

Management Control Using Non-Binding Budgetary Announcements

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ABSTRACT

We use an experiment to investigate the efficacy of a non-binding budgetary announcement made by an owner in order to mitigate a management control problem induced by asymmetric information. The owner's announcement indicates how much funding she will provide for each possible cost report by the manager regarding an investment opportunity. The manager has private knowledge of the cost, incentive to overstate it, and the ability to do so undetected by the owner. The experiment consists of three treatments: (1) the owner fully commits to honor her announcement regarding how she will use the manager's cost report, (2) the owner makes no announcement at all, and (3) the owner makes a non-binding announcement regarding how she will use the manager's cost report. The first two treatments establish empirical benchmarks to gauge the effectiveness of the non-binding announcement. There are three main results. First, owners in the non-binding announcement treatment significantly outperform those in the no announcement treatment throughout the experiment. Second, owners appear to use the non-binding announcement as a bluff in an attempt to convince managers that they will reject a profitable project more often than they intend. This strategy appears to be particularly effective for the owners in the first half of the experiment. Third, the difference in owner welfare between the non-binding announcement and binding announcement treatments is much less than the prediction made from standard game-theoretic assumptions. The third result suggests that, to the extent that commitment is costly, an optimal control system might not employ commitment.

Keywords: capital budgeting; commitment; experiment

Data Availability: The data are available from the contact author.

I. INTRODUCTION

Budgeting problems have received considerable attention from accounting researchers. Early studies addressed the allocation of capital within the firm assuming there were no information asymmetries. More recently, researchers have investigated settings in which the rationing of capital arises endogenously due to the presence of information asymmetries and goal incongruence (Antle and Eppen 1985). The budgeting problem we focus on is of the second type in which a central headquarters (owner) must elicit information from a better-informed subordinate (manager) regarding the cost or profitability of a potential investment. Problems of this type have been studied extensively through the use of theoretical analysis; see Antle and Fellingham (1997) for a comprehensive review. These analyses generally assume the owner has full and costless powers of commitment to an *ex ante* budget. They demonstrate that, by using her powers of commitment, the owner may efficiently reduce the manager's consumption of slack. Our interest in examining issues related to owner commitment in budgeting is motivated by the observation that the assumption of full and costless commitment is crucial in deriving an optimal solution, yet it might not be appropriate in modeling some budgeting settings.

The assumption of full and costless commitment might not be appropriate for two reasons. First, it is costly to anticipate and contract on all possible contingencies. Second, the owner generally finds it *ex ante* efficient to commit to actions that are *ex post* inefficient. As a consequence of the second reason, the owner and subordinate often arrive at a situation where *both* parties would prefer to renegotiate (Demski and Frimor 1999; Baiman 1990). Thus, full commitment by the owner to a budget is frequently

unattainable and, even when full commitment is attainable, its cost may outweigh its benefits. This finding motivates interest in *non-binding* budgetary announcements. Experiments have shown that budgets, even if unsupported by full commitment, can be useful in informing other members of the firm about the owner's intentions (Kachelmeier, Smith, and Yancey 1994). There is also empirical evidence that non-binding announcements are regularly used in the budgeting process (Umapathy 1987). We use an experiment to examine whether non-binding budgetary announcements are effective in mitigating the owner's welfare losses attributable to an information asymmetry. Specifically, we compare the effect of using non-binding budgets to that of using fully binding budgets and that of using no budgetary announcements.

Our experiment is based on the capital investment model introduced in Antle and Eppen (1985). In the model, a manager obtains pre-decision cost information related to a potential investment. In an *ex ante* efficient contract, the owner reduces the manager's expected slack by committing to a budget that implies *ex post* she will turn down some positive net present value investments. Thus, the assumption of full commitment is crucial. The Antle and Eppen setting is especially useful for investigating the efficacy of a non-binding budgetary announcement, given the stark contrast in game-theoretic predictions derived from assumptions of full commitment versus no commitment. Given full commitment, equilibrium production decisions are *ex post* inefficient but the owner obtains, in expectation, a large share of the surplus. Under the no commitment equilibrium, the manager essentially "holds up" the owner by submitting the highest feasible cost report that would cause the owner to prefer investing to not investing (Milgrom and Roberts 1992, 137-8).

It is helpful to contrast our investigation with the experimental study of Kachelmeier et al. (1994). Their experiment shows that a non-binding budgetary announcement can be useful in eliminating an equilibrium not desired by the owner, in accordance with equilibrium refinements found in Farrell (1983; 1987). In contrast, in our study a non-binding announcement would have no effect if all individuals were fully rational, individual-wealth-maximizers. However, numerous laboratory studies find that subject behavior deviates from rational, individual wealth maximization in important ways. For example, the extensive laboratory study of the ultimatum game, a variant of which resembles the budgeting setting that we study, demonstrates that subjects reject profitable offers, even though the game-theoretic prediction is that they should accept them (Huck 1999). The explanation put forth for this seemingly irrational behavior is that individuals exhibit a preference for fairness. Evans, Hannan, Krishnan, and Moser (2001) (hereafter EHKM) use a setting similar to ours, except they do not investigate non-binding announcements. They also find evidence of a preference for fairness, as well as for honesty.

We incorporate an individual's preference for fairness into two different conjectures regarding how a non-binding budgetary announcement might be useful to the owner. The *signaling* conjecture predicts owners will use non-binding announcements to truthfully signal their sense of what they consider to be fair offers by managers. If this conjecture holds and the managers believe the owners' signals, the combined welfare of owners and managers will be increased due to a reduction in the frequency of disagreements. In contrast, the *bluffing* conjecture predicts that owners will use their announcements to misrepresent their sense of fairness. If this conjecture holds and

managers naively believe owners' misrepresentations, owners will be able to extract wealth from managers. The data provided by the experiment allows us to distinguish between these two behavioral conjectures, as well as conjectures based upon *full rationality*.

Our experiment consists of three treatments. Two are baseline treatments: *binding announcements* by the owner regarding the maximum funds she will supply to the manager (analogous to full commitment) and *no announcement* (binding or otherwise). In the third treatment, the owner makes a *non-binding announcement* regarding the maximum funds she *intends* to supply - an announcement the owner might not necessarily adhere to subsequent to receiving the manager's report. Given the prior experimental results providing evidence of motivations other than individual wealth maximization, the two baseline treatments, as opposed to the theoretical predictions, establish the appropriate benchmarks. Therefore, in order to properly gauge the incremental effects of the owner's non-binding announcement, we compare the results from our non-binding announcement treatment to these baseline treatments.

