

Disobedience and Authority

Anthony M. Marino, John G. Matsusaka, and Ján Zábajník*

University of Southern California

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Abstract

This paper presents a theory of the allocation of authority in an organization in which centralization is limited by the agent's ability to disobey the principal. We show that workers are given more authority when they are costly to replace or do not mind looking for another job, even if they have no information advantage over the principal. The allocation of authority thus depends on external market conditions as well as the information and agency problems emphasized in the literature. Evidence from a national survey of organizations shows that worker autonomy is related to separation costs as the theory predicts.

* Comments appreciated: amarino@usc.edu, matsusak@usc.edu, zabojnik@usc.edu, Marshall School of Business, University of Southern California, Los Angeles, CA 90089-1427. We thank Michael Raith for helpful comments, and Dean Darwin for useful discussions about motivating a sales force.

1. Introduction

The allocation of authority is a critical part of the architecture of an organization. One venerable tradition holds that decision rights ought to be placed in the hands of those with relevant information (Simon, 1945/1997). More recently, scholars have emphasized how agency problems might make it undesirable to give decision rights to subordinates, even if they are informed, leading to a theory of authority based on a tradeoff between information and agency problems (Aghion and Tirole, 1997; Dessein 2002; Marino and Matsusaka, 2005). Yet casual observation suggests that even when information and agency conditions are such that a manager would like to make the decision, he may lack the means to induce the worker to carry it out. A manager can tell his sales force to push one of the firm's products over the other but the workers in the field can undermine the order with a lackluster effort for the product that they dislike. Or, to take an example that might be closer to home, a dean can set standards for classroom instruction (theory versus applications, cases versus lectures, and so on) but faculty can sabotage the standards with halfhearted implementation. Since tenured faculty are difficult to dismiss and monetary incentives are weak in a university, a dean may lack the tools necessary to enforce an order, and may have no choice but to delegate decision authority to individual faculty. Professors may enjoy significant control over how they do their jobs, not because such an assignment of authority is optimal from an information or agency perspective, but because there is no way for the dean to centralize authority.

The purpose of this paper is to extend the emerging theory of the allocation of authority in organizations by incorporating the fact that agents can disobey orders. The possibility of disobedience limits the amount of control a manager can exercise, and may

result in the delegation of decision rights to workers. The ability to prevent disobedience depends critically on the strength of sanctions available to managers. Chief among the available sanctions is the power to dismiss a worker: “Within the firm, the sanctions which authority can use are basically those of hiring and firing” (Arrow, 1974, p. 71). Authority is limited is thus limited by the strength of the sanctions, but also by the cost to the manager of using those sanctions. Even if a worker fears dismissal, the sanction will be ineffective if it is too costly for the manager to replace the worker. According to our analysis, workers that are costly to replace or who do not mind looking for another job, will have more scope to disobey an order, and will end up being given more control over how they carry out their assignments.

One implication is that if white collar workers are particularly costly to replace (perhaps because they require more firm-specific training) compared to blue collar workers, white collar workers may be given more autonomy than blue collar workers, even when it comes to routine tasks where they have no information advantage. Our approach also reveals that authority may depend and not only on an internal calculus involving hidden information or action, as in most previous research (for example, Aghion and Tirole (1997) and Gilligan and Krehbiel (1987, 1989)), but also on external market conditions. If labor markets develop so that workers can find new jobs at a lower cost, workers must be given more decision rights all else equal. Thus, our model suggests that a broadening and deepening of labor markets that makes it easier for workers to find new jobs if dismissed, will lead to employees having more autonomy in the workplace, as seems to have occurred over the last half century (Simon 1945/1997).

Managers have additional tools to gain compliance with their commands beyond the threat of dismissal. A vast literature shows how monetary incentives can help align the worker's incentives with the manager, yet the effectiveness of such contracts is limited by risk aversion and limited liability. When we introduce monetary incentives into our model with limited liability, we find that separation costs continue to play a role in the allocation of authority. Less obviously, we find that introduction of monetary incentives has an ambiguous effect on the amount of centralization. Monetary incentives can lead to more centralization if they allow a manager to enforce a command that would not be enforceable with only the threat of dismissal, but can lead to delegation if the incentives are sufficiently strong to make the threat of dismissal unnecessary. One implication is that the growing availability of information technologies that allow more accurate monitoring of worker performance and hence facilitate formal incentive contracts could lead to more or less centralization of decision authority. Interestingly, availability of monetary incentives can even make the manager worse off because the ability to offer incentive contracts in the future makes the manager less willing to dismiss a disobedient worker, and thus weaken the threat of dismissal.

