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An experimental investigation of budget rejection authority placement in three-tier hierarchies

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AN EXPERIMENTAL INVESTIGATION OF BUDGET REJECTION AUTHORITY PLACEMENT IN THREE-TIER HIERARCHIES

BY

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ACCEPTANCE

This dissertation was prepared under the direction of the *JAMES C. WILHELM'S* Dissertation Committee. It has been approved and accepted by all members of that committee, and it has been accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy in Business Administration in the J. Mack Robinson College of Business of Georgia State University.

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ABSTRACT

AN EXPERIMEENTAL INVESTIGATION OF BUDGET REJECTION AUTHORITY PLACEMENT IN THREE-TIER HIERARCHIES

BY

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In a participative budgeting setting, this paper examines the relative merits of different choices regarding to whom to assign budget rejection authority in a hierarchical firm. While the participative budgeting literature has traditionally examined dyadic firms (i.e. firms consisting of only an owner and a worker), many firms exist as taller hierarchies. In such firms, the question of where to locate an important budgetary control – rejection authority – in order to promote improved budgetary reporting becomes meaningful. It is hypothesized that delegating budget rejection authority to the manager leads to increased slack consumption by the agent in comparison to the situation in which the principal retains such authority. Research questions address whether the agents report more accurately when both the manager and the principal have rejection authority by comparison to the arrangement in which only one of these individuals hold such power. Results generally suggest that delegating rejection authority to the manager does not entail agency related costs. Further, agent slack capture is least when the control is duplicated but this benefit comes at a substantial decrease in the amount of surplus the firm can capture.

I. Introduction

This study examines how the choice of where to locate budget rejection authority within a hierarchical firm impacts the reporting choices of agents in a participative budgeting setting. Firms spend vast amounts of time and money on the budgeting process. While participative budgeting provides a means for the principal to obtain the agent's private, unobservable information, thereby improving future firm performance through better planning, this benefit comes at the cost of exposing the firm to the potential for opportunistic misreporting by the agent (Jensen 2003). Given these concerns regarding the value of participative budgeting, a substantial amount of accounting literature investigates means by which to ameliorate the downsides associated with its use (for a review of the literature, see Rasmuβen 2015).

A feature common in most of the prior budgeting literature is that the firm is presumed to have a flat structure – i.e. it consists of a principal and one or more (peer) subordinate agents. To the contrary, many firms are organized as hierarchies in which there are one or more levels of managers who act as intermediaries between the principal and the agent(s). Prior literature generally suggests that firms add managerial levels when time constraints or informational processing burdens on the principal become too great and force delegation of some duties to managers (e.g. Harris and Raviv 2002, Colombo and Grilli 2013). Since the principal is typically thought to have an array of duties, a question that arises when examining firms with more than two hierarchical levels is whether the principal should delegate supervision of controls intended to improve budgetary reporting to subordinate actors. This question is the focus of the current study.

One of the most intuitive controls to place on the participative budgeting process is budget rejection authority (Rankin, Schwartz, and Young 2008). While participative budgeting

allows the agent to be involved in the budgeting process, it is not often the case that they are given *carte blanche* to set their own budget with no oversight from their superior. The rejection authority implemented in Rankin et al (2008) reflects this fact. One of the general results from that study (and the extensional Douthit and Stevens 2015) is that agents claim less budgetary slack when principals are granted the authority to reject the agent's budget. However, while rejection authority would, by necessity, be held by the principal in a flat firm, if a hierarchical firm wished to implement rejection authority, it faces an important choice regarding where to locate such authority. Specifically, it could grant rejection authority to the principal, as in a flat firm, or it could choose to delegate supervision of the control to a manager. Importantly, these are independent decisions in the sense that the decision to grant rejection authority to one party does not preclude granting such authority to the other party. This implies that, if rejection authority has been implemented in a hierarchical firm, there are three possible cases. The principal, alone, could retain the ability to reject the budget, this power could be delegated to the manager alone, or both the principal and the manager could be granted rejection authority. The last case is particularly important because it represents a situation in which a control has effectively been duplicated, which has no analog in a flat firm.

Assuming that there are benefits to each of the choices above, the question then turns to the relative benefits of each arrangement. In the *absence* of rejection authority, traditional agency theory treats the presence of additional hierarchical levels as irrelevant to the decision of any of the economic actors. Since preferences in such analyses are assumed to be solely for pecuniary payoffs, the prediction is that the agent consumes the entirety of the available slack. As a result, regardless of the vertical arrangement of the firm, the amount transferred to the residual claimant (and to any other intermediate actors) is the same – zero. However, when rejection authority has

been granted, the agent must take into account the fact that their budget can potentially be rejected, and traditional agency theory predicts that slack capture is reduced as a result. This should be the case regardless of where rejection authority exists within the firm.

When comparing the situations in which only one superior actor (i.e. the manager or the principal) has rejection authority, I turn to traditional agency theory. The game theoretical solution to the situation in which only the principal has rejection authority is that the agent allocates more of the surplus to the manager (than when only the manager has rejection authority) to ensure that the principal does not reject the budget. I therefore hypothesize that the slack capture of agents will be greater when only the manager has budget rejection authority than when only the principal has such authority.

When examining the case in which both superior actors have budget rejection authority, it may seem straightforward and intuitively appealing to expect that less slack would be captured by the agent than in circumstances in which only one superior actor holds such power. However, due to changes in behaviour due to restrictions on autonomy, differences in perceptions of the probability of budget rejection, and tradeoffs between preferences for fairness and concerns for strategic issues, there are reasons to suspect that the average amount of slack captured by the agent may *increase*. Due to these competing directional effects, I state two research questions to examine how agent slack capture differs between the situation in which both the manager and principal hold rejection authority and each of the two situations in which only one of these individuals has rejection authority.

To test the hypothesis and explore the research questions, I conducted a 2x2 experiment in which manager rejection authority and principal rejection authority are each manipulated at two levels (absent/present). Participants take the role of either agent, manager, or principal in a

hypothetical three-tier hierarchical firm and interact over twelve periods to perform a budgeting task based on the instruments used in Evans, Hannan, Krishnan and Moser (2001) and Rankin et al (2008).[1] I find that, consistent with prior literature (e.g. Forsythe et al 1994, Rankin et al 2008, Douthit and Stevens 2015), granting rejection authority to some superior actor in the firm's hierarchy (i.e. the manager and/or principal) leads to less slack capture on the part of the agent. Contrary to the hypothesis, results suggest that there is no significant difference in slack capture by the agent when only the manager has rejection authority compared to when only the principal has rejection authority. Analysis of the research questions suggests that slack capture is decreased by giving both the manager and the principal rejection authority by comparison to giving only the principal such authority but that this comes at the cost of the firm foregoing a substantial amount of their potential surplus due to budget rejections.[2] Additional analyses provide insight into the fact that the information asymmetry present in the setting causes superior actors (the manager and principal) to struggle with identifying the exact characteristics of the reports they receive, sometimes leading to what appear to be strictly irrational choices.

This study contributes to the literature in the following ways. From an academic perspective, this paper explores theory that suggests that implementation of budgetary rejection authority at the manager level entails an agency cost stemming from increased misreporting at the agent level. From a practitioner's standpoint, this paper provides empirical evidence to guide management accountants as they make choices with regards to which control tasks should be delegated to which members of the firm. Specifically, the agency costs outlined above are not

[1] This study takes the three-tier hierarchical structure of the firm as given. Section two briefly discusses why managers may exist, thereby leading to a three-tier (or taller) structure.
[2] This result is similar in spirit to the results described in Baiman et al (2007) in which the authors demonstrate analytically that an internal auction mechanism can allocate firm resources in a first-best, socially efficient manner, but only at a cost to the principal of paying out costly incentives to the manager.

observed which suggests that firms can delegate rejection authority to managers without fear of inducing poorer agent reporting. Further, this study presents, to the best of my knowledge, the first evidence of the effects of implementation of redundant controls; when both the manager and the principal have rejection authority, the same control (i.e. budget rejection) has been implemented at different levels in the firm. Results indicate that implementing rejection authority at both the manager and principal levels results in the lowest amount of agent misreporting, implying that firms may profitably employ multiple levels of budgetary review.

This paper proceeds as follows. The next section provides background and develops the hypothesis and research questions. Section three explains the experiment used to test the predictions, which is followed by a discussion of the analyses. Section five concludes.