Our main result is that the owners' welfare is significantly greater in the non-binding announcement treatment than in the no announcement treatment throughout the entire experiment, even though from the standpoint of fully rational, individual wealth maximization there should be no difference. The owners' welfare is less in the non-binding announcement treatment than in the binding announcement treatment. Therefore, our results support the conventional position that when full and costless commitment is available, it should be employed. However, full commitment is rarely, if ever, costless. In our experiment the benefit to the owner of full commitment was much smaller in

magnitude than predicted by standard game-theoretic analysis. This result suggests that, when full commitment is costly, it may be efficient to substitute non-binding announcements for full commitment.

At the detailed level, the results are consistent with the conjecture that the owner used the non-binding announcement as a bluff. In particular, we found that owners funded almost 60 percent of the cost reports that were above their announced budget. This result held throughout the entire experiment. The owners' attempts to bluff were particularly effective in the first half (25 rounds) of the experiment, where not only did non-binding announcements perform better than no announcements, but also the owners did nearly as well with non-binding announcements as with binding announcements.

The paper proceeds as follows. Section II describes the experiment. Sections III and IV describe our behavioral predictions and results, respectively. Section V provides a discussion and summary.

II. EXPERIMENTAL METHOD

In total, 60 undergraduate students from a large university participated in the experiment. The subjects interacted through a computer network and were separated by partitions. There were three treatments: Binding Announcement (BA), Non-Binding Announcement (NBA), and No-Announcement (NA). Each student participated in only one treatment. Each treatment was run in a single session of 20 subjects.

Elements Common to All Treatments

In all three treatments, the game consists of an owner and a manager of a firm. To avoid role-playing, in the administration of the experiment these roles were referred to as

Position 1 and Position 2, respectively. The owner is the residual claimant to a production process. The cost of production follows a uniform distribution with positive support on $C \equiv \{.00, .01, .02, \dots, 1.99, 2.00\}$. If implemented, the project yields certain revenue of \$2.00 to the owner.

Prior to production, the manager learns the cost. The owner never learns the cost. Before deciding whether or not to produce, the owner elicits a cost report from the manager. The manager's report is constrained to belong to the set C , but need not be truthful. After receiving the manager's report, the owner decides whether to fund production. This decision may be constrained by prior owner commitments, depending on the experimental treatment, as described below. If production is funded, the owner and manager payoffs are $(\$2.00 - \text{manager report})$ and $(\text{manager report} - \text{actual cost})$, respectively. If production is not funded, both the owner and the manager receive a payoff of zero. We refer to an iteration of this setting as a *round*.

Before the experiment began, we distributed instructions and read them aloud to the participants (see Appendix). Next, participants completed a questionnaire to insure that they understood the task and how to compute outcomes and payoffs for themselves and other participants. The experiment lasted for 51 rounds. Subjects remained in their roles as owners or managers for the entire experiment. After each round, the computer randomly re-paired the subjects. This was done in order to simulate a one-shot setting, while providing the subjects with substantial experience. Subjects' computer screens contained a record of all past rounds. The cost sequence used in each treatment was identical, in order to facilitate welfare comparisons among treatments. At the end of the experiment, we paid each subject

with cash, in private. The conversion rate used was one U.S. dollar for every laboratory dollar earned. Additionally, each subject received a flat show-up fee of \$7.50.

Treatments

In the BA treatment, the owner made a binding commitment concerning her use of the manager's report. The commitment took the following form. The owner made a *binding* announcement regarding the greatest cost that would be funded for production. The manager received this announcement prior to the elicitation of the manager's cost report. Any reported cost by the manager at or below the announcement caused production to be funded at the level of the report, while any reported cost above the announcement resulted in no production. Thus, the owner fully committed to her use of the report. Under an assumption of full rationality and individual wealth maximization, in equilibrium the owner would set the budget at \$1 and the manager's best response would be to report the cost as \$1 for actual costs at or below \$1, and to report a cost above \$1 otherwise. The equilibrium yields the owner and manager per-round expected earnings of \$0.50 and \$0.25, respectively.¹

In the NBA and NA treatments, the owner decided after the receipt of the manager's cost report whether or not to fund production — the owner made no *ex ante* commitments to a maximum cost to be funded. In the NA treatment the owner made no announcement of any type. In contrast, in the NBA treatment, prior to eliciting the manager's cost report, the owner made a *non-binding* announcement to the manager regarding her intended maximum level of funding. In the NBA treatment, the owner could still accept projects if the manager reported a cost greater than her announcement. However, the owner could not reject cost reports that were less than the announcement.² In

both treatments, under an assumption of full rationality and individual wealth maximization, the announcement is payoff irrelevant in equilibrium. A subgame perfect equilibrium is characterized as follows. The manager reports the cost is 1.99, except that when the cost is 2.00 he reports 2.00 and the owner always funds the project.³ Effectively, the manager appropriates the entire surplus available from production.

III. BEHAVIORAL PREDICTIONS

We briefly describe several experimental studies that are similar to ours, and hence are useful in forming predictions. The BA benchmark treatment, wherein the owner makes a binding commitment, is similar to EHKM. EHKM found that when the theoretically optimal contract was implemented, the managers lied to a lesser degree than predicted.⁴ When a contract that was more generous to the manager was used, the extent of lying declined. The authors attributed this result to the subjects' tastes for honesty and fairness.⁵

The NA benchmark treatment, wherein the owner can make no announcement, is very similar to the offer variant of the *ultimatum game with one-sided uncertainty* (Mitzkewitz and Nagel 1993; Rapoport and Sundali 1996; Guth and Huck 1997). This version of the ultimatum game involves a surplus to be distributed between an "offeror" and a "receiver". The size of the surplus to be distributed is only known to the offeror (manager). The offeror submits a proposed amount to be given to the receiver (owner). If accepted, the receiver keeps the offered amount, while the offeror keeps the remaining surplus. If rejected, both parties receive nothing. There are two noteworthy and consistent findings from laboratory investigations of this setting: (1) receivers, due presumably to their own preference for fairness, reject some positive-surplus offers and (2) offerors,

either in anticipation of the receivers' preference for fairness or due to their own preference for fairness, usually offer more than the smallest possible amount.

The findings from both EHKM and the ultimatum game experiments indicate that the results from our two baseline treatments, NA and BA, are unlikely to conform to predictions based on assumptions of full rationality and individual wealth maximization. This underscores the necessity of using empirical rather analytical benchmarks in this study. More importantly, the results from the ultimatum experiments, and the behavioral theories used to explain them, suggest ways in which a non-binding announcement might be useful. Below we develop two behavioral conjectures regarding the manner in which non-binding announcements may be useful to the owner. We describe the associated owner and manager behavior for each conjecture and develop hypotheses. Finally, we offer a third conjecture in which managers in the NBA treatment regard owners' announcements as inconsequential, and describe the corresponding owner and manager behaviors.