The fact that managers may be forced to delegate decisions for certain workers has implications for hiring policies, managerial styles, and span of control, that do not arise in models where compliance is guaranteed:

- Hiring policy. For jobs that allow workers to make decisions, it is important to have workers whose preferences are aligned with the organization's interests. For jobs where workers will be told what to do, preference alignment is less important

than having workers whose action choices have a large effect on payoffs. Thus, to the extent that white collar workers are harder to replace and given more decision authority than blue collar workers, managers will be relatively more interested in hiring workers that “share the organization’s values” when it comes to white collar jobs, and more interested in raw ability when it comes to blue collar jobs.

- **Managerial traits.** Evidence in economics and psychology suggests that managers may be inherently different in their empathy towards workers, desire for power, attitudes toward risk, and other attributes. We show that a manager with empathy for his workers will tend to delegate more because he seeks to avoid giving orders that will be disobeyed and require disciplinary action, whereas a manager with a lust for power tends to give more orders, dismiss more workers, and experience more disobedience.
- **Span of control.** Previous research suggests that the span of control is limited because information costs increase as the number of subordinates grows. We show that even when information is not constraining, disobedience may limit the span of control. If the marginal cost of replacing a worker is increasing in the number of dismissals, a manager is unable to enforce his orders when his work force is too large.

We provide some evidence on our central implications by studying the autonomy of workers in a sample of firms in the *National Organizations Survey, 1996-97 and 2002*.

Consistent with our model, in a regression framework we find that workers are given more autonomy in carrying out their tasks when it is costly for the firm to replace them and when workers have good outside job opportunities. We also find more delegation in smaller firms, where the loss of an individual worker is likely to be more disruptive in the short run, than in larger firms.

Our analysis is related to several strands of the literature. A growing body of research following Aghion and Tirole (1997) and Gilligan and Krehbiel (1987, 1989) considers the limits on authority that arise from the principal's limited information.¹ We are interested primarily in an external limit to authority – even if the principal wants to make a decision, he may not have the means to force the agent to carry out the decision. The premise of our analysis is that managerial authority ultimately depends on the willingness of workers to follow orders, what Simon (1945/1997; 1991) calls the worker's "zone of acceptance" and Barnard (1938/1968) calls the "zone of indifference." Baker et al. (1999) assume, in contrast, that managerial authority is unlimited and can never be delegated to a subordinate. They study how reputation can be used to effectively delegate authority to agents. Our paper and Baker et al. can be thought of as focusing on different types of decisions: Baker et al. applies to decisions that do not require implementation by the agent (perhaps certain types of promotion decisions) while we focus on decisions that can only be implemented by the agent. Disobedience is also the focus of Landier et al. (2005) who investigate when disobedience can be optimal for an

¹ Papers in this vein include Holmstrom (1977, Ch. 2), Dessein (2002), Zabochnik (2002), Marino and Matsusaka (2005), and Alonso and Matouschek (2006).

organization, and Van den Steen (2005) who studies why agents would agree to contracts in which one party has something like authority.

The outline of the paper is as follows. Section 2 lays out the model. Section 3 identifies the key factors that limit the authority of the manager and derives the main implications of the model. Section 4 introduces monetary incentives. Section 5 examines several extensions of the basic model, including hiring policies, managerial traits, span of control, and social sanctions and rewards. Section 6 reports the empirical evidence. Section 7 concludes.

2. The Model

A principal supervises an agent on a project that takes two periods ($t = 1, 2$) to complete. This can represent a manager and worker, a CEO and division manager, a dean and professor in a university, and so on. The principal cannot implement the project himself – he requires the agent to do it – but he can replace an unsatisfactory agent with another agent. All actors are risk neutral and discount the future at $\delta \in (0, 1)$.

A. Actions and Payoffs

The project's return is realized at the end of the second period, but consists of a payoff generated each period. For example, in the first period a sales person makes an initial visit to a potential customer, and in the second period the deal is closed. The final price is the combination of payoffs generated in both periods (both visits).

The return in each period depends on the state $i \in \{1, 2\}$ and an action chosen by the agent $a \in \{a_1, a_2\}$. The states are equally likely, and the state persists across both

periods. In state i , the principal's payoff is H if the action is a_i , and L if the action is a_{-i} , where $H > L \geq 0$. There are two types of agents, good and bad. In state i , a good agent earns $b > 0$ from action a_i , and earns 0 from action a_{-i} . In contrast, a bad agent in state i earns b from action a_{-i} , and earns 0 from action a_i . Thus, a good agent agrees with the principal about what action to take while a bad agent disagrees with the principal. Payoffs as a function of states and actions are summarized in Table 1. For simplicity, the payoff matrix and action choices are identical in each period. For example, if the project generates a payoff of H in the first period and H in the second period, the return at the end of the second period is $2H$.