II. BACKGROUND and DEVELOPMENT of HYPOTHESES

Background

Participative budgeting has been explored for at least six decades. The earliest study, Argyris (1952), recommended that participative budgeting be implemented in firms to alleviate dysfunctional behaviours resulting from the pressure to achieve mandated budget targets. From an efficiency standpoint, participative budgeting allows the firm to integrate useful information held only by those individuals who perform the firm's day-to-day operations which can lead to improved decision-making (Horngren et al 2018). In contrast to both the notional benefits of this budgeting method and the fact that it is frequently observed in practice (Shields and Shields 1998), the traditional agency theory analysis of the participative budgeting arrangement suggests that it should have little value (Jensen 2003). Agents are predicted to misreport their private information to the full extent possible due to a misalignment of the incentives between the agent

and principal stemming from a formulation of the utility function as only admitting arguments for wealth and leisure (Ross 1973, Jensen and Meckling 1976). In an attempt to reconcile these contradictory observations, several accounting studies have noted that agents have preferences for non-pecuniary sources of utility. Such preferences tend to ease the misalignment of incentives between the principal and agent, implying that the participative budgeting arrangement does provide value, even from a theoretical standpoint. Examples of such non-pecuniary factors are the preference for honesty (Evans et al 2001), the desire to *appear* honest in the face of an information system (Hannan et al 2006, Abdel-Rahim and Stevens 2018), concerns for reputation formation (Stevens 2002), non-binding communication (Rankin et al 2003), and agents' perceptions of the principal's fairness (Zhang 2008).

As an alternative to any of the control mechanisms described above, the firm could attempt to encourage better reporting behaviour by implementing budget rejection authority – i.e. the principal is granted the right to reject the agent's budget proposal. Should the budget be rejected, the firm's surplus is lost (see Rankin et al 2008, Hannan et al 2010, and Douthit and Stevens 2015). Studies generally find that agents misreport less when faced with the possibility that their budget may be rejected.

As noted above, however, the bulk of accounting studies in this area portray the firm as having only two levels (i.e. one level inhabited by the principal and a subordinate level populated by all the, possibly numerous, agents). It is certainly the case that some firms are structured in this fashion, but a great many firms exist as taller hierarchies. Literature in economics explores the question of why firms with more than one agent adopt any particular vertical structure and what the optimal hierarchical structure should be (see e.g. Calvo and Wellisz 1978, Keren and Levhari 1979, Qian 1994). Regardless of the firm's exact hierarchical structure, a point that is

made repeatedly in this stream of literature is that humans are boundedly rational – i.e. they do not possess the ability to instantly process an infinite amount of information (Simon 1957, Williamson 1967, van Zandt 1996). This means that as the firm expands (and there are strong incentives to do so – namely monopoly power; Knight 2009) there inevitably comes a point at which the principal can no longer process all the information generated by the firm and no longer has sufficient time to monitor all the agents. As a consequence, the principal must delegate some of their responsibility to one of the agents. Presuming that the delegated tasks are supervisory in nature, such as budgetary review, it must be the case that a managerial layer of the firm results.[3] Additionally, while there is some evidence that firms may be decreasing their height by eliminating some hierarchical levels (Rajan and Wulf 2006), there is also empirical evidence that firms grow taller, particularly as they "grow up" from their initial owner-operated structure to one that includes middle management (Colombo and Delmastro 1999, Colombo and Grilli 2013).

The preceding discussion leads to two, first-principles questions with regards to rejection authority in hierarchical firms (Young 2010). First, because the surplus available from the agent's improved reporting may be consumed by an intermediate actor (i.e. the manager) before it reaches the principal, is rejection authority still useful in hierarchical firms? Second, if rejection authority is implemented, where within the firm's hierarchy should it be implemented? While there have been a handful of studies in the accounting literature that examine firms that are taller than a dyad, these either investigate topics other than participative budgeting (e.g. Hales and Williamson 2010, Arshad et al 2018, Kuang and Yang 2017), or deviate from the

[3] As long as the marginal product of each of the responsibilities that the principal retains exceed their marginal product of budgetary review, it is sensible to grant budgetary control (e.g. budget rejection authority) to the manager. This is the case even if the information asymmetry between the manager and the agent is identical to the information asymmetry between the principal and the agent.

stylized conception of how information flows within hierarchical firms (Cardinaels et al 2014; for discussion of information flows see Shun and Yun 2017).

Development of Hypotheses

This study uses a design adapted from the standard budgeting setting found in Evans et al (2001) and Rankin et al (2008) to examine participative budgeting in a firm with three hierarchical levels. At the top of the firm exists the principal who acts as residual claimant. At the next lower level is a manager whose duty is to aggregate and pass on budgetary requests from the agent who resides at the lowest level of the firm. This setup is consistent with many studies in the economics literature on optimum firm height (e.g. Keren and Levhari 1979, Marschak and Reichelstein 1998, Jun and Kim 2010). In this basic setting, the agent possesses private and unverifiable information about the firm's production cost. They then make a cost report to the manager. If the agent misrepresents their cost by stating a cost higher than the one they observe, they consume the difference between their report and their actual information as budgetary slack. The manager receives the agent's cost report as their own private information and then allocates the resulting profit between themselves and the principal. Two manipulations introduce the ability for one or more of the superior actors to reject the budget. Specifically, manager rejection authority is manipulated as either present or absent and principal rejection authority is manipulated as either present or absent. If the budget is rejected (in conditions in which budget rejection authority exists), production is suspended, and no member of the firm claims any of the available surplus (defined as the firm's revenue less the agent's private cost information).

The basic setting (i.e. that does not incorporate budget rejection authority) is a natural extension of Evans et al (2001) with an additional hierarchical level. Further, one of the important commentaries in Rankin et al (2008) is that the participative budgeting setting is structurally similar to either a dictator game (absent rejection authority) or an ultimatum game (with rejection authority).[4,5] Consequently, the participative budgeting setting in which no rejection authority has been implemented can be compared to two, back-to-back (or sequential) dictator games. The agent acts as the first dictator who makes an allocation between themselves and the manager by reporting their privately observed production cost. The manager then uses the information sent to them by the agent to make a dictator allocation between themselves and the principal. As noted in the previous section, while the traditional agency theory prediction is that the agent will consume the entirety of the available surplus by reporting the maximum possible cost, there is overwhelming evidence that this prediction is not empirically descriptive. Dictators don't always take their entire endowment in dyadic relationships (see Camerer 2003 for an extensive review) and in sequential dictator games, the first mover has been shown to send somewhat less than 30% of their initial endowment, on average (Bonein and Serra 2008 and Bahr and Requate 2014). However, these studies also show that while the prediction of completely self-interested behaviour is not, on average, observed empirically, there are frequent instances in which the entire pie is consumed by the dictator. For example, in Forsythe et al (1994), between 21% and 36% of dictators sent nothing, depending on the size of the stakes;

[4] In a dictator game, a dictator is given an endowment (often $10) and asked to split it with a receiver (Kahneman et al 1986). The players each receive the allocated amounts. An ultimatum game is very similar in that a proposer is given an endowment and asked to split the amount with a receiver. The difference is that the receiver can either accept or reject the proposed allocation. If they accept, both players receive the allocated amounts; if they reject both players receive nothing (Güth et al 1982).

[5] The participative budgeting setting deviates from the traditional dictator setting in that the dictator's (agent's) endowment is hidden and stochastic. Further, preferences for honesty are a potential element in the participative budgeting setting as the dictator must make a factual assertion, which is not a component of the traditional dictator setting.

similarly, Evans et al (2001) find that between 27% and 29% of agents (which is the functional equivalent of the dictator role in their study) send nothing. It is important to note that in participative budgeting setting, situations in which the agent consumes the entire pie imply that the firm earns no profit, even though profitable production can usually occur.

As discussed above, a means to reduce not only the average slack capture by the agent but also the incidence of complete slack capture, would be to incorporate rejection authority. Presumably, this control should be effective regardless of where it is situated within the hierarchy. However, unless this result is empirically confirmed, interpretation of the remainder of the study would be challenging. Consequently, I state the following proposition:

Proposition: Regardless of where it is located within the firm's hierarchy, rejection authority leads to less average slack capture by agents compared to the condition in which no rejection authority is granted.

Presuming that granting rejection authority somewhere within the hierarchy serves to improve reporting from the agent, the interesting question then becomes exactly where to locate such authority. The most conservative choice, in terms of cost and ease of implementation, would be to grant rejection authority to a single individual - either the manager only or the principal only. Extending the discussion comparing participative budgeting to dictator and ultimatum games suggests that when only the manager has rejection authority, participative budgeting in a three-tier hierarchy is comparable to a sequential ultimatum-dictator game. Similarly, the situation in which only the principal has rejection authority can be compared to a sequential dictator-ultimatum game. Under standard agency theory assumptions, the agent is

predicted to capture less slack in the latter case (i.e. principal only rejection authority) than in the former case. An example is illustrative.

Assume that the agent has $10 to allocate and the smallest indivisible unit is $1. In an ultimatum-dictator arrangement (i.e. rejection authority granted to only the manager), the traditional agency theory prediction is that the agent keeps $9 and sends $1 to the manager. This is because the agent needs to send them only the smallest amount to ensure that the manager accepts the proposal – the principal is not a concern.[6] The manager accepts, keeps the $1, and sends nothing to the owner.