Our first behavioral conjecture regarding how non-binding announcements might be beneficial to the owner is that she may use them to truthfully signal the maximum cost report she is willing to fund. The potential credibility of the non-binding announcement as a signal derives from the finding that in ultimatum experiments first-movers anticipate (or learn) that second-movers will reject some positive surplus offers. In the context of our experiment, these prior findings indicate that owners will refuse to fund some cost reports that are strictly less than \$1.99. If owners are using their non-binding announcements to signal their intentions, and if managers are aware of this and respond to the owner's signals accordingly, the frequency of rejected cost reports in the NBA treatment would be less than in the NA treatment. These behaviors would increase the

combined welfare of the owners and managers in the NBA treatment relative to the NA treatment. We label the hypotheses derived from this conjecture as *signaling (SIGNAL)*.

Our second behavioral conjecture regarding how non-binding announcements might be beneficial to owners is that the owner may use the announcement as a bluff. If managers (naively) believe that owners are using the non-binding announcements as a truthful signaling mechanism, the owners' best response is to exploit managers by *falsely* signaling their unwillingness to accept offers that, in fact, they would find acceptable. Taken to the extreme, owners might try to signal an unwillingness to accept reports above \$1.00, the cutoff under the standard game theoretic assumptions under conditions when the owner can commit. If owners and managers behave as described above, owner welfare would be greater in the NBA treatment than in the NA treatment. We label the hypotheses derived from this conjecture as *bluffing (BLUFF)*.

Our third conjecture is based upon the idea that a fully rational manager should ignore the non-binding announcements regarding the owner's maximum acceptable report. If owners anticipate that managers will disregard the announcement, they would best respond by making an announcement at, or anywhere below, their highest acceptable report. Under this third conjecture, the prediction regarding announcement behavior in the NBA treatment of our experiment would not be different from that under the *SIGNAL* or *BLUFF* conjectures. However, we do have a distinct expectation regarding the welfare effect of a non-binding announcement under this third conjecture. We expect that both the owners' and managers' welfare would be similar in the NBA and NA treatments. We label the hypotheses derived from this conjecture as *full rationality (FULLRAT)*. We present our hypotheses below.

Hypothesis 1-SIGNAL: *Owners will not fund cost reports above their non-binding announcement.*

Hypothesis 1-BLUFF: *Owners will fund a non-negligible portion of cost reports above their non-binding announcements.*

Hypothesis 1-FULLRAT: *Owners might or might not fund a non-negligible portion of cost reports above their non-binding announcements.*

Hypothesis 2-SIGNAL: *The combined welfare of owners and managers will be greater in the non-binding announcement treatment than in the no-announcement treatment.*

Hypothesis 2-BLUFF: *Owners will have greater welfare in the non-binding announcement treatment than in the no-announcement treatment.*

Hypothesis 2-FULLRAT: *Owners will have equal welfare in the non-binding announcement treatment and no-announcement treatment.*

We also are naturally interested in the comparison between the BA and the NBA treatments. We do not formulate any specific hypotheses, because none of the three conjectures implies a relationship between owner earnings in these two treatments. For example, even if owners are able to successfully use the non-binding announcement as a bluff, this does not imply that they will entirely overcome the managers' strategic advantage that exists when owner commitment is lacking. Therefore, our comparison of owner earnings in the binding announcement and non-binding announcement treatments is presented on an exploratory basis.

IV. RESULTS

In Tables 1a and 1b we present an overview of the results. Table 1a presents mean values of owner announcements, owner welfare, manager welfare and total welfare under each treatment. We also report an efficiency measure, the percent of production funded, and the predictions derived under fully rational, individual wealth maximization. The data in Table 1a are partitioned by halves, with Half 1 representing rounds 1 through 25 and Half 2 representing rounds 26 through 51. Table 1b presents the empirical distribution of the announcements and reports for each treatment.

Several aspects of the results indicate that in all three treatments behavior is inconsistent with the predictions derived from fully rational, individual wealth maximization. For example, in BA, the mean cutoff is 1.142. Treating an owner as the unit of observation (we aggregate the data from each owner into a single observation), the announcement over all rounds is significantly above the theoretical prediction of 1.00 ($p = .001$ from a Wilcoxon signed rank test).⁶ Interestingly, Table 1b-Panel A shows that the modal range of cutoffs chosen by owners in BA is 1.21-1.30. This range is quite close to 1.33, which is the announcement that, if binding, would imply an equal split of the surplus.⁷ A second aspect of the results that is inconsistent with fully rational, individual wealth maximization is that reports in the NA treatment are not clustered around 2.00, as shown in Table 1b-Panel B. In particular, approximately 84 percent of the reports in NA are less than 1.90.⁸

Given the results of prior experiments, these results are not surprising. In fact, it was because we expected significant deviations from game-theoretic predictions that the

two baseline treatments were administered, so as to provide the appropriate benchmarks for the NBA treatment.

Inspection of Table 1a reveals that non-binding announcements appear to have an effect consistent with mitigating the control problem inherent in our setting. In Half 1 of the experiment, owners in NBA did better than in NA — their mean per-round earnings were .406 versus .328 in Half 1 in treatments NBA and NA, respectively. Owners did not do as well in NBA as in BA — their mean per-round earnings were .448 in BA. In Half 2, owners in NBA continue to do better than in NA, although to a lesser degree — their mean per-round earnings were .326 versus .287 in Half 2 in treatments NBA and NA, respectively. In Half 2, the distinction between BA and NBA is clearer — the BA treatment yielded mean per-round owner earnings of .401. Non-parametric statistical tests of the differences are provided when we address the formal hypotheses.

[Insert Table 1 about here]

Analysis of Hypotheses

Our first set of hypotheses concerns whether the owners use the non-binding announcement as a truthful signal of their intentions. Of the cost reports that were above the non-binding announcement, owners in NBA funded approximately 60 percent in each half of the experiment. In these instances in which the owners violated their announced intentions, the average report by the manager was 1.48. In the remaining cases wherein the owner did follow her announced intention and rejected the project, the average report was 1.81. Together, these results provide strong disconfirmatory evidence regarding Hypothesis 1-SIGNAL. Further, Table 1a reveals that, contrary to the rationale of

SIGNAL, the relative frequency of production occurring was slightly greater in NA (66 percent) than in NBA (63 percent) over all rounds. Taken together, the evidence is consistent with a rejection of Hypothesis 1-SIGNAL in favor of either Hypothesis 1-BLUFF or Hypothesis 1-FULLRAT.