B. Information

Neither the principal nor the agent knows the agent's type at the time of hiring, but they both know that the agent is good with probability α . The principal may choose to dismiss the agent after the first period and hire a new agent to complete the project in the second period. The new agent's probability of being good is β . The parameter α represents the congruence between the preferences of the initial agent and the principal, and β is the congruence between the principal and a replacement agent. The two parameters may be different if the principal has learned something about the incumbent agent at some time before the start of our model.² A bad agent's desire to appear to be a good agent is what may induce him to obey an order from the principal.

² Separate congruence parameters between incumbent and replacement workers allows us to study how changes in the incumbent's congruence affect the allocation of authority, holding constant the congruence of the pool of replacement workers.

Neither the principal nor the agent knows the state initially. After the agent is hired and installed in the organization, the agent learns whether he prefers a_1 or a_2 , that is, he observes which action gives him b and which gives 0. At this point, the agent does not know whether he is a good or bad type, however, because he cannot observe the state. For instance, the salesman learns that he is better able to sell one of the firm's products than the other, but he does not know if his favored product is the one that is most important for the firm's overall strategy.

The principal can learn the state and give the agent an order at a cost of $c > 0$. Continuing the previous example, the principal learns which of the products should be emphasized by the salesman in order to maximize the firm's overall profit. If the principal gives a command, he will order action a_i in state i .

C. Authority and Disobedience

If an order is given, the agent has the option to follow the order or he may disobey and choose the other action. The principal observes the agent's action after it has been taken, but he cannot overrule or otherwise directly force an action. That is, the sales manager cannot go into the field himself, and the dean cannot teach the classes himself. At this point, we assume the agent is paid a fixed wage so the most the principal can do is dismiss a disobedient agent and hire a replacement for the second period. If an agent is dismissed, the principal incurs a cost s_p to find and train a replacement, and the agent incurs a cost s_A to find a new job that pays his reservation utility 0. The costs are incurred in the second period.

Instead of giving an order, the principal can delegate the decision to the agent. As discussed above, all of the principal's payoffs arrive at the end of the second period. The salesman makes an initial visit to a client in the first period and a final visit to close the deal takes place in the second period. Since the principal has no payoff at the end of the first period, he cannot determine the agent's type until the project is over if he does not know the state. The agent's private benefits are received instantaneously in the first and second period, and the separation costs are paid in the second period.

3. Basic Tradeoffs

A. Authority when the Agent Obeys

The principal's expected utility depends on whether he gives an order, and how the agent responds. At one extreme, the principal retains authority, becomes informed, and gives an order that the agent obeys. His expected utility in this case of "centralization" is

$$(1) \quad V^C = -c + \delta H + \delta(\alpha H + (1-\alpha)L).$$

The cost c is paid to collect information and issue an order. The agent obeys the order in the first period, producing a return of H . In the second period, the agent chooses H or L depending on his type. All revenue from the project arrives discounted in the second period.

At the other extreme, the principal delegates the decision to the agent. Since the agent does not know the state, he chooses his privately optimal action. The principal's payoff in this "delegation" case is

$$(2) \quad V^D = 2\delta(\alpha H + (1-\alpha)L).$$

A comparison of (1) and (2) shows that centralization when the agent obeys is better for the principal than delegation when

$$(3) \quad c < \delta(1-\alpha)(H-L).$$

Thus, centralization is preferred when the principal's cost of becoming informed (c) is low, when the agent's preferences differ from the principal's preferences (α is small), and when the agent's action choice has a significant impact on the principal's return ($H-L$ is large), that is, it is an "important" decision from the principal's perspective.³ These tradeoffs are fairly standard in models of delegation, and appear in a variety of models when the principal's orders are automatically accepted by the agent (Gilligan-Krehbiel, 1997, 1989; Aghion-Tirole, 1997). Since we are primarily interested in the factors that limit authority, except where noted we will assume throughout that c is

³ Our result that centralization is more valuable when α is high stems from the fact that a good agent makes the right choice from the principal's perspective, but the bad agent requires direction. If the model were set up so that the good agent requires direction from the principal to make the right choice, this result would be reversed. Our choice is consistent with Aghion and Tirole (1997) but our main conclusions with respect to separation costs do not depend on this modeling decision.

sufficiently small so that (3) holds, meaning that the principal always prefers centralization to delegation when centralization is feasible.