When only the principal has rejection authority, and under the same endowment assumptions as the previous paragraph, the agent is predicted to keep $8 and send $2 to the manager (Güth et al 1996). To see why this is, consider the usual prediction for a dyadic ultimatum game. If the agent keeps $9 and sends the manager $1, the manager has two choices. On one hand, they can keep the $1 and send $0 to the principal, who is likely to reject the proposal. On the other hand, they can keep $0 and send $1 to the principal who will accept the proposal. In either event, the manager's payoff is $0, and they are therefore indifferent between the two choices. Note that the agent would prefer that the manager send the $1 to the principal (because the agent gets to keep what they allocated to themselves if the principal accepts), but due to the manager's indifference, there is no guarantee of this happening. To solve this issue, the agent must send $2 to the manager, who then keeps $1 and sends $1 to the principal thereby assuring the latter's acceptance. Using the underlying economic games to draw conclusions

[6] Technically speaking, there are two subgame perfect equilibria in the basic ultimatum game (Forsythe et al 1994). In one, the proposer sends nothing and the responder, gaining no utility from rejecting such a proposal, accepts (Güth et al 1982). However, since the responder is indifferent between rejecting and accepting, they could equally choose to reject which implies that the proposer does better, in expectation, by sending the minimum possible amount which they know the receiver will not reject (Abbink et al 1999). This is the second SPE.

about the budgeting setting, one can see that the prediction is that the agent captures less slack when only the principal holds rejection authority than when only the manager holds rejection authority, as hypothesized below:

H1: Average slack capture by agents will be greater when only the manager has budget rejection authority than when only the principal has budget rejection authority.

Rather than granting budget rejection authority at a single level in the hierarchy, the firm could choose to give both the manager and the principal this authority. When both superior actors (i.e. the manager and the principal) have budget rejection authority, the setting resembles a sequential ultimatum game – the agent and the manager are both proposers whose recipients can potentially reject their proposals (Güth et al 1996). The game theoretic solution in this case is identical to the situation in which only the principal has rejection authority: the agent sends twice the minimum amount to the manager who keeps half, sending the minimum amount to the principal (using the example from above, the payoffs would be $8/$1/$1 to the agent/manager/principal). Thus, traditional agency theory predicts that there is no value to granting rejection authority to the manager when the principal also possesses this authority.

Moving away from the traditional agency theory predictions, this setting is essentially a combination of the settings in which the individual superior actors have rejection authority and it is intuitively appealing to posit that slack capture should be less when both superior actors can reject the budget. While there is literature that examines the interplay of the various components of management control systems (e.g. Kennedy and Widener 2008), there appears to be a dearth of studies that examine the effects of multiple, duplicated, controls. Despite this, conditional on

the effects of granting rejection authority being additive and linear, agents should claim less slack than in either of the instances in which only one of the superior actors have rejection authority.

There are, however, several reasons to suspect that the effect of duplicated rejection authority may not be linear or additive. First, it important to recognize that while rejection authority has been duplicated, it has been duplicated at adjacent hierarchical levels, not within the same level. In other words, it is not the case that the agent makes an allocation between themselves and the principal which is first reviewed by the manager and then subsequently reviewed by the principal. Instead, the manager reviews the agent's choice and then incorporates a choice of their own before the principal has an opportunity to make their approve or reject decision. This implies a substantially more complex strategic environment than in the dyadic relationship, one in which linear and additive effects of incorporating budget rejection may not be observed.

Second, the motivation crowding literature often explains the counter-intuitive result that the imposition of a control decreases the desired behaviour relative to a situation in which the control is absent by appealing to the notion that individuals have a dispreference for restricted autonomy (Frey and Jegen 2001, Falk and Kosfeld 2006). Since there are two individuals who can potentially reject the budget, the agent may perceive that the choice set that leads to budget acceptance has been substantially restricted. and, as a result, that their autonomy has been reduced. This suggests that the motivation crowding effects observed elsewhere in the literature may lead to increased slack capture when both superior agents have budget rejection authority.

Third, and related to the prior argument, multiple "rejection nodes" (i.e. places in the hierarchy at which the budget can be rejected) likely influence the agent's perception of the

chance that the budget will be rejected. Specifically, if both the manager and principal can reject the budget, there is a (weakly) greater chance that the budget will be rejected than when only one of those two individuals possess rejection authority. Further, to the extent that agents, irrespective of the condition, have a desired expected payoff in mind when they make a report, this increased probability of rejection should influence their reporting. Expected value has two parts – a probability and a payoff magnitude. Since the probability of rejection increases due to the addition of another rejection node, the only way the agent can maintain their desired expected payoff is to increase the magnitude of the payoff. This would be accomplished by building in additional slack, implying that greater slack is captured by agents when both the principal and the agent have rejection authority than when one or the other alone has such authority.

Finally, Knez and Camerer (1995) and Camerer (2003) make the point that a fundamental difference between dictator and ultimatum games is the presence of a strategic component to ultimatum games. Specifically, proposers in ultimatum games must respect the fact that the responder can reject their proposal. This leads the average proposer to offer a larger share to the receiver. However, the fact that dictators send anything to receivers in dictator games suggests that preferences for fairness (or altruism) do exist. It is difficult to disentangle these two motivations (strategic concerns and preferences for fairness) in an ultimatum game because they look identical from a behavioural standpoint – i.e. the proposer sends more money. The aforementioned papers point out that it may be the case that fairness motivations drive behaviour less in ultimatum games than in dictator games because the responder in an ultimatum game can "stick up for themselves." Moving back to the current study, in both conditions in which only one superior actor has rejection authority, one of them is subject to receiving an allocation from a dictator. However, when both superior actors have rejection authority, this is no longer the case

and may suggest that the agent claims more slack because both the manager and the principal are able to impact their own payoffs.[7] This argument is consistent with Rankin et al (2008) who posit that the strategic component introduced by granting budget rejection authority serves to reduce the perception of budgeting as an ethical dilemma.

Given the competing effects described in the preceding discussion, I pose the following two research questions:

*RQ1: Do agents capture more slack on average when both the manager and the principal have rejection authority by comparison to the setting in which only the **manager** has rejection authority?*

*RQ2: Do agents capture more slack on average when both the manager and the principal have rejection authority by comparison to the setting in which only the **principal** has rejection authority?*

III. Method

Experimental Design and Procedures

To examine the posed questions, I conducted a 2x2 full-factorial experiment in which the presence of managerial authority to reject the budget and the presence of principal authority to reject the budget are each manipulated at two levels (absent/present) between-subjects. This leads to four conditions: *None* (i.e. no rejection authority), *Manager* (only the manager has

[7] Note that this argument does not suggest that lowest average slack capture should be observed in the condition in which no rejection authority exists. The argument is that concerns for fairness exist both when rejection authority is present and when it is not, but that these concerns are replaced, to some degree, by strategic concerns when rejection authority is present. The argument made in the text is that fairness concerns are suppressed when there is no dictator allocation in the hierarchy – i.e. when both superior agents have rejection authority.

rejection authority), *Principal* (only the principal has rejection authority), and *Both* (the manager and the principal have rejection authority).

Upon entering the laboratory, participants were seated at computer terminals separated by privacy partitions. After a brief introduction by an experimental facilitator, computerized instructions were provided, followed by a computerized quiz. In the event that a participant answered a question incorrectly, they were given reminder information about the relevant portion of the instructions and required to answer the question correctly before proceeding.

Participants are assigned a role – either agent, manager, or principal - at random and maintain their roles for the duration of the experimental session.[8] Participants are informed that they will be grouped into firms consisting of one of each of the three roles and that these firms will be maintained throughout the session. The participants interact for twelve periods by completing a task adapted from Evans et al (2001). The task of each firm is to prepare a production budget for each period and each member of the firm receives a salary to compensate them for their budgeting efforts. The salaries of the participants in other roles are kept hidden (e.g. the manager is unaware of the magnitude of the salary provided to either the principal or the agent and vice versa). Agents receive $5.00, managers receive $7.50, and principals receive $10.00 at the beginning of each period. These values were selected in order to approximately equalize average payoffs across the roles.

In the *None* condition, the budgeting process starts with the agent being provided private information regarding the production cost for the period. Costs are drawn from a uniform distribution with support of [$13.00, $27.00].[9] Twelve costs were randomly generated prior to

[8] During the experiment, these roles were referred to as Worker, Manager, and Owner, respectively. For expositional clarity, I will continue to use the terms agent, manager, and principal throughout the manuscript.
[9] As indicated in the text, all costs are presented to the participants in dollars, rather than experimental currency units (ECUs). There is a substantial literature in economics regarding money illusion, which describes differences in

the experimental sessions and presented in a random order to each agent. After observing the production cost for the period, the agent then reports a cost to the manager. The agent consumes any difference between their report and the actual cost as budgetary slack. The manager then sends a report to the principal regarding the amount of profit that the principal will receive. In each period, the firm receives $27.00 of revenue from sales of the product they produce. The profit available for the manager to send to the principal is the difference between the firm's revenue and the agent's reported cost. Any profits that are not sent to the principal are retained by the manager. At the end of each round, participants receive only reminder information about the decision(s) they made during the round that has just been completed before moving on to the subsequent period (this design choice is discussed in greater detail below). In each round, each role has additional questions to answer immediately following the decisions detailed above. The manager is asked to give an estimate of the actual production cost and the owner is asked to give an estimate of the available amount of profit. After round twelve, process measures are collected.