Our second set of hypotheses concerns the welfare effects of the three treatments. In order to test these hypotheses, we use a Wilcoxon rank-sum test to compare the differences in median per-round owner earnings between the NBA and NA treatments. The mean per round earnings of each owner is the unit of observation. The test yields one-tailed *p*-values of .09, .14 and .05 for Half 1, Half 2 and All Rounds, respectively.⁹ We conclude that the data better support Hypothesis 2-BLUFF (owners' welfare will be greater in NBA than in NA) than Hypothesis 2-FULLRAT (owner welfare will be equal in NBA and NA), with the additional observation that the "bluff" becomes less effective with extensive experience. Because total welfare decreased from NA to NBA (.811 to .778, respectively for all rounds), we reject Hypothesis 2-SIGNAL (combined welfare will be greater in NBA than in NA). A final piece of evidence consistent with the *BLUFF* conjecture is the non-binding announcements averaged .972 over all rounds. This is close to the equilibrium cutoff if commitment were possible, which is 1.00. As discussed above, an announcement of 1.00 would maximize owner earnings if the manager believed the bluff.

We conjectured that a non-binding announcement would be useful to the owner if it affected the manager's reporting. Thus far, we have presented only indirect evidence on this issue. Figure 1a provides more direct evidence by showing the mean level of manager reports for the NBA treatment as a function of the actual cost realization and the

announcement. As a basis of comparison we also provide Figure 1b, the mean level of manager reports for the NA treatment as a function of the actual cost realization. We aggregate the data in order to obtain enough observations to allow for meaningful conclusions. Inspection of Figure 1a clearly indicates that in the NBA treatment the managers' cost reports were positively associated with the owners' announcements.¹⁰ This effect occurs primarily within the two lower ranges of costs (higher ranges of surplus). This should not be surprising, because for high cost outcomes the non-binding announcement will on average be much lower than the actual cost. Given that we require the manager's report to be no less than the actual cost, the result is a report well above the owner's announcement.

[Insert Figure 1 about here]

Although preferences for honesty are not the focus of this study, we provide a brief discussion of our results as they relate to the issue of honesty. Inspection of both Figure 1a and 1b indicate that managers' cost reports do vary to some extent with the actual cost realization, which might be indicative of managers' preferences for honesty as well as fairness. This can be most clearly seen in Figure 1b where there is no potential confounding of the effects of the cost realization with the effects of the announcement. For example, in the NA treatment when the cost realization was between .51 and 1.00 the mean report was 1.53, whereas when the mean cost realization was between .00 and .50 the mean report was 1.45. Put differently, given an increase of .50 in the total surplus, the managers offered the owners an additional .08 on average. Prior literature offers limited guidance on interpreting these results. EHKM interpret their results to suggest that when

managers faced contracts that provided them with a larger share of the total wealth, they increased their honesty. Because the NA and NBA treatments are clearly more favorable to managers than the BA treatment, our results might be interpreted to suggest that an increase in fairness produces an increase in honesty.

However, in the Mitzkewitz and Nagel (1993) study of the ultimatum game with one-sided uncertainty they found that subject offers varied with the amount of the available surplus. In their study the surplus ranged from one to six, and when the surplus was six, the modal offer was two. However, when the surplus was three, the modal offer was 1.5. That is, the size of the offer was positively associated with the size of the surplus. This finding is analogous to ours, in that we found that the cost reports were positively associated with the actual costs. Their study did not include a reporting task, so preferences for honest reporting could not have been a factor in offeror behavior. Therefore, the Mitzkewitz and Nagel results indicate that we might expect to find a positive association between cost reports and actual costs, without it being attributable to a preference for honesty on the part of managers. Because we did not manipulate the presence and absence of reporting, we cannot distinguish the effects of preferences for honesty and fairness based solely on our data.

Additional Analyses

Two salient issues not yet addressed are the significance of the difference between owner earnings in the BA and NBA and the dynamics of play through time. First, we address the natural question of whether commitment was helpful to owners. Our behavioral conjectures have not provided us with a prediction concerning which treatment will lead to larger owner earnings. We therefore conduct a Wilcoxon rank-sum

test of the difference in medians between the BA and NBA treatments and report two-tailed p-values, which are .31, .02, and .10 for the Half 1, Half 2, and All Rounds, respectively.¹¹ Our results are consistent with the notion that commitment becomes relatively more valuable to owners as their ability to bluff managers dissipates. However, the magnitude of the difference in owner earnings in the BA and NBA treatments remains well below game-theoretic predictions for the entire experiment.

As seen in Table 1a, the difference in owner earnings between the NBA and NA treatments is less in the second half of the experiment. We present a more detailed description of how owner and manager earnings vary over time in Figures 2a and 2b. Figure 2a shows that the owners' welfare in NBA was greater than or equal to that in NA throughout the entire experiment, although the difference narrowed considerably after round 20. The narrowing of the difference in owner earnings between NA and NBA as the experiment continued should not diminish the importance of the finding that non-binding budgets might be useful in mitigating managerial control problems. Our experiment was much longer than the similarly focused generic bargaining experiments by Rapoport and Sundali (1996) and Mitzkewitz and Nagle (1993), which lasted for twenty and eight rounds, respectively. The extended length of our experiment in comparison to the generic bargaining experiments afforded the subjects additional opportunities for learning, which may have decreased the effectiveness of owners' bluff in latter rounds. Also, the graph does not indicate that owner earnings in NBA converged to those in NA. Figure 2b illustrates that manager welfare was larger in NA than in NBA and larger in NBA than in BA throughout the experiment. We consider manager welfare

to be a metric of secondary importance, compared to productive efficiency and owner welfare, because we envision the owner as designing the control system.

[Insert Figure 2 about here]

V. DISCUSSION AND CONCLUSION

The most immediate implication of our results is that, in the absence of full and costless powers of commitment, an owner's non-binding budgetary announcement can be useful in mitigating managerial control problems arising from asymmetric information. This result was obtained despite strong game-theoretic predictions that fully rational, individual-wealth-maximizing agents would ignore such announcements. Therefore, our results would appear to significantly strengthen and expand the conclusions found in Kachelmeier et al. (1994) regarding the usefulness of non-binding budgetary announcements. Further, the difference in owner earnings between the full commitment treatment and the non-commitment treatments is far less than the predictions derived from traditional game-theoretic analysis. Our experiment did not incorporate any commitment costs but, as a practical matter, full commitment is likely to be accompanied by significant costs. Our results suggest that decision makers should keep in mind that the gains from full commitment might be less than expected and should weigh these gains against any commitment costs.