B. Disobedience

The agent can disobey an order from the principal, and the principal's only recourse is to replace the agent with another who he hopes will be better. The principal's utility when he gives an order that is disobeyed and replaces the agent ("centralization with disobedience") is

$$(4) \quad V^{CD} = -c + 2\delta\alpha H + \delta(1-\alpha)(L + \beta H + (1-\beta)L - s_p).$$

Of course, the principal prefers to have his order obeyed: $V^C > V^{CD}$. Whether he is better off giving an order that is disobeyed or simply delegating depends on the parameters. The benefit of giving an order even if it is disobeyed is that a bad agent will be revealed and replaced in the second period by a new draw from the distribution.⁴ The disadvantage of giving an order is the cost of collecting information and the cost of finding a replacement. Giving an order is preferred ($V^{CD} > V^D$) if

$$(5) \quad c < \delta(1-\alpha)(\beta(H-L) - s_p).$$

In words, the principal compares the cost of becoming informed with the expected benefit of possibly replacing a bad agent with a good agent, less the direct cost of

⁴ Alternatively, the principal could become informed, not bother to give an order, but use his information to identify and dismiss a bad agent based on the action taken in the first period.

replacement. Given our assumption that c is small enough that (3) holds, the principal prefers centralization when feasible, and either delegates or gives an order that is disobeyed when centralization is infeasible.

In order for centralization to be feasible, two conditions must hold. First, the principal must be willing to fire a disobedient agent. Only a bad agent would consider disobeying an order. The principal is willing to dismiss a bad agent at the end of the first period if $-\delta s_p + \delta(\beta H + (1 - \beta)L) > \delta L$. The principal's incentive compatibility condition for feasible centralization is then

$$(ICP) \quad s_p < \beta(H - L) \equiv s_p^*.$$

The principal's cost of firing must be less than marginal value of employing a congruent agent rather than a bad agent in the second period, weighted by the probability of hiring a congruent agent.

The other feasibility condition is that the agent must prefer obeying and keeping his job to disobeying and being dismissed. The benefit of staying into the second period is that the agent can choose his preferred action without consequence from the principal. A bad agent disobeys if $b - \delta s_A > \delta b$. Then the agent's incentive compatibility condition for feasible centralization is

$$(ICA) \quad s_A > b(1 - \delta) / \delta \equiv s_A^*.$$

The agent's cost of dismissal must exceed the difference between earning b in the first period and earning discounted b in the second period.

The two incentive compatibility conditions define the limits to centralization. Together with conditions (3) and (5), they characterize the principal's choice of decision process, summarized in the following proposition and illustrated in Figure 1.

Proposition 1. *Centralization is optimal and feasible if and only if both ICP and ICA hold. If ICP holds but ICA does not hold, then centralization with disobedience is optimal if (5) is satisfied. In all other cases, delegation is optimal.*

Proposition 1 and Figure 1 indicate that even when the principal would prefer to make the decision himself (that is, (3) holds), he can only enforce his authority when the agent's cost of dismissal is sufficiently high and his own cost of replacing the worker is sufficiently low. In all other cases, he will either delegate the decision to the agent, or give an order that is disobeyed by the bad agent.

C. Factors Affecting the Assignment of Authority

While previous research has studied how changes in information and agency problems alter the optimal assignment of decision authority, our model highlights how changes in the principal's ability to control disobedience can drive the delegation decision. Here we discuss how the allocation of authority depends on the parameters.

1. Principal and Agent Separation Costs

A key idea of our paper is that the amount of centralization is limited by the principal's and agent's separation costs. The principal's separation cost is comprised of the direct cost of dismissing a worker (creating a paper trail, counseling out, potential

lawsuits, separation payments), locating and hiring a replacement, as well as the cost of training the new worker. If workers with specialized skills are more costly to replace – because replacements are harder to find and require the firm to invest in more training – the model implies that they should be given more decision rights. This may explain why white collar workers seem to have more autonomy in how they perform their job than blue collar workers. The information view of delegation also suggests giving white collar workers more control when they are more informed about the best course of action, but does not predict giving them control over aspects of their job where their information advantage is less obvious, such as scheduling of work hours and attire.

The cost of replacing a worker is likely to be lower in a large firm than a small firm because in a large firm there are more co-workers who can step in and cover for the dismissed worker until a replacement is found. Therefore, workers in small firms should have more autonomy than workers in large firms.