Following the post-experiment questionnaire, one period was selected at random for payment and the results of the decisions from that period were shown to the participants. Once this information was digested, the participants were paid in private for the selected period. With the exception of the private production cost provided to the agent and the salaries of the respective members of the firm, the experimental process and parameters were common knowledge among all participants.

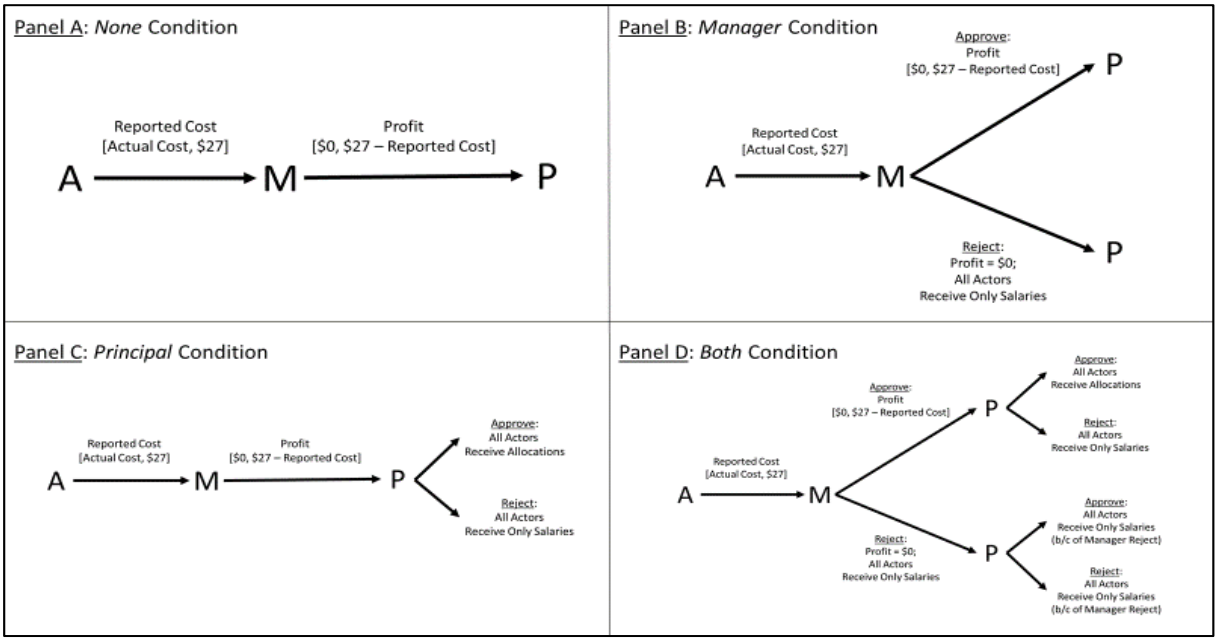
In the conditions in which one or more of the participants have rejection authority, the individual with such authority is asked to either approve or reject the budget before they make

behaviour stemming from maximization of nominal currency rather than real currency. Prior experimental studies provide some indication that denominating payoffs in ECUs can lead to important differences in the choices of participants (see, e.g. Mazar et al 2008) which is why all payoffs are denominated in dollars in this study, which is also consistent with the design choice made in Evans et al (2001).

their decision (if any). For example, in the *Both* condition, the manager receives the production cost report from the agent after which they are asked to either approve or reject the budget. Conditional on the manager approving the budget, they then divide the available profit between themselves and the principal. The principal then decides to either approve or reject the allocation. If any of the individuals with rejection authority choose to reject the budget, production does not occur for that period and each member of the firm receives only their salary. If all the individuals with rejection authority approve the budget, production occurs as budgeted. In these conditions, the worker is asked, immediately following their production cost report, to estimate the probability that the budget will be approved by the individual (or individuals) with rejection authority. Figure 1 provides a decision tree for the three roles and the range of values that their choices could take.

FIGURE 1

Experiment Decision Tree for Each Condition



Design Choices

Two specific design choices warrant additional discussion. The first is the decision to provide only reminder information at the end of each period. This choice was made to address concerns regarding the ability to compare the *None* condition to the conditions in which one or more actors have the ability to reject the budget. As noted in the previous section, the *None* condition is the functional equivalent of a sequential dictator game. As such, no learning regarding what acceptable behaviour entails can occur since the agent and the manager make dictator allocations which cannot be rejected. By comparison, in the other three conditions, the provision of even own-payoff information at the end of the period implies a degree of learning regarding the acceptable amount of surplus to retain. For example, if the agent reports a particular cost and the budget is rejected (regardless of who, specifically, has rejection authority), they can infer that the production cost they reported was too high. To the extent that this feedback provides cues regarding acceptable behaviour, this suggests that it would be technically inappropriate to compare the *None* condition to any of the other conditions because of a perfect confound between the manipulated variables and the opportunity to learn about cues to acceptable behaviour. Such cues have repeatedly been shown to influence choices (e.g. Bicchieri 2006). As a result, while it is uncommon not to provide information on at least own-payoffs at the end of each period, the instrument described above withholds this information until the end of the experiment (for examples of such a design choice, however, see Abbink et al 1999).

In addition to the above discussion, keeping information restricted is attractive for two other reasons. First, because no information regarding the actions of the other actors in the firm is provided, there is no reason to re-pair participants. This enables me to provide each member of the firm with each of the twelve costs. If own-payoff information were provided, this would

necessitate re-pairing each round to avoid reputation formation and it would be exceedingly difficult, if not impossible, to prevent the manager and principal from being grouped multiple times with an agent facing a particular cost. For example, a manager could, in theory, end up being paired with an agent that faced the highest production cost in all twelve rounds. This substantially curtails opportunities for analysis of the behaviour of the managers and principals. Relatedly, providing no payoff feedback after each round enables me to analyze an individual agent's set of choices over the full set of costs, free from any influence regarding whether their budget proposal had been rejected in the prior period. The influence of changing costs is often expected to have an impact in participative budgeting studies, but the analysis of this effect is often contaminated by the impact of decisions made in previous rounds (e.g. a budget proposal being rejected).

Second, the goal of this study is to examine budgeting in a single-period setting. While dynamic budgeting settings present interesting opportunities for research, they are outside the scope of the current study. As this is the case, withholding feedback until the end of the experiment better preserves the independence of observations in each round which is more in line with the single-period setting that is of primary interest.

The second design choice that requires additional explication is the structure of the salary information provision. Keeping the salary of the superior actors hidden is consistent with prior literature that attempts to control for the distributive preferences of agents (Douthit and Stevens 2015). While this is not the focus of the current study, it does provide control for distributive fairness preferences that exist orthogonal to the decision by an agent to report a specific cost. However, this study also keeps hidden the salary of the *subordinate* members of the firm (e.g. the principal does not know the salary of the manager or agent). While it is appealing to endow

the principal with a salary from which the salaries of the manager and agent are taken, the concern described above regarding learning makes this choice problematic. Specifically, when, for example, the principal has rejection authority, if they were aware of the salary of the manager, they would have more complete payoff information regarding the relative payoffs to themselves and the manager than the manager would have when they made their profit report. The same dynamic exists between the manager and agent when the manager has rejection authority. While the agent's behaviour is the focus of this study, the choice was made to maintain bilateral information asymmetry regarding the salaries of each individual to facilitate supplemental analyses regarding the behaviour of the managers and principals.

Participants

Participants were 231 undergraduate students at a public university in the United States who were recruited from a participant database. Average compensation (which included a $5 show-up payment) was $13.68 for agents, $14.17 for managers, and $15.88 for principals and 63% of participants were female. The experiment was administered using the zTree software (Fischbacher 2007) and IRB approval was obtained prior to administering the experiment. A requirement for using the laboratory in which this study was conducted is that no deception is employed.

IV. RESULTS

This section begins with a discussion of the descriptive statistics and is followed by tests of the predictions. The section concludes with a series of supplemental analyses.

Descriptive Statistics

Average slack capture by the agent across the four conditions is presented in Table 1 and box plots provide a visual summary of the data in Figure 2. Slack capture is measured in a manner consistent with prior literature as [Reported Cost – Actual Cost]/[$27 – Actual Cost]. Recall that $27 is the maximum cost that can be reported. Note that this measure is unaffected by whether the budget was rejected or not; it is, in essence, the attempted slack capture by the agent. As can be seen in the table, the most slack was captured, on average, in the *None* condition and the least amount of slack was captured in the *Both* condition. Additional descriptive information is provided in Figure 3, which shows the average amount of slack capture by agents across the various actual costs. Recall from the experimental design that each agent saw all twelve pre-drawn costs in a random order. One of the surprising results from this figure is that the percent of slack captured seems largely invariant to the cost. This runs contrary to intuition that suggests that, when there is more room to share surplus (i.e. when the actual cost is lower), agents tend to capture less slack.