One curious aspect of our results is that the usefulness of non-binding announcements seemed to be predicated on the ability of the owner to use the non-binding announcement as a bluff. This is an effect of intra-firm communication that is not included in most theories of the firm. However, one might question the sustainability of

our results after individuals have gained substantial experience. We suggest that when non-binding announcements are combined with repeated interaction with the same individual, a firm attribute that has been widely investigated in the laboratory, a more complete understanding of the usefulness of non-binding announcements may be obtained. Therefore, the combination of non-binding announcements and repeated interaction would appear a fruitful avenue for future research. Nevertheless, our finding that non-binding budgetary announcements were useful seems particularly significant, in that it occurred in an extreme setting where there was neither an opportunity for repeated interaction nor could the announcements be interpreted as eliminating undesirable equilibria.

Another potential avenue for future research is to explain the conspicuous difference between our finding of virtually no manager honesty in the BA treatment and the considerable degree of honesty found by EHKM. As noted earlier, in very few (about 2 percent) of the instances in our BA treatment did managers display any honesty. We speculate that the cause of these contradictory findings might be the strategically interactive nature of our experiment, which is missing in EHKM, the efficiency wage paid to managers, which is missing in our setting, or the difference in the context described in the experimental instructions to subjects. The strategic interaction of our setting, wherein manager-participants were aware that owner-participants chose the contracts, encouraged managers to attribute fairness intentions to the actions of the owner. To the extent that managers judged owners' intentions in making the binding announcement to be unfair, we would expect managers to be resentful. This might have been the cause of the low levels of truthfulness found in our study. Also, our strategically

interactive setting might have led to more competitive behavior on the part of the managers. In addition, the absence of an efficiency wage in our experiment meant the managers would receive a smaller share of the surplus than owners in the BA treatment. EKHM found lower levels of truthfulness associated with contracts that provided managers with a smaller share of the surplus. Finally, EKHM used context-rich language, while our experiment featured more neutral language. Therefore, the notion that over-reporting a cost was, in fact, lying was made more salient in EHKM. We note that our experiment was not designed to discern between these or any other explanations for reporting behavior. Clearly, however, the antecedents of dishonest reporting are of interest to accounting researchers. Therefore, experimentation designed to further distinguish between the differences found in the BA treatment of our experiment and EHKM would be useful.

Appendix

I. Instructions for Non-Binding Announcement Treatment (NBA)

Introduction:

Welcome and thank you for participating in this experiment. Your pay will depend on the decisions you make during the experiment. If you follow the instructions and make appropriate decisions, you can earn an appreciable amount of money. At the end of today's session, you will be paid in private and in cash. It is important that you remain silent and do not look at other people's work. If you have any questions, or need assistance of any kind, please raise your hand and an experimenter will come to you.

Before the first decision round begins participants will be assigned as Position One participants or Position Two participants. Half of the participants will be assigned as Position One participants and half of the participants will be assigned as Position Two participants. You remain as either a Position One or Position Two participant for all decision rounds. Each of you has an assigned subject number. At the beginning of each decision round subjects are randomly paired by subject numbers. There will be 51 decision rounds.

Overview:

Each period the cost of implementing a project is randomly determined and revealed only to the Position Two participant. The cost is randomly drawn each period from the set of possible costs (0, 1, 2, . . . , 200). These numbers represent pennies (i.e., 200 = \$2.00). Each number is equally likely to be drawn each period. The Position Two participant learns the

cost. The Position One participant NEVER LEARNS THE ACTUAL COST. If implemented the project yields revenue of \$2 to the Position One participant.

Position 1 Participants' Task:

Each decision round the Position One participant chooses a reimbursement cutoff amount. This amount represents the maximum amount of project cost that the Position One participant is willing to cover. In other words it is the maximum amount that the Position One participant is willing to reimburse the Position Two participant. This amount is communicated to (sent to) the Position Two participant.

Position 2 Participants' Task:

The Position Two participant observes the actual cost. The Position Two participant also receives the maximum reimbursement amount from the Position One participant. After observing the actual cost and the maximum reimbursement amount the Position Two participant reports a cost to the Position One participant. The reported cost must be equal to or greater than the actual cost. If the reported cost is less than or equal to the reimbursement cutoff then the Position One participant gives the Position Two participant the amount he/she reports. If the reported cost is greater than maximum reimbursement amount the Position One participant either gives the Position Two participant nothing or an amount equal to the Position Two participant's reported cost. Since the project yields revenue of \$2 the payoff to the Position One participant is \$2 minus the amount given to the Position Two participant if the project is implemented and \$0 otherwise. The payoff to the Position Two participant is the amount received from the Position One participant minus the actual cost if the project is implemented and \$0 otherwise.

Example 1:

If the Position One participant chooses a maximum reimbursement amount equal to 68 this means that he/she intends to only reimburse reported costs of up to 68. If the Position Two participant reports 133 then the Position One participant either gives the Position Two participant nothing and both earn 0 or 133 and the Position One participant earns $67 = 200 - 133$ and the Position Two participant earns $133 - \text{actual cost}$.

Example 2:

If the Position One participant chooses a maximum reimbursement amount equal to 125 this means that he/she intends to only reimburse reported costs of up to 125. If the Position Two participant reports 77 then the Position One participant gives 77 to the Position Two participant and the project is implemented. The Position One participant receives a payoff of $123 = 200 - 77$ and the Position Two participant receives $77 - \text{actual cost}$.

Summary and Sequence of Events:

The cost is randomly drawn each period from the set of possible costs (0, 1, 2, . . . , 200). Each number is equally likely to be drawn each period. The Position One participant chooses a reimbursement cutoff amount and this amount is sent to the Position Two participant. This amount represents the maximum amount of project cost that the Position One participant is willing to cover. The Position Two participant learns the actual cost and the maximum reimbursement amount and submits a cost report to the Position One participant. The reported cost must be equal to or greater than the actual cost. If the reported cost is less than or equal to the maximum reimbursement amount then the

Position One participant gives the Position Two participant an amount equal to the reported cost. If the reported cost is greater than the maximum reimbursement amount the Position One participant either gives the Position Two participant nothing or an amount equal to the Position Two participant's reported cost. At the beginning of each decision round subjects are randomly paired by subject numbers. There will be 51 decision rounds.

II. Instructions for Binding Announcement Treatment (BA)

Instructions for the BA treatment are identical to those for the Non-binding Announcement treatment, with the exceptions below.

Position 1 Participants' Task:

Each decision round the Position One participant chooses a reimbursement cutoff amount. This amount represents the maximum amount of project cost that the Position One participant is willing to cover. In other words it is the maximum amount that the Position One participant is willing to reimburse the Position Two participant. This amount is communicated to (sent to) the Position Two participant.

