920
Error	76	.306		

Panel B: Test of H2 – Owners' investment in an RMS positively correlates with owners' belief that an RMS is a signal of trust

Correlation	*n*	r	p-value
Pearson Correlation	20	0.32	**0.08***
Spearman Correlation	20	0.41	**0.03****

Panel C: Test of H3 – The presence of an RMS positively affects managers' honesty in reporting to a greater extent when the RMS is an endogenous owner's choice

Source of Variation	df	MS	F-stat	p-value (one-tailed)
Model Contrast (+3, +1, -2, -2)	3	0.056	4.25	**0.02****
Error	76			

Notes:

Experimental manipulation: The determinant of RMS presence is manipulated between subjects at two levels: exogenous assignment and endogenous owner choice. RMS presence is manipulated within subjects: absent and present.

Panel A: Dependent variable: Proportion of cost reports within the lower cost range (participant-level measure) = (number of cost reports within the lower cost range in the four equal-cost periods with realized cost within the lower cost range ÷ 4). The use of equal-cost periods controls for the total available slack across the four conditions.

Panel B: Test of correlation between: (a) Owner participant-level measure of proportion of investment = total number of investments in the ten periods ÷ 10 and (b) response to the exit questionnaire item "When corporate headquarters managers decided to deduct 410 lira from their endowment to change the probability distribution of costs, they decided to trust the division manager" on a 7-point likert scale with 1 labeled "strongly disagree", 4 labeled "neutral", and 7 labeled "strongly agree".

Panel C: Planned Contrast Test: +3 × Endogenously Present RMS +1 × Exogenously Present RMS -2 × Endogenously Absent RMS -2 × Exogenously Absent RMS. Dependent variable: Average % Honesty (participant-level measure) = 1-(Slack Created ÷ Slack Available) averaged across the five equal-cost periods. The use of equal-cost periods controls for the total available slack across the four conditions in the analysis.

**, * Indicate statistically significant at the 0.05 and 0.10 levels, respectively, in a one-tailed or two-tailed test. Reported significance tests for directional predictions are one-tailed and are shown in bold.

TABLE 5

Supplemental Analysis

Panel A: Simple Main Effects on Average Percentage of Honesty

Comparison	df	t-stat	p-value
Effect of RMS Presence within Exogenous Assignment: Exogenously Absent RMS *vs.* Exogenously Present RMS	19	2.39	**0.01****
Effect of RMS Presence within Endogenous Choice: Endogenously Absent RMS *vs.* Endogenously Present RMS	19	3.73	**<0.01****
Effect of Endogenous Choice within Absent RMS: Exogenously Absent RMS *vs.* Endogenously Absent RMS	38	1.02	0.31
Effect of Endogenous Choice within Present RMS: Exogenously Present RMS *vs.* Endogenously Present RMS	38	1.50	**0.07***

Panel B: OLS Regression of Average Percentage of Honesty – *Endogenous RMS Choice Treatment*

	Model 1 Endogen. Present RMS			**Model 2 Endogen. Absent RMS**		
Independent Variable	Expected sign	β	p-value	Expected sign	B	p-value
Intercept	?	-0.55	0.14	?	0.07	0.74
Investment (Noninvestment) is a signal of trust (distrust)	+	0.09	0.14	No sign	0.07	0.11
A desire to reward (punish) the owners' trust (distrust)	+	0.11	**0.01****	No sign	-0.03	0.38
Adjusted R^2		0.35			0.15	

Notes:

Panel A: For within-subject treatment effects (the first two comparisons), the tests are paired t-tests where each participant counts as a single independent observation. For the between-subject treatment effects (the last two comparisons), the tests are two-sample t-tests where each participant counts as a single independent observation. Dependent variable: Average % Honesty (participant-level measure) = 1-(slack claimed ÷ slack available) averaged across the five equal-cost periods. The use of equal-cost periods controls for the total available slack across the four conditions in the analysis.

Panel B: Model 1: Regression of Average % Honesty in the Endogenously Present RMS condition on responses to the two exit questionnaire items "When corporate headquarters managers decided to change the probability distribution of costs, they decided to trust the division manager" and "When corporate headquarters managers decided to change the probability distribution of costs, division managers felt that they needed to reward corporate headquarters managers for trusting them". Model 2: Regression of Average % Honesty in the Endogenously Absent RMS condition on the two exit questionnaire items "When corporate headquarters managers decided to keep the probability distribution of costs, they decided not to trust the division manager" and "When corporate headquarters managers decided to keep the probability distribution of costs, division managers felt that they needed to punish corporate headquarters managers for not trusting them".

**, * Indicate statistically significant at the 0.05 and 0.10 levels, respectively, in a one-tailed or two-tailed test.

Reported significance tests for directional predictions are one-tailed and are shown in bold.