Tests of Predictions

Table 2 presents t-test comparisons of the average amount of slack captured in the various conditions. The proposition states that slack capture will be greatest in the *None* condition (i.e. where no rejection authority has been granted). Not surprisingly, strong support provided for the proposition. Table 2, Panel A shows that comparisons of average slack between the *None* condition and the other three conditions all indicate that the average slack capture in the *None* condition is statistically greater. As speculated in the development of the proposition, the number of reports of the maximum possible cost (i.e. $27) are substantially higher in the *None*

TABLE 1: Descriptive Statistics

Percent Slack Capture[a] *by Condition*

Condition	Mean % Slack (Std. Dev)
None	0.7756
n = 240	(0.3345)
Manager	0.5632
n = 240	(.3145)
Principal	0.5933
n = 240	(.2636)
Both	0.4992
n = 204	(.2668)

[a] Slack capture is measured as (Reported Cost - Actual Cost)/($27 - Actual Cost). This measure is unaffected by a budget rejection; in essence it is the amount of attempted slack capture.

condition (130 reports) than in the *Manager*, *Principal*, *or Both* conditions (34, 26, and 13 reports, respectively). The results of the t-tests are also supported in untabulated regression analysis in which slack capture is regressed on the conditions. A note about the regression analyses conducted in this paper is in order. As the dependent variable, slack capture, is a percentage bounded by zero and one, standard OLS regressions are inappropriate. Further, logit, probit and tobit regressions are not appropriate because, in the case of logit and probit, values of zero or one are undefined and, in the case of tobit, the data has not been censored. Consequently, I follow the recommendation of Baum (2008) and use a generalized linear model with a logit link

function and the binomial family clustering standard errors at the individual level. All referenced regressions use this method unless otherwise noted.

FIGURE 2

Box Plots: Slack Capture by Condition

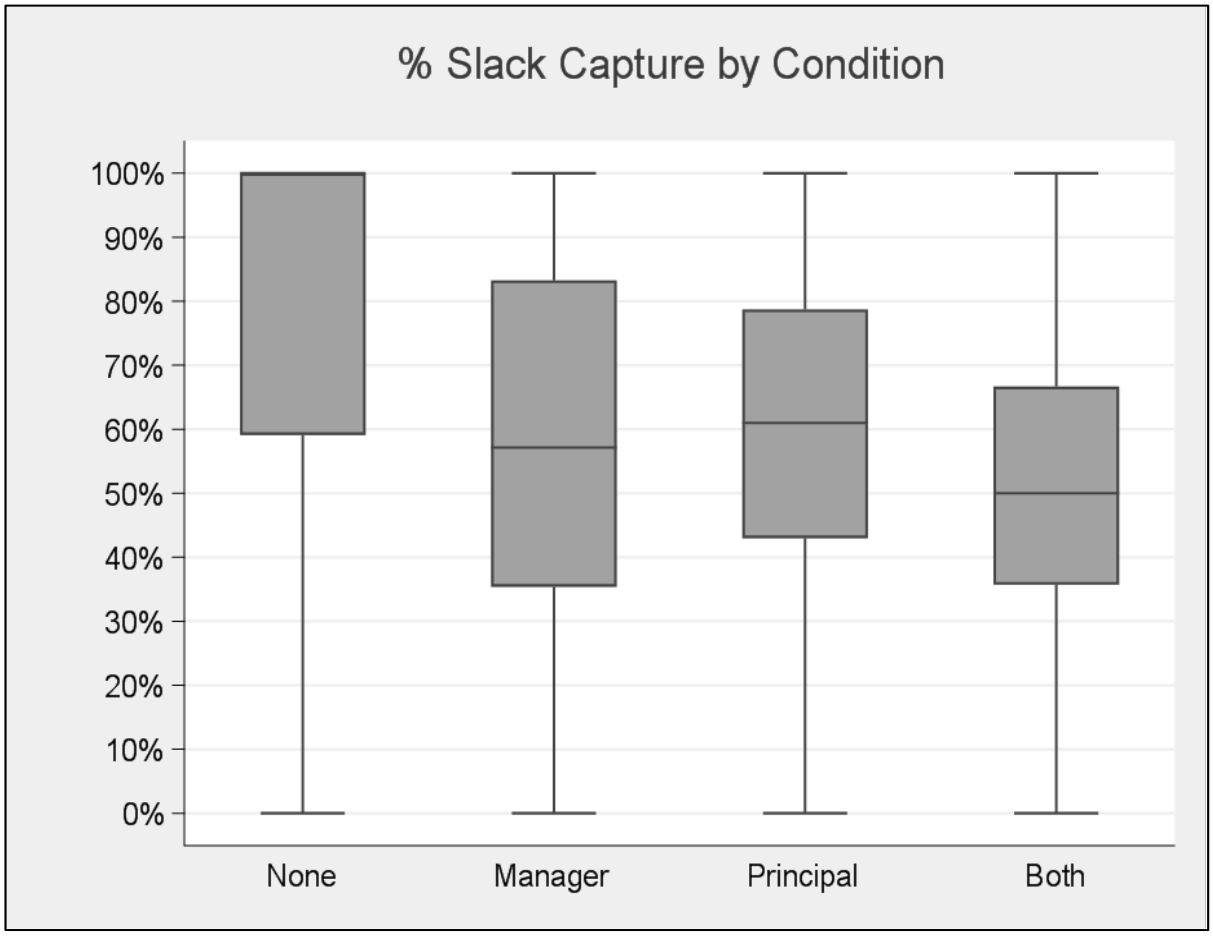


FIGURE 3

% Slack Capture by Actual Cost

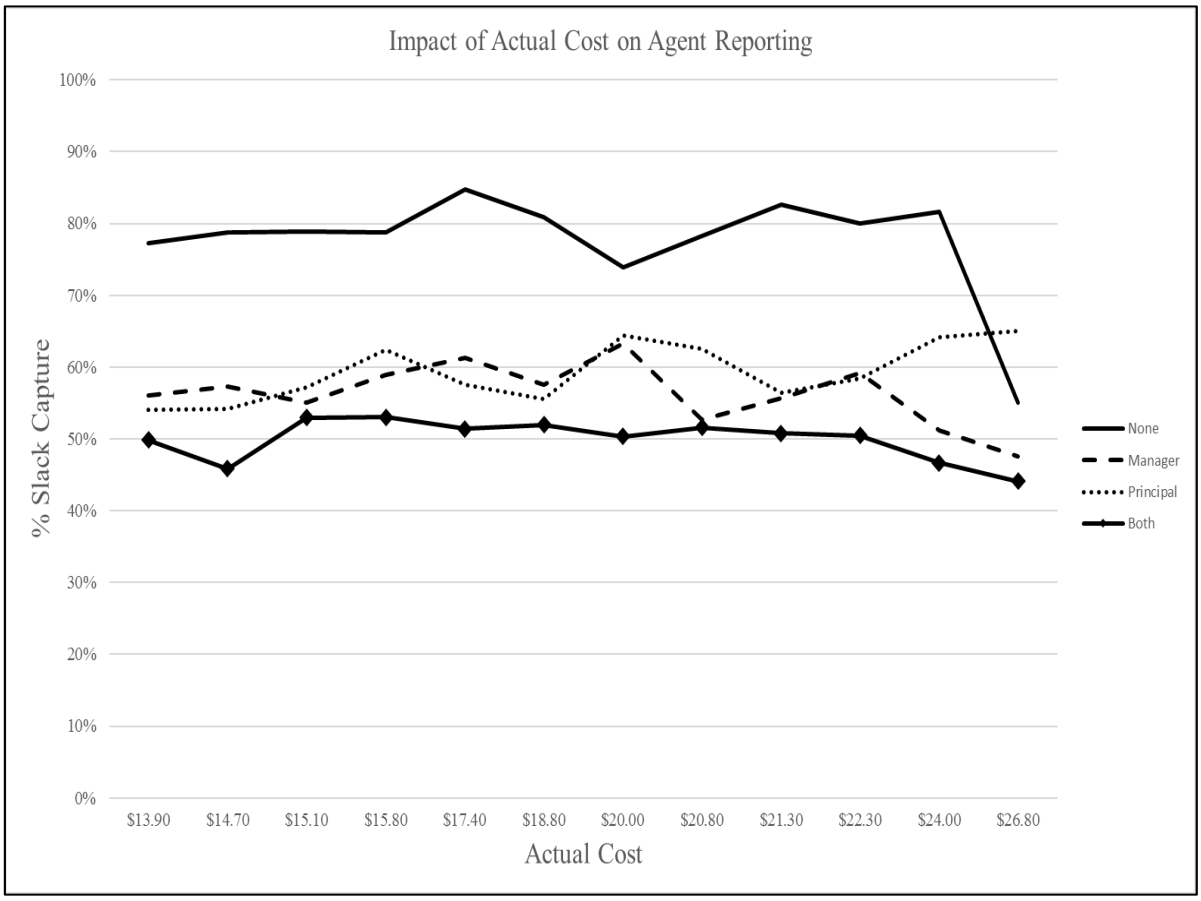


TABLE 2: Tests of Predictions

Panel A: *Tests of Proposition*

	t-statistic	p-value[a]
Slack (*None*) > Slack(*Principal*)	7.17	<0.01
Slack (*None*) > Slack(*Manager*)	6.63	<0.01
Slack (*None*) > Slack(*Both*)	9.51	<0.01