Position 2 Participants' Task:

The Position Two participant observes the actual cost. The Position Two participant also receives the maximum reimbursement amount from the Position One participant. After observing the actual cost and the maximum reimbursement amount the Position Two participant reports a cost to the Position One participant. The reported cost must be equal to or greater than the actual cost. If the reported cost is less than or equal to the reimbursement cutoff then the Position One participant gives the Position Two participant the amount

he/she reports. If the reported cost is greater than the reimbursement cutoff the Position One participant gives the Position Two participant nothing. Since the project yields revenue of \$2 the payoff to the Position One participant is \$2 minus the amount given to the Position Two participant if the project is implemented and \$0 otherwise. The payoff to the Position Two participant is the amount received from the Position One participant minus the actual cost if the project is implemented and \$0 otherwise.

Summary and Sequence of Events:

The cost is randomly drawn each period from the set of possible costs (0, 1, 2,..., 200). Each number is equally likely to be drawn each period. The Position One participant chooses a reimbursement cutoff amount and this amount is sent to the Position Two participant. This amount represents the maximum amount of project cost that the Position One participant is willing to cover. The Position Two participant learns the actual cost and the maximum reimbursement amount and submits a cost report to the Position One participant. The reported cost must be equal to or greater than the actual cost. If the reported cost is less than or equal to the maximum reimbursement amount then the Position One participant gives the Position Two participant an amount equal to the reported cost. If the reported cost is greater than the maximum reimbursement amount then the project is not implemented and the Position Two participant receives nothing. At the beginning of each decision round subjects are randomly paired by subject numbers.

There will be 51 decision rounds.

III. Instructions for No Announcement Treatment (NA)

Instructions for the NA treatment are identical to those for the Non-binding

Announcement treatment, with the exceptions below.

Position 1 Participants' Task:

Each decision round the Position One participant receives a cost report from the Position Two participant. The Position One participant either gives the Position Two participant nothing or an amount equal to the Position Two participant's reported cost.

Position 2 Participants' Task:

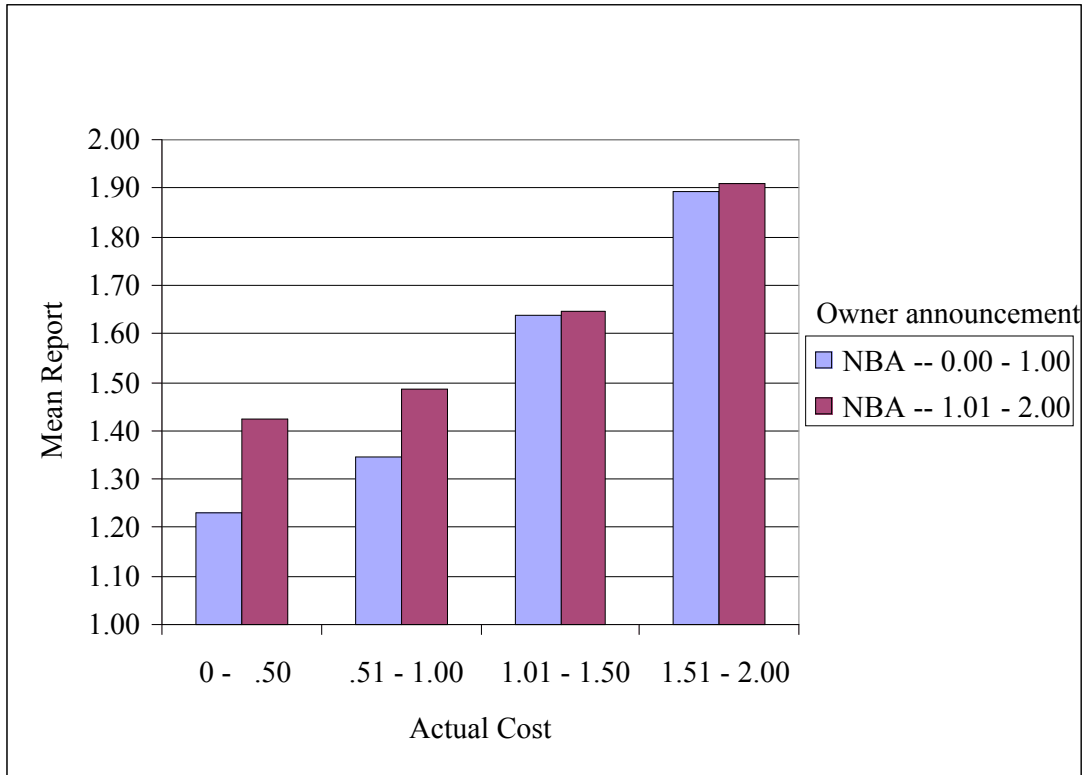
The Position Two participant observes the actual cost. After observing the actual cost the Position Two participant reports a cost to the Position One participant. The reported cost must be equal to or greater than the actual cost. The Position One participant either gives the Position Two participant nothing or an amount equal to the Position Two participant's reported cost. Since the project yields revenue of \$2 the payoff to the Position One participant is \$2 minus the amount given to the Position Two participant if the project is implemented and \$0 otherwise. The payoff to the Position Two participant is the amount received from the Position One participant minus the actual cost if the project is implemented and \$0 otherwise.

Summary and Sequence of Events:

The cost is randomly drawn each period from the set of possible costs (0, 1, 2, ..., 200). Each number is equally likely to be drawn each period. The Position Two participant learns the actual cost and submits a cost report to the Position One participant. The reported cost must be equal to or greater than the actual cost. The Position One participant either gives the Position Two participant nothing or an amount equal to the

Position Two participant's reported cost. At the beginning of each decision round subjects are randomly paired by subject numbers. There will be 51 decision rounds.

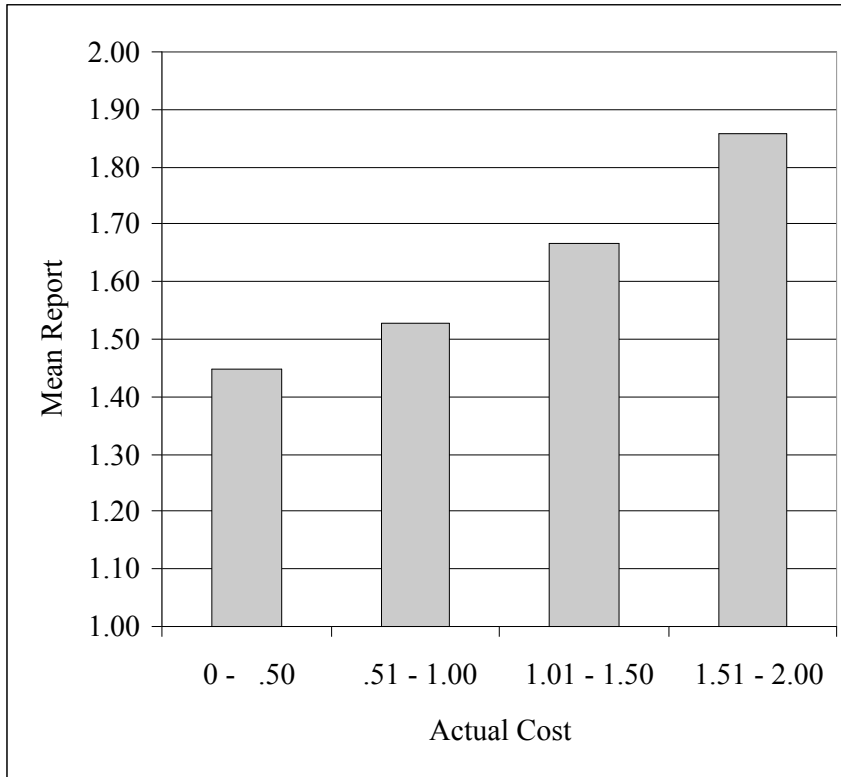
FIGURE 1a: Relationship among Actual Cost, Owner's Non-Binding Announcement, and Manager's Report in NBA Treatment