When the worker's separation cost is low, the firm will delegate more because the principal has no stick to enforce his commands if the worker does not fear dismissal. This formalizes Arrow's (1974, p. 64) observation: "The scope of this authority will usually be limited by the terms of the contract, and, more fundamentally, it is limited by the freedom with which an employee can leave the job." The worker's cost of being dismissed depends on characteristics specific to the worker as well as general market conditions. Well-developed labor markets are likely to reduce the cost of finding a new job by reducing the amount of search required. Our model thus identifies a link between the centralization of authority and general market conditions. This gives one way to understand the long run trend toward more autonomy in the workplace (Simon,

1945/1997). As labor markets have expanded and workers have become more mobile, workers are less averse to losing their job, and firms must delegate more decision rights to them (assuming the firm's cost of replacement does not decrease at the same time, for example, if the firm's replacement costs primarily involve training). Similarly, our analysis suggests that workers in less developed economies will be given less flexibility in how they accomplish their tasks than workers in developed economies, and workers in towns dominated by a single employer will have fewer decision rights than workers in a city with competing employers.

Observe that the effect of principal and agent separation costs is somewhat asymmetric. A sufficiently large separation cost for the principal results in delegation, regardless of the agent's separation cost, but the same does not hold for the agent's separation cost. Thus, allocation of authority can be principal's separation costs

2. Discount Rate

The discount rate does not play a role in most existing models of delegation, but it is crucial in our analysis because the willingness of a worker to obey a command he dislikes today depends on how he values continuing on the job tomorrow. An increase in δ makes it easier to satisfy the agent's incentive compatibility condition (ICA) because the agent places a higher value on keeping his job. In terms of Figure 1, an increase in δ shifts down the border of the shaded centralization region. An increase in δ also increases the principal's value of centralization with disobedience relative to outright delegation because it increases the value of identifying and replacing a bad agent (condition (5)). This effect is represented by a rightward shift in the boundary between

centralization with disobedience and delegation. The net effect of the two shifts is to expand the centralization region, reduce the delegation region, and increase the centralization with disobedience region relative to the delegation region (although not necessarily with respect to full centralization).

In short, the model suggests that delegation is more likely when the principal and agent heavily discount the future. Since workers and managers of firms in distress are likely to discount the future at a higher rate, one implication is that distressed firms delegate more authority to workers. Similarly, firms in industries that are downsizing would be expected to delegate more, assuming their separation costs do not change.

The discount rate is also important in Baker et al. (1999) and Alonso and Matouschek (2004), but it works in the opposite direction. In that model, the principal has unlimited ability to enforce orders and his problem is to find a way to credibly delegate. When the principal and agent discount the future, it is harder for the principal to commit not to intervene, and less delegation is the result.

3. Congruence, Private Benefits, and Task Importance

The parameters α , b , and $H - L$ have been much discussed in the literature. The typical finding is that decisions are delegated when the principal and agent have congruent preferences (α is high), when the worker has high private benefits associated with the decision (b is high), and when worker's choice is relatively unimportant for the principal ($H - L$ is low). As noted, our model displays the same basic features when the principal's commands are obeyed (see (3) and (5)), that is, when disobedience is not a concern. Private benefits and task importance also affect the allocation of authority by

changing the constraints on obedience. An increase in private benefits makes the worker less obedient by tightening his incentive compatibility constraint, possibly making centralization infeasible. An increase in task importance relaxes the principal's firing constraint, making centralization more feasible. Thus, the effects on the constraints tend to reinforce the effects on the principal's utility.

A more distinctive implication concerns β , the probability that a new hire will share the preferences of the principal. This parameter could be high for firms that are admired by some outsiders because of their innovative nature (Apple) or because of their association with social objectives that some workers share (Whole Foods). A high value of β makes the firm more willing to dismiss a disobedient worker, shifting the principal's incentive compatibility line right in Figure 1. Somewhat counter-intuitively, firms that can rely on outside workers to share their values may be less likely to delegate, even if the average congruence of existing workers (α) is also higher.

4. Monetary Incentives

Our analysis so far abstracts away from monetary incentives, assuming that the principal's only "stick" is the threat of dismissal. In some organizations, such as government bureaucracies, this may not be a bad assumption, but in firms it is less plausible. In this section, we are interested in the robustness of our previous conclusions to the introduction of incentive contracts, and more substantively, in how the availability of monetary incentives affects the allocation of authority and the principal's welfare.

We extend the model by assuming the agent has a reservation utility of zero and is protected by limited liability so that the wage in each period must be nonnegative. The

only contractible variable is output, so in each period the principal and agent sign a one-period contract conditional on output.⁵ To minimize rents received by the agent, the principal sets the wage equal to zero when output is L . Let w_t denote the wage at time t if output is H . As a convention, we assume both w_1 and w_2 are paid in the second period when output is observed. To simplify, we assume throughout that $\alpha = \beta$, although we will continue distinguishing between the two in order to help the reader see where our expressions are coming from. Also, we restrict our analysis to the case $b < H - L$, omitting the case where it is efficient to let the agent choose his preferred action.⁶

A. *Optimal Monetary Incentives*

Monetary incentives can be effective only if the principal gives an order because without an order the agent does not know which action the principal would like him to take. Therefore, in solving for the optimal contract, we only consider the case where the principal is informed.