Panel B: *Tests of Hypothesis*

	t-statistic	p-value[a]
Slack (*Manager*) > Slack(*Principal*)	1.14	0.87

Panel C: *Tests of Research Questions*

	t-statistic	p-value[b]
RQ1: Slack(*Both*) < Slack(*Manager)*	2.27	0.02
RQ2: Slack(*Both*) < Slack(*Principal)*	3.73	<0.01

[a]: All t-tests one-tailed

[b]: All t-tests two-tailed

Recall that H1 predicts that, when only the manager is granted budget rejection authority, slack capture by agents is greater than when only the principal has budget rejection authority. As show in Table 2, Panel B, no support is found for the prediction that agents misreport more in the

Manager condition than in the *Principal* condition (p-value 0.87, one-tailed). This conclusion is supported in a regression framework as well. This suggests that, contrary to the agency theory prediction, delegating budget rejection authority entails no cost in terms of increased misreporting from the agent. The actual cost does not load if it is included in the regression specification, in line with the above commentary regarding the constancy of slack capture over differing actual costs.

Turning to the research questions, cell mean comparisons show that slack capture is less when both the principal and the manager have rejection authority (49.92% slack claimed) by comparison to when either the manager only (56.32% slack claimed) or the principal only (59.33% slack claimed) possess such authority. Table 2, Panel C shows that these differences are significant at conventional levels (*Manager* vs. *Both* p-value 0.02; *Principal* vs. *Both* p-value <0.01, both two-tailed). However, neither of these conclusions are supported in a regression framework. Untabulated regression analysis suggests that granting budget rejection authority to both the manager and principal reduces slack capture by a marginally statistically significant (p-value 0.11) compared to granting only the principal rejection authority, but that there is no benefit over granting only the manager such authority (p-value 0.37). The choice to cluster standard errors at the individual level in the regression framework described above is a conservative choice. A regression in which the standard errors are not clustered (but robust standard errors are still used) shows that slack capture in the *Both* condition is significantly less than in either the *Principal* ($p<0.01$) or the *Manager* conditions ($p=0.02$). Furthermore, a Kolmogorov-Smirnov test of equality of distributions supports this result by indicating that the values in the *Both* condition are smaller than in the *Principal* condition ($p<0.01$) and the

Manager condition ($p<0.01$). Overall, the results indicate that granting both parties rejection authority provides significant benefits in terms of curbing misreporting by the agent.

Supplemental Analyses

Analyses Related to the Research Questions

The theory section suggests three reasons why slack capture in the *Both* condition might be greater than when only one actor possesses rejection authority. First, motivation crowding due to additional control implementation was conjectured to lead to greater slack capture in the *Both* condition. Second, since the likelihood that the budget is accepted is lower in the *Both* condition, it was theorized that participants may capture more slack to maintain a constant expected value. Finally, a speculation was made that strategic elements inherent to the sequential ultimatum setting may displace some concerns for fairness thereby leading to greater slack capture in the *Both* condition. While the results presented above relative to the research questions indicate that slack capture is less when both superior actors have rejection authority, it is worthwhile to provide evidence that the putative causal mechanisms were not in operation.

Prior literature suggests that motivation crowding is caused by individuals exhibiting a dispreference for restrictions on their autonomy (Frey and Jegen 2001, Falk and Kosfeld 2006). In the post-experiment questionnaire (PEQ), each agent was asked two questions intended to gain insight into their perception of autonomy. Specifically, agent participants were asked, "How much control do you feel you had over your budget report?" and, "How restricted did you feel your choices were when reporting your production cost?"[10] The responses to these questions are significantly correlated (pairwise correlation 0.41, p-value<0.01) so they are (additively)

[10] Responses were on an 11-point Likert scale in which one was no control/very restricted and eleven was complete control/not at all restricted.

combined into one measure. Comparisons across conditions indicate that agents in the *None* condition felt that they had significantly more autonomy than in the any of the conditions incorporating rejection authority (all p-values<0.05). However, compared to the *Both* condition, there is no significant difference in perceived autonomy in the *Manager* condition (11.94 vs. 13.95, p=0.26) and only a marginally significant higher degree of autonomy in the *Principal* condition (11.94 vs. 14.75, p=0.08).[11] Note that while there is some indication that autonomy restriction exists, there appears to be no evidence of motivation crowding as slack capture is less in the conditions in which autonomy restriction is higher.

As discussed in the experimental design section, after their budget report was made, the agents were asked to estimate how likely they felt the budget was to be approved by the individual(s) with rejection authority.[12] An examination of agents' responses shows that agents did not perceive a lower probability that the budget would be approved in the *Both* condition than in either the *Principal* or *Manager* conditions (*Both*: 50.7%, *Principal*: 45.7%, *Manager*: 52.9%). The general pattern that emerges from the agents' responses is that agents indicated a significantly greater likelihood that the budget would be accepted when the manager had rejection authority than when the principal alone had such authority (*Both* vs. *Principal* p=0.04; *Both* vs. *Manager* p<0.01). A plausible explanation for these observations would be that the agent perceives a narrower social distance with the manager in the conditions in which the manager has rejection authority, thus leading to a higher perceived probability that the budget will be approved. However, an analysis of two questions intended to measure the agent's perceived social distance to the manager show no significant differences between conditions (all

[11] No significant differences are observed between the *Manager* and *Principal* conditions (13.95 vs. 14.75, p=0.57).
[12] This was asked on a Likert scale with eleven choices ranging between 0% and 100% in 10% increments.

p>0.10).[13] Another possible reason for the deviation from the expected results of the perceived probability of approval is that, while the agent made their cost report and their probability assessment decisions sequentially, it is quite likely that these two decisions are inextricably linked. As a result, if the agents had been asked about the relative unconditional probability that cost reports are rejected in the *Both* condition, they may well have responded that budgets are less likely to be approved. However, their responses to the probability assessment were made *conditional* on their cost report which may account for the observed perceptions of budgetary approval likelihood.

Camerer (2003) discusses the idea that, because the receiver in ultimatum games can determine their own fate by rejecting the proposer's offer, the proposer's behaviour may stem less from concerns for fairness than from strategic concerns. Agents were asked, "How much effect do you feel your production cost report had on the manager (owner)?" in two questions in the PEQ (11-point Likert scale; 1 = "No effect at all"; 11 = "A great deal of effect"). If agents in fact feel that the manager and/or principal could impact their own payoff through their ability to reject the budget, then the answer to these PEQ questions should be significantly lower in the conditions in which the appropriate individual had been granted such authority. However, no significant differences to these questions are observed between conditions, implying that concerns for fairness were invariant to the manipulation of rejection authority location.

Rejection Behaviour of Superior Actors

In this section, I shift focus away from the agent's reports and consider the rejection behaviour of managers and principals in conditions in which they were imbued with the ability to

[13] The two questions were, "How similar to the manager do you feel you are in general?" and, "How likely is it that you would be friends with the manager?" Both were significantly correlated and therefore summed for the analysis presented in the text.

reject the budget. Table 3, Panel A shows the frequency of rejections made by managers and principals by condition; Panel B provides a more granular breakdown of the rejection behaviour of the two superior actors in the *Both* condition. Table 4, Panel A shows the average amount of slack accepted and rejected by managers in the *Both* and *Manager* conditions. Consistent with the result that slack capture is lower in the *Both* condition, the average rejected and accepted agent cost reports are lower in the *Both* condition than in the *Manager* condition ($p=0.08$ for accepted budgets; $p=0.05$ for rejected budgets). Further, in both conditions the slack capture in cost reports that were accepted was significantly lower than the slack capture in cost reports that were rejected ($p<0.01$ in both conditions). Recall from the experimental design section that managers were asked to provide an estimate of the agent's private production cost information (similarly, principals were asked to estimate how much profit the manager had to split). Perceived slack is measured as [Reported Cost – Perceived Actual Cost]/[$27 – Perceived Actual Cost]. The gap between the average slack capture in accepted reports and rejected reports is larger in perception in both conditions and the difference remains statistically significant ($p<0.01$ in both conditions).

Table 4, Panel B shows the manager's proposed share, as a percentage of the available profit, when the principal rejected the managers profit split compared to when they accepted the profit split. The percentage of available profit is calculated as the amount of profit the manager assigned to themselves divided by the available profit (i.e. $27 minus the cost reported by the agent). As seen in the table, there is very little difference between the average manager profit when the principal accepted versus when the principal rejected; this difference is not statistically significant in either condition (both $p>0.30$). In fact, in the *Principal* condition, while the difference between the average accepted and rejected manager profit is a statistical zero, the

principal, on average, accepted a smaller share of the surplus than they rejected. This general result no longer holds when examining the principal's perception of what they were rejecting versus what they were accepting. In Table 4, Panel B, the perceived manager percent of profit is measured as the amount of profit the manager assigned to themselves divided by the principal's perception of the amount of available profit. The principal perceived that they were rejecting manager proposals that were, on average, statistically higher than the proposals they were accepting ($p<0.01$ in both conditions).