NBA = Non-binding announcement treatment

FIGURE 1b: Relationship between Actual Cost and Manager's Report in NA

Treatment



NA = No announcement treatment

FIGURE 2a: Owner Earnings Over Time

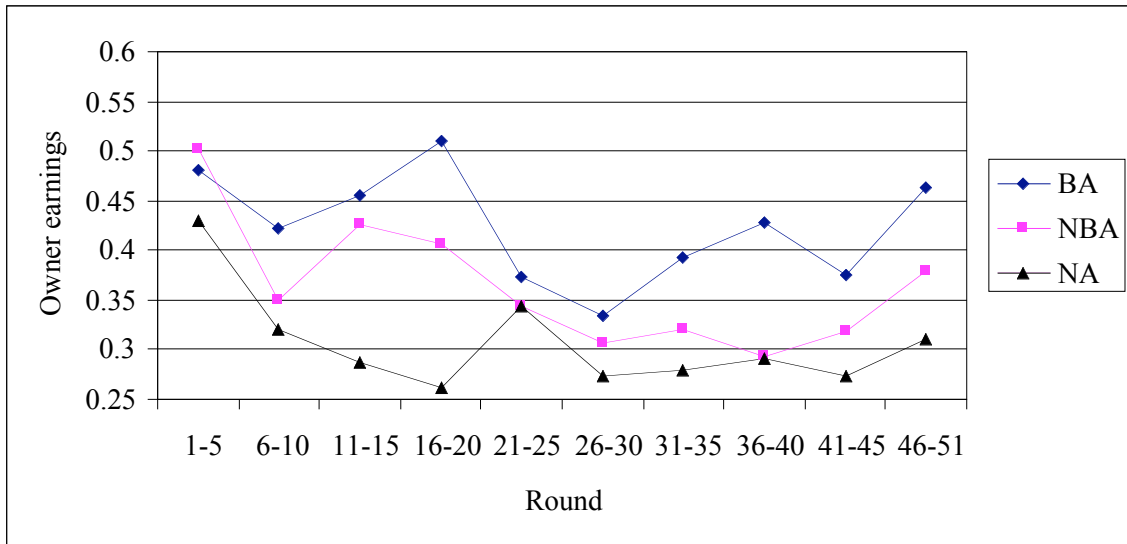
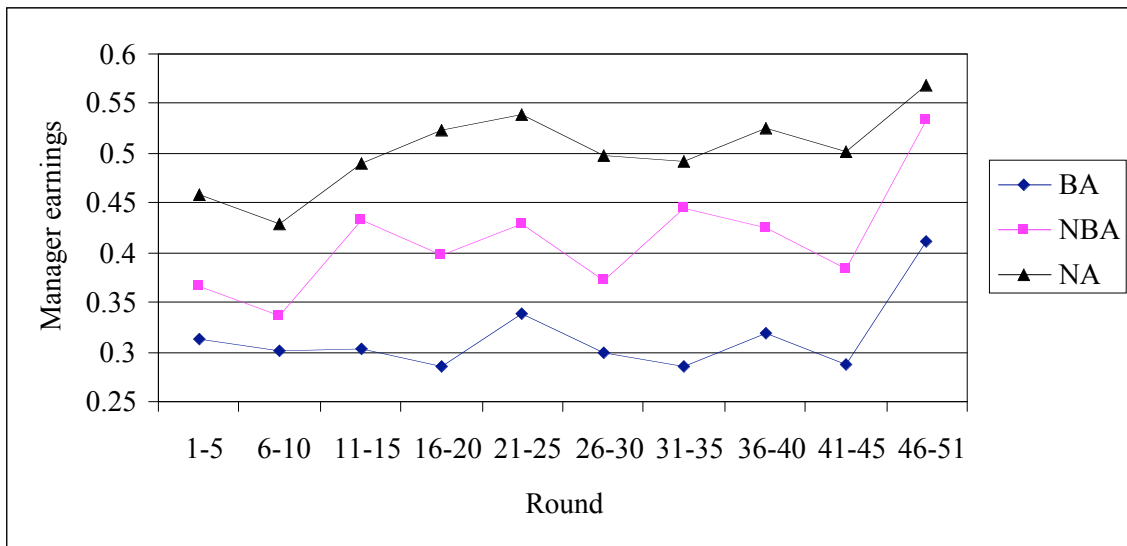


FIGURE 2b: Manager Earnings Over Time



BA = Binding announcement treatment
 NBA = Non-binding announcement treatment
 NA = No announcement treatment

TABLE 1a: Overview of Results: Mean Announcements, Earnings, and Efficiency

Measures

	Mean owner announcement			Mean owner earnings per round			Mean manager earnings per round		
	BA	NBA	NA	BA	NBA	NA	BA	NBA	NA
Game-theoretic	1.000	Any	NA	.500	0	0	.250	1.000	1.000
Half 1	1.099	.951	NA	.448	.406	.328	.308	.392	.488
Half 2	1.183	.992	NA	.401	.326	.287	.324	.436	.519
All Rounds	1.142	.972	NA	.424	.363	.307	.316	.415	.504

	Mean total earning per round			Maximum possible total earnings	Relative efficiency measure			Percentage of rounds with production		
	BA	NBA	NA		BA	NBA	NA	BA	NBA	NA
Game-theoretic	.750	1.000	1.000	1.000	.750	1.000	1.000	50%	100%	100%
Half 1	.756	.798	.816	1.036	.730	.770	.788	52	64	64
Half 2	.725	.762	.806	.994	.729	.767	.811	51	61	68
All rounds	.740	.778	.811	1.015	.729	.766	.799	51	63	66

Mean “Maximum possible total earnings” denotes mean total earnings assuming that investment had taken place in each of the 51 rounds, given the pre-sequenced actual cost realizations in each round. We calculate the “Relative efficiency measure” by dividing actual total earnings by Maximum possible total earnings. The maximum is the same for all three treatments because we used the same pre-sequenced costs in all three treatments.