In the second period, a bad agent obeys an order if and only if $w_2 \geq b$. To minimize the wage bill, the principal sets $w_2^* = b$ if monetary incentives are offered. The agent's private benefits b thus determines the cost of using monetary incentives. If the principal knows the agent's type, he never gives monetary incentives to a good agent because a good agent's private benefits lead him to choose the right action. On the other

⁵ Allowing the contract to be conditional on whether an order is obeyed would not change anything. We also rule out multi-period contracts.

⁶ Even though it is efficient to follow the agent's preferred choice when private benefits are sufficiently large, the principal might not find it optimal to do so because monetary transfers from the agent to the principal are not possible. None of our main implications below reverse if private benefits are large.

hand, the principal always gives monetary incentives to a bad agent because $H - b \geq L$. If the agent's type is unknown, the principal gives an incentive contract if $H - w_2^* \geq \alpha H + (1 - \alpha)L$ or $(1 - \alpha)(H - L) \geq b$. Observe that the principal is more willing to give monetary incentives when the agent is known to be bad than when the agent's type is uncertain. The optimal contract depends on the agent's private benefit, as established in the next two subsections.

1. Monetary Incentives when $b \leq (1 - \beta)(H - L)$

When the agent's private benefit is low enough to fall in this range, the principal gives a second-period incentive contract to a replacement worker as well as to a known bad agent. Since both a replacement and a known bad agent would choose H in the second period, and both would be paid the same, the principal is never willing to incur the separation cost associated with replacing a disobedient agent. Therefore, an agent who is disobedient in the first period will not be fired, but retained and given monetary incentives in the second period.

In the first period, the bad agent obeys an order if $\delta w_1 \geq b$, so the optimal first period wage is $w_1^* = b / \delta$ if monetary incentives are offered. The principal used monetary incentives in the first period if and only if

$$\delta(H - w_1^*) + \delta(H - w_2^*) \geq \delta(\alpha H + (1 - \alpha)L) + \delta(\alpha H + (1 - \alpha)(H - w_2^*)),$$

which reduces to

$$(6) \quad b \leq \frac{\delta(1-\alpha)(H-L)}{1+\alpha\delta} \equiv b^* .$$

If $b \leq b^*$, the principal offers monetary incentives in both periods and the agents obey. If $b > b^*$, the principal does not offer monetary incentives in the first period, but does give an order. The bad agent disobeys, revealing his type, and the principal retains him with monetary incentives in the second period. Since the agent is not fired for disobedience, separation costs are unimportant in this parameter region. To summarize:

Optimal monetary incentives when b is low. Suppose the principal is informed.

(a) If $b \leq b^*$ (defined in (6)), then the principal uses monetary incentives in both periods and all agents obey.

(b) If $b^* < b \leq (1-\beta)(H-L)$, then the principal does not use monetary incentives in the first period, the bad agent disobeys but is not fired, and the principal uses incentives for the bad agent in the second period.

2. Monetary Incentives when $(1-\beta)(H-L) < b \leq H-L$

In contrast to the previous case, here a worker of unknown type (including a replacement) does not receive monetary incentives in the second period. Since a known bad agent receives monetary incentives in the second period, replacing a disobedient worker is optimal if $-s_p + \beta H + (1-\beta)L \geq H - b$, or

$$(7) \quad s_p \leq b - (1-\beta)(H-L) \equiv s_p^{**} .$$

Two things are worth noting. First, the cost of separation matters here. Second, s_p^{**} is less than $\beta(H - L) = s_p^*$, the cutoff point for replacing a disobedient agent in the absence of monetary incentives. The availability of monetary incentives reduces the principal's willingness to dismiss a bad agent because the principal can get compliance in the second period with a wage scheme instead of having to hire and train a new worker.

Turning to the first period, if $s_p \leq s_p^{**}$, the bad agent will be fired if disobedient, so he obeys an order if $\delta(w_1 + b) \geq b - \delta s_A$. If $s_p > s_p^{**}$, the principal will not fire a disobedient agent, but retain him and use monetary incentives in the second period. Then a bad agent obeys an order in the first period if $\delta(w_1 + b) \geq b + \delta b$. Using the definition $s_A^* = b(1 - \delta) / \delta$ from (ICA), the optimal first period wage can be summarized as

$$(8) \quad w_1^* = \begin{cases} s_A^* - s_A & \text{if } s_p \leq s_p^{**} \text{ and } s_A < s_A^*; \\ 0 & \text{if } s_p \leq s_p^{**} \text{ and } s_A \geq s_A^*; \\ b / \delta & \text{if } s_p > s_p^{**}. \end{cases}$$

As was the case without monetary incentives, the bad agent can be induced to obey an order simply with the threat of firing when $s_A \geq s_A^*$. When $s_A < s_A^*$, to get obedience requires in addition a wage payment that brings the combined (wage + separation) cost of disobedience up to s_A^* . The optimal contract is as follows and depicted in Figure 2 (proved in the appendix).