To better understand this difference in the rejection behaviour of managers and principals, I examined how accurately managers and principals estimated production costs and available profit, respectively. To measure accuracy, the following metrics are developed:[14,15]

$$Average\ Absolute\ Cost\ Deviation = \frac{1}{n}\sum_{i=1}^{n}|Perceived\ Cost_i - Actual\ Cost_i|$$

$$Average\ Absolute\ Profit\ Deviation = \frac{1}{n}\sum_{i=1}^{n}|Perceived\ Profit_i - Available\ Profit_i|$$

[14] Note that the average absolute profit deviation measure contains instances in which the manager rejected the budget. In these cases, the profit available for the manager to split between themselves and the principal was zero. Recall, however, that the principal only sees that they were offered zero profit and therefore are free to estimate what the actual profit was from any amount on [$0, $14].

[15] An absolute error measure is developed because when the denominator, actual profit, is zero, relative percent error of profit would be undefined. Actual profit is zero when either the agent reports the maximum production cost of $27 or the manager rejects the budget. There are 283 of these instances in the data set. Somewhat surprisingly, there are few, if any, feasible alternative measures of relative percent error, particularly in cases such as this where the estimated value can also be zero.

TABLE 3: Budget Rejections

Panel A: *Frequency of Rejection by Condition*

Condition	# Manager Rejections	# Principal Rejections	# Both Rejected
None (n=240)	n/a	n/a	n/a
Manager (n=240)	63	0	63 (26%)
Principal (n=240)	0	133	133 (55%)
Both (n=204)	54	111	114 (56%)

Panel B: *Rejections in the* Both *Condition* [a]

Manager Action	Frequency	Principal Action	Frequency
Accept	150	Approve	90
		Reject	60
Reject	54	Approve	3
		Reject	51

[a] In the *Both* condition, if the manager approved the agent's report, the principal was informed of the manager's allocation of the available profit and then asked to either approve or reject the budget. If the manager rejected the agent's report, then the principal was informed only that the amount of profit being sent was $0. They were not informed that the manager had rejected the budget. Panel B shows that, out of the 54 instances in which the manager rejected the agent's report, the principal also rejected 51 times. In the remaining three instances, they approved the allocation of $0 that resulted from the manager's rejection of the agent's cost report.

TABLE 4: Comparison of Accepted versus Rejected Offers

Panel A: *Slack Approved vs. Rejected by Managers* [a]

	Both Condition		*Manager* Condition	
	Actual % Slack	Perceived % Slack	Actual % Slack	Perceived % Slack
Rejected Budgets	0.6745	0.7810	0.7833	0.6071
	n = 54	n = 54	n = 63	n = 63
Accepted Budgets	0.4361	0.3821	0.4848	0.3807
	n = 150	n = 150	n = 177	n = 177

Panel B: *Manager Profit Approved vs. Rejected by Principals* [b]

	Both Condition		*Principal* Condition	
	Actual Manager % Profit	Perceived Manager % Profit	Actual Manager % Profit	Perceived Manager % Profit
Rejected Budgets	0.6504	0.7531	0.5384	0.7822
	n = 60	n = 60	n = 60	n = 60
Accepted Budgets	0.6166	0.6284	0.5705	0.5521
	n = 90	n = 90	n = 90	n = 90

[a] Actual % Slack is calculated as (Reported Cost - Actual Cost)/($27 - Actual Cost). Perceived % Slack is calculated as (Reported Cost - Perceived Actual Cost)/($27 - Perceived Actual Cost).

[b] Actual Manager % Profit is calculated as (Available Profit - Principal Profit)/Available Profit, where Available Profit is $27 less the agent's reported cost and Principal Profit is the amount offered to the principal by the manager. Perceived Manager % Profit is calculated as (Perceived Available Profit - Principal Profit)/Perceived Available Profit.

Table 5, Panel A provides descriptive statistics relative to absolute cost deviation and absolute profit deviation for each condition. Results indicate that managers and principals have a difficult time accurately estimating the production cost and available profit given the information asymmetry present in the setting; the managers estimates are incorrect by $3.81 on average and principals are incorrect by $4.76 on average. In every condition, managers appear to be better at estimating production costs than principals are at estimating available profit. Specifically, managers are significantly better at estimating profit in the *Manager* and *None* conditions; this is not the case in the other two conditions. As shown in Table 5, Panel B, comparisons of estimation accuracy between budget rejections and budget approvals show that both roles are better at making estimates when they approve than when they reject (these differences are statistically significant in all conditions for both roles; all $p<0.03$). When linking these results to the discussion above regarding differences in the amount of manager surplus rejected versus approved by principals, the story that emerges is that principals are poor enough at estimating the amount of available profit when they reject the managers' proposals that it impedes their ability to make rational decisions regarding budget rejections. This is meant in the strictest sense of the term "rationality" – i.e. principals accept smaller shares and reject larger shares in the *Principal* condition.

Firm-Level Outcomes

As a final analysis, I examine the firm's outcomes. Regardless of the agent's actions, the bottom-line concern for the firm's residual claimant (the principal in this setting) is the amount of residual they claim. To get a sense of how well the firm does under the various budgetary control schemes, I calculate how much surplus each of the three actors claim in each condition.

TABLE 5: Accuracy of Estimations

Panel A: *Average Absolute Cost Deviation*[a] *and Average Absolute Profit Deviation*[b] *by Condition*

		Condition			
	All	*Both*	*Principal*	*Manager*	*None*
Average Absolute Cost					
Mean	$3.81	$3.26	$3.44	$3.67	$4.77
Std. Dev.	$3.01	$2.57	$2.72	$2.75	$3.62
Min	$0.00	$0.00	$0.00	$0.00	$0.00
Max	$13.80	$13.78	$13.80	$12.33	$13.80
Average Absolute Profit					
Mean	$4.76	$3.37	$3.70	$5.63	$6.11
Std. Dev.	$4.25	$3.36	$3.28	$4.51	$4.88
Min	$0.00	$0.00	$0.00	$0.00	$0.00
Max	$14.00	$14.00	$14.00	$14.00	$14.00
p-value (test of equality of cost and profit deviations)	<0.01	0.70	0.36	<0.01	<0.01

Panel B: *Accuracy of Estimations: Approvals vs. Rejections*

	Condition			
	Both	*Principal*	*Manager*	*None*
Average Absolute Cost				
Budget Approved:	$3.02	n/a	$3.39	n/a
Budget Rejected:	$3.92	n/a	$4.47	n/a
p-value (difference = 0)	0.03		<0.01	
Average Absolute Cost				
Budget Approved:	$2.39	$2.50	n/a	n/a
Budget Rejected:	$4.19	$4.67	n/a	n/a
p-value (difference = 0)	<0.01	<0.01		

[a] Absolute cost deviation is measured as the manager's perception of the production cost less the actual production cost.

[b] Absolute profit deviation is measured as the principal's perception of the available profit less the actual available profit.

In the participative budgeting setting, the surplus is set once the actual cost is known and the total amount of surplus available over the course of the twelve rounds of the experiment was the same for each firm (specifically, $93.10). The percentage of surplus claimed, therefore, is calculated as the total amount of surplus claimed by agents, managers, or principals in each condition divided by the total surplus available to the firms in that condition. Figure 4 shows the average surplus claimed by the firm's three actors across the four conditions. The portion of the graph labeled "Lost" is due to situations in which the budget was rejected by at least one of the superior actors; recall that the result of a rejection is that the entire surplus is foregone. The figure shows that the choice of whether and where to locate budget rejection authority has a substantial impact on both how much surplus the firm is able to claim and who, within the firm, receives the claimed surplus. Generally speaking, granting budget rejection authority to someone in the firm improves the principal's share but comes at the cost of the firm rejecting a sizeable portion of their profitable production. Further, granting budget rejection authority to the principal, either alone or along with the manager, is particularly damaging to the firm's overall ability to take advantage of surplus-generating production as nearly 45% of the total available surplus is lost to rejected budgets.

Tables 6 and 7 provide additional information on the amount of surplus received by each role. Table 6, Panel A shows the average amount of surplus received by each role in each condition and Panel B shows t-test comparisons of these amounts. Overall, the table shows three results. First, the agent receives less surplus as rejection authority is incorporated. Second, the manager does best when they are the only individual with rejection authority. Third, the principal receives a larger share of the surplus when rejection authority has been implemented somewhere in the firm but does not earn a significantly different share depending on where rejection

authority has been implemented. Table 7, Panel A provides average surplus received by each role conditional on the budget not being rejected (Panel B provides associated t-test comparisons). This panel reveals that, as long as the budget is not rejected, the principal does do best when they have rejection authority (in the *Both* and *Principal* conditions). However, it is clear when interpreting the overall results from Tables 6 and 7 that the condition in which the principal does best when "successful" budgeting occurs (i.e. no rejection happens), also comes with the highest rejection rates which has economic consequences for the principal.