BA = Binding announcement treatment
 NBA = Non-binding announcement treatment
 NA = No announcement treatment
 Half 1 = Rounds 1-25
 Half 2 = Rounds 26-51

TABLE 1b: Empirical Distributions of Owners' Announcements and Managers' Reports by Announcement Treatment

Panel A: Binding Announcement Treatment

Owners' announcement range	Frequency	Percent	Cumulative frequency	Cumulative percent
0-0.90	76	14.90	76	14.90
0.91-1.00	89	17.45	165	32.35
1.01-1.10	64	12.55	229	44.90
1.11-1.20	71	13.92	300	58.82
1.21-1.30	136	26.67	436	85.49
1.31-1.40	30	5.88	466	91.37
1.41-1.50	15	2.94	481	94.31
1.51-1.60	21	4.12	502	98.43
1.61-1.70	2	0.39	504	98.82
1.71-1.80	5	0.98	509	99.80
1.81-1.90	0	0.00	509	99.80
1.91-2.00	1	0.20	510	100.00

Managers' report range	Frequency	Percent	Cumulative frequency	Cumulative percent
0-0.90	29	5.69	29	5.69
0.91-1.00	44	8.63	73	14.31
1.01-1.10	52	10.20	125	24.51
1.11-1.20	52	10.20	177	34.71
1.21-1.30	93	18.24	270	52.94
1.31-1.40	35	6.86	305	59.80
1.41-1.50	31	6.08	336	65.88
1.51-1.60	28	5.49	364	71.37
1.61-1.70	25	4.90	389	76.27
1.71-1.80	26	5.10	415	81.37
1.81-1.90	16	3.14	431	84.51
1.91-2.00	79	15.49	510	100.00

TABLE 1b: Overview of Reporting and Announcement Results**Panel B: Non-binding Announcement Treatment**

Owners' announcement range	Frequency	Percent	Cumulative frequency	Cumulative percent
0-0.90	184	36.08	184	36.08
0.91-1.00	76	14.90	260	50.98
1.01-1.10	77	15.10	337	66.08
1.11-1.20	47	9.22	384	75.29
1.21-1.30	55	10.78	439	86.08
1.31-1.40	36	7.06	475	93.14
1.41-1.50	32	6.27	507	99.41
1.51-1.60	1	0.20	508	99.61
1.61-1.70	2	0.39	510	100.00

Managers' report range	Frequency	Percent	Cumulative frequency	Cumulative percent
0-0.90	21	4.12	21	4.12
0.91-1.00	16	3.14	37	7.25
1.01-1.10	16	3.14	53	10.39
1.11-1.20	22	4.31	75	14.71
1.21-1.30	23	4.51	98	19.22
1.31-1.40	39	7.65	137	26.86
1.41-1.50	83	16.27	220	43.14
1.51-1.60	62	12.16	282	55.29
1.61-1.70	54	10.59	336	65.88
1.71-1.80	42	8.24	378	74.12
1.81-1.90	48	9.41	426	83.53
1.91-2.00	84	16.47	510	100.00

TABLE 1b: Overview of Reporting Results

Panel C: No Announcement Treatment

Managers' report range	Frequency	Percent	Cumulative frequency	Cumulative percent
0-0.90	7	1.37	7	1.37
0.91-1.00	5	0.98	12	2.35
1.01-1.10	3	0.59	15	2.94
1.11-1.20	14	2.75	29	5.69
1.21-1.30	16	3.14	45	8.82
1.31-1.40	25	4.90	70	13.73
1.41-1.50	77	15.10	147	28.82
1.51-1.60	81	15.88	228	44.71
1.61-1.70	89	17.45	317	62.16
1.71-1.80	84	16.47	401	78.63
1.81-1.90	56	10.98	457	89.61
1.91-2.00	53	10.39	510	100.00

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Endnotes

¹ Note that if the manager reports a cost above \$1, both the manager and the owner would weakly prefer to renegotiate.

² The restriction that the owner may not reject reports below the non-binding announcement was included to reduce subject confusion. Neither fully rational, individual wealth maximization nor any of our behavioral conjectures would provide a rationale for rejecting a report below the non-binding announcement. Therefore, if we observed it, we would have interpreted this behavior as noise. Further, the results reported in Section IV suggest this restriction was not binding — almost 60 percent of the reports above the non-binding announcement were funded. In a similar vein, managers in all treatments could not report the cost below the actual cost. That is, the managers could not choose to lose money.

³ There is another equilibrium where the owner always produces and the manager always reports 2.00. The welfare implications are virtually identical to the one described in the text.

⁴ In EHKM when the actual cost was below the cutoff, a non-negligible fraction of the manager-participants reported costs that were less than the cutoff. This resulted in the managers appropriating less of the surplus than the amount available to them.

⁵ The role of owner was hypothetical in EHKM, potentially making it difficult for subjects to attribute fairness intentions to an experimenter-determined contract. See Falk, Fehr and Fischbacher (2001) for a discussion of fairness intentions.

⁶ One possible explanation for why owners in BA set the cutoff above 1.00 is they believed the managers were sometimes displaying spite. By spite, we mean instances

where the actual cost was just below the cutoff, but the manager reported the cost as above the cutoff, because the cutoff was perceived as being set unfairly by the owner. Another possible explanation is that owners believed managers would report somewhat honestly. However, in contrast to EHKM, we observed virtually no honesty by the managers. In 306 instances where the actual cost was below the cutoff, the manager reported the cost at or above the cutoff 301 times.

⁷ With the cutoff set at 1.33, the owner and manager would each receive expected wealth equal to 0.44.

⁸ Although cost reports were not as great as predicted by standard game-theoretic analysis, for only 12 (15) of the 510 (510) observations in NBA (NA) was the manager's report equal to the actual cost.

⁹ A standard *t*-test produced one-tailed *p*-values of .06, .13 and .04 for the Half 1, Half 2 and All Rounds, respectively.

¹⁰ We also ran a regression on reports versus announcements for the NBA treatment. We controlled for the actual cost outcome and the use of multiple observations from the same subject. We further eliminated all observations where the cost outcome was greater than the announcement. The coefficient on announcements was positive and significant at the .01 level. This further strengthens the conclusion that reports are positively associated with the level of the announcement.

¹¹ We also conducted a Wilcoxon rank-sum test for the difference in median owner earnings between the BA and NA treatments. This test yields two-tailed *p*-values of .03, .01 and .006 for Half 1, Half 2 and All Rounds, respectively