Optimal monetary incentives when b is high. Suppose the principal is informed and $(1 - \beta)(H - L) < b \leq H - L$.

(a) If $s_p \leq s_p^{**}$, then a disobedient agent is replaced, the principal uses monetary incentives in the first period if and only if

$$(9) \quad s_A^* - (1 - \alpha)s_p - (1 - \alpha)(1 - \beta)(H - L) < s_A < s_A^*,$$

a bad agent obeys if monetary incentives are used or if $s_A \geq s_A^*$, and (only) a known bad agent receives monetary incentives in the second period.

(b) If $s_p > s_p^{**}$ then a disobedient agent is not replaced, monetary incentives are not used in the first period, a bad agent disobeys in the first period, and (only) a known bad agent receives monetary incentives in the second period.

B. Authority and Separation Costs when Monetary Incentives are Available

When monetary incentives are available, the concept of decision centralization is somewhat ambiguous. In addition to outright commands, the principal may simply reveal his information and rely on monetary incentives to induce the agent to make the right choice without the threat of dismissal. In order to discuss authority when monetary incentives are available, we distinguish between two forms of communication between a principal and a subordinate. Organization scholars observe that managers can influence workers in more ways than giving orders (Simon, 1945/1997, p. 180):

The relation of authority by no means comprehends all situations where the verbalizations of one person influence the behavior of another. . . . The characteristic which distinguishes authority from other kinds of influence is . . . that a subordinate holds in abeyance his own critical faculties for choosing

between alternatives and uses the formal criterion of the receipt of a command or signal as his basis for choice. On the other hand, a person who receives a suggestion accepts it as only one of the evidential bases for making his choice.

We flesh out this idea by distinguishing between communication where the agent is expected to obey the order regardless of his own information and communication where the agent is free to ignore the order but his pay depends upon the principal's payoff. We define *authority* to be a situation in which the principal gives an order and the agent is fired if he disobeys. We define *suggestion* to be a situation in which the principal gives an order and the agent's job does not hinge on whether or not he obeys the order, although his compensation may depend on the outcome.⁷ Given these definitions, the next proposition establishes the robustness of our central conclusion that high separation costs promote delegation to the introduction of monetary incentives (proof in appendix).

Proposition 2. *When monetary incentives are available, an increase in s_p or a decrease in s_A can cause the optimal decision arrangement to shift from authority to delegation or suggestion but not the other way around.*

Although an increase in principal or agent separation costs makes authority less likely, the effect on suggestion can go either way. For the parameter assumptions underlying Figure 2, an increase in s_p that causes a shift from region II to region IV can

⁷ "Suggestion" in our model is a bit artificial because the principal does not really want the agent to take into account his own information. Suggestion would have a more realistic flavor in a more complicated model in which the agent has valuable information about the principal's payoff..

trigger a shift from delegation to suggestion if $s_A < b(\alpha - \delta)$. Intuitively, the cost of monetary incentives in region II may be high enough to make delegation optimal in that region. Suggestion can be optimal in region IV even though the agent disobeys and the principal does not replace him because the agent's disobedience allows the principal to assign him an incentive contract in the second period without having to offer the same contract to a good agent.

C. How Monetary Incentives Change Authority

This section studies how the allocation of authority varies depending on whether monetary incentives are or are not available to understand how decision authority responds to exogenous changes in availability of monetary incentives. For example, how does centralization in government jobs, where political considerations limit the use of monetary incentives, compare to centralization in firms? Will firms delegate more or less if innovations in information technology allow better measurement of worker performance and make it possible to link pay to performance? The next proposition shows that monetary incentives can both replace and augment authority.

Proposition 3. *If monetary incentives become available, the optimal decision arrangement can change from authority to delegation but not the other way around, except when $(1 - \beta)(H - L) < b \leq H - L$ and $s_p < s_p^{**}$, in which case the optimal decision arrangement can change from delegation to authority.*

Intuitively, availability of monetary incentives has two effects on the value of authority. First, the substitution of cash incentives for the threat of dismissal may allow the principal to avoid the deadweight cost of dismissal, making suggestion relatively attractive compared to authority. But, acting in the other direction, monetary incentives can also be combined with a threat of dismissal to augment the principal's power to sanction the agent. If the agent's separation cost is so low that the threat of dismissal alone cannot prevent disobedience, adding monetary incentives may increase the cost of dismissal enough to get compliance, and can make centralization feasible when it would not be otherwise. In short, monetary incentives can lead to more authority by strengthening the principal's ability to enforce commands.