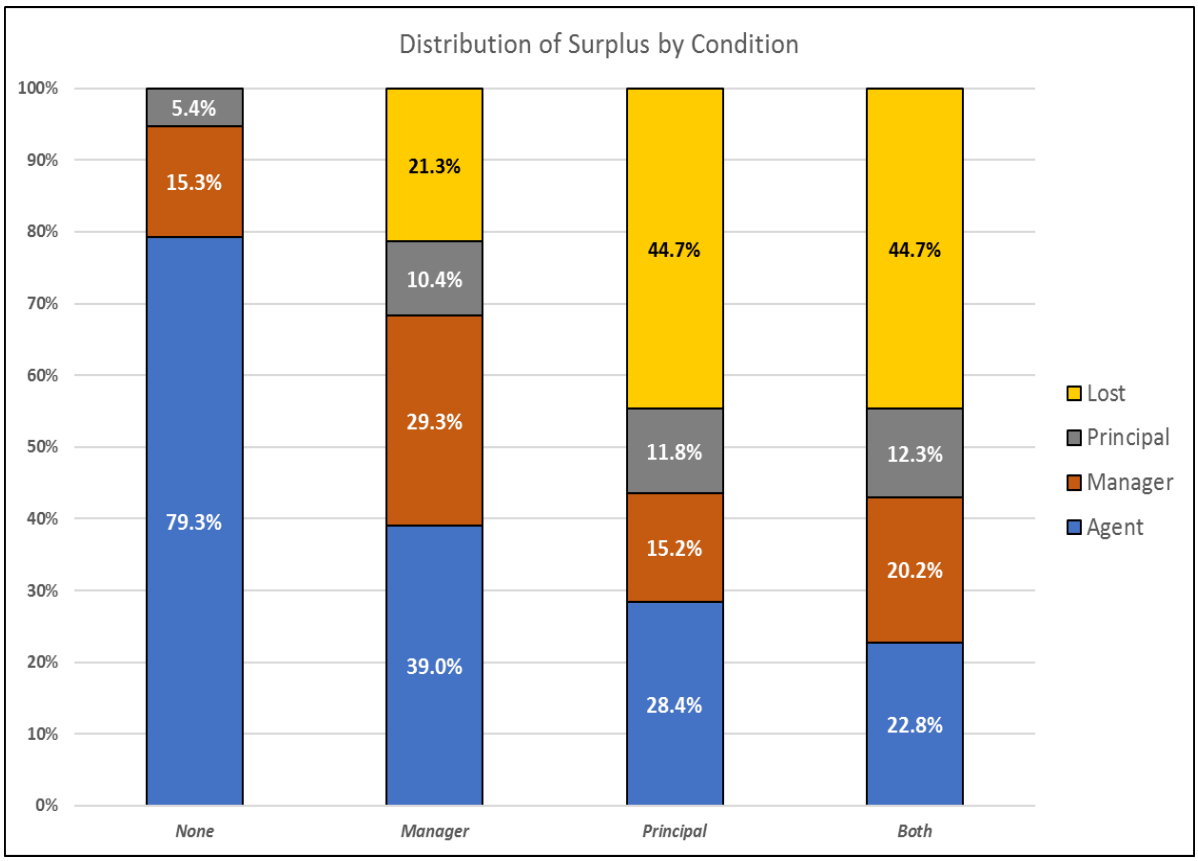
V. CONCLUSION

This study examines the question of where, within the firm's hierarchy, an important budgetary control – the authority to reject the budget – should best be located. The literature in economics on optimal firm height makes the point that, as the firm "grows up," there is often a point at which the time constraints and cognitive load placed on the firm's owner become too burdensome (e.g. Williamson 1967, Colombo and Grilli 2013). A typical response to this problem is to grow the firm vertically by incorporating one or more levels of managers. When this happens, an important decision that needs to be made is exactly which duties should be delegated to these managers and which should be retained by the principal.

The results of this study yield three broad takeaways. First, in spite of theory-driven concerns that delegating budget rejection authority to the manager may result in more misreporting by agents, this study provides evidence suggesting that this is not a primary concern. Specifically, when only the manager has rejection authority, agent misreporting is statistically indistinguishable from an arrangement in which the only the principal has such authority. Second, the question of where to locate budget rejection authority in hierarchical firms

FIGURE 4

Distribution of Surplus



The percentage of surplus received by each role in each Condition is determined by taking the total amount of surplus received by a given role in a given Condition and dividing by the total amount of surplus available in the Condition. For example, there were 20 firms in the *Manager* condition and each firm could claim a maximum of $93.10 over the course of the twelve rounds. As a result, there was a total of $1862 of surplus available, of which the agents received $726.30. Thus, they received $726.30/$1862 = 39% of the total surplus.

Table 6: Surplus Received by Role

Panel A: *Average Surplus Received by Role and Condition*

		Condition			
		Both	*Principal*	*Manager*	*None*
Agents					
	Mean	17.85%	23.02%	35.76%	77.56%
	Std. Dev.	23.90%	30.02%	32.06%	33.45%
Managers					
	Mean	16.13%	12.14%	28.13%	16.02%
	Std. Dev.	20.38%	16.67%	27.80%	24.74%
Principals					
	Mean	10.13%	9.42%	9.86%	6.42%
	Std. Dev.	14.01%	13.74%	11.15%	14.89%

Panel B: *T-test Comparisons of Received Surplus* [a]

Agents

	Manager	*Principal*	*Both*
None	<0.01	<0.01	<0.01
Manager		<0.01	<0.01
Principal			0.05

Managers

	Manager	*Principal*	*Both*
None	<0.01	0.04	0.96
Manager		<0.01	<0.01
Principal			0.02

Principals

	Manager	*Principal*	*Both*
None	<0.01	0.02	0.01
Manager		0.70	0.82
Principal			0.59

[a]: All entries in the tables in Panel B are p-values of t-test comparisons of the average amount of surplus received in the conditions along the vertical and horizontal axes. For example, the p-value of the t-test comparing the average surplus received by principals in the *Manager* and the average surplus received by principals in the *Both* conditions is 0.82.

Table 7: Surplus Received by Role Conditional on No Budget Rejections

Panel A: *Average Surplus Received by Role and Condition*

		Condition			
		Both	*Principal*	*Manager*	*None*
Agents					
	Mean	40.47%	51.63%	48.48%	77.56%
	Std. Dev.	19.42%	23.25%	27.85%	33.45%
Managers					
	Mean	36.56%	27.23%	38.15%	16.02%
	Std. Dev.	13.84%	14.54%	25.80%	24.74%
Principals					
	Mean	22.97%	21.14%	13.37%	6.42%
	Std. Dev.	12.24%	13.26%	11.03%	14.89%

Panel B: *T-test Comparisons of Received Surplus* [a]

Agents

	Manager	*Principal*	*Both*
None	<0.01	<0.01	<0.01
Manager		0.33	0.02
Principal			<0.01

Managers

	Manager	*Principal*	*Both*
None	<0.01	<0.01	<0.01
Manager		<0.01	0.59
Principal			<0.01

Principals

	Manager	*Principal*	*Both*
None	<0.01	<0.01	<0.01
Manager		<0.01	<0.01
Principal			0.32

[a]: All entries in the tables in Panel B are p-values of t-test comparisons of the average amount of surplus received in the conditions along the vertical and horizontal axes. For example, the p-value of the t-test comparing the average surplus received by principals in the *Manager* and the average surplus received by principals in the *Both* conditions is less than 0.01.

is nuanced and the best choice critically depends on the exact goal(s) of the firm implementing the controls. If the goal is to reduce slack capture by the agent, to ensure a more equal distribution of surplus to the various levels of the firm and/or to ensure that the residual claimant receives as much surplus as possible, then the results of this study suggest that rejection authority should be included at every hierarchical layer beyond the first. Third, the incorporation of rejection authority leads to a sizeable "deadweight loss" due to the rejection of budgets and entails noticeable economic consequences for the residual claimant. Further, this result has the flavour of the tradeoff described in Antle and Eppen (1985) in which the principal pre-commits to funding, at a given hurdle rate, any budget report less than or equal to the hurdle rate (i.e. the principal provides funds equal to the hurdle rate) and rejecting any report above that. The fundamental concern stemming from that model is that, in order to curb agent opportunism, the firm must forego profitable opportunities. Despite that fact no hurdle rate is implemented in this study, the same type of tradeoff is observed as a result of budget rejection authority. Additionally, because the both superior actors (particularly the principal) have a difficult time evaluating the reports of their subordinates, the rejection behaviour of the superior actors may not make them better off in some instances. This implies that even simple decision aids or information systems may act to ameliorate the effects of rejections and control agent slack but cause the firm to give up less in profitable production.

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