Proposition 3 implies that monetary incentives can complement or substitute for the threat of dismissal. In most cases, the sanctions work as substitutes, but they can be complements when the principal's and agent's cost of separation are not too high (region II in Figure 2). This suggests that workers will have more autonomy (and stronger monetary incentives) in jobs where performance is easy to monitor, and hence to contract on, than jobs where performance is difficult to monitor, except in environments where managers and workers do not incur large costs from separation. Our analysis also implies that advances in information technology that make it easier to monitor and hence to contract on performance will tend to result in workers being given greater autonomy in accomplishing their assignments. The exception is jobs where the separation cost for workers is low, perhaps such as fast food workers in large urban areas, in which case monetary incentives may be coupled with dismissal threats to allow greater centralization.

Availability of monetary incentives gives the principal another tool and typically makes him better off. However, as the next proposition shows, introduction of monetary incentives can make the principal worse off in some circumstances (proof in appendix).

Proposition 4. *The principal can be worse off when monetary incentives are available than when they are unavailable.*

The potential problem with monetary incentives, from the principal's point of view, is that it may be more difficult to credibly threaten a worker with dismissal when monetary incentives are cheaper than replacing a disobedient worker. Intuitively, suppose that centralization is optimal when monetary incentives are unavailable. The principal then can elicit good behavior from the bad agent in the first period at no cost through the threat of dismissal. When monetary incentives are available, the threat of dismissal may not be credible, and the principal may only be able to elicit good behavior by paying for it. Thus, the principal may be forced to use a more costly tool to gain compliance.

This result may provide some insight on the otherwise puzzling fact that many organizations seem to use few or no monetary incentives. If a firm can commit not to use monetary incentives, the threat of firing becomes more effective. Commitment might be achieved by not adopting monitoring technology even if it is available. The underlying logic also suggests that the principal would like to have monetary incentives available when the cost of replacing workers is high and decisionmaking is typically delegated.

5. Extensions

This section sketches several extensions to the basic model in order to illustrate how incorporation of disobedience into a model of authority may shed light on a variety of organizational issues. To keep results uncluttered, we focus on the model without monetary incentives.

A. *Hiring Policies*

The fact that compliance with orders is not guaranteed has interesting implications for a firm’s hiring policy. In particular, when decisions must be delegated to a particular job holder, it changes the type of worker that the firm would to have in that job. To analyze this, consider two jobs, one with very low information and centralization costs c so centralization is optimal (that is, costs that satisfy (3)) and the other with very high costs so that delegation is optimal, respectively called the “blue collar” and “white collar” jobs for short (alternatively, we could assume that the separation costs are such that one job is centralized and the other decentralized). Worker are characterized by α , H , and L , and we are interested in which characteristics are important for each job. For example, is congruence more valuable for the white collar or blue collar worker?

For simplicity, suppose that $L = 0$. Then there are two relevant worker characteristics: α represents how closely the worker shares the organization’s objectives and H represents the importance of the worker’s choice, what might be called his marginal product or ability. Worker attributes are supplied elastically in the market at prices p_α and p_H . A firm seeking to hire a worker for a job type $i = C, D$ solves

$$(10) \quad \max_{\alpha, H} \{V^i - p_\alpha \alpha - p_H H\},$$

where $V^C = -c + (1 + \alpha)\delta H$ from (1) and $V^D = 2\alpha\delta H$ from (2).

Observe that the marginal value of a is higher for a decentralized than centralized job, all else equal: $dV^D / d\alpha = 2\delta H > \delta H = dV^C / d\alpha$. Intuitively, congruence is more important for white collar workers than for blue collar workers because white collar workers are given more autonomy, making it more important that they share the organization's goals. Conversely, the marginal product of worker ability is higher for the centralized than decentralized job, all else equal: $dV^C / dH = (1 + \alpha)\delta > 2\alpha\delta = dV^D / dH$. Ability is more important for blue collar workers than for white collar workers because the difference between centralizing and delegation for the principal consists of forcing the agent to choose H instead of L .

Taking first order conditions, the solution to the hiring problem (10) is $\alpha_D = p_H / 2\delta$, $H_D = p_\alpha / 2\delta$, $\alpha_C = p_H / \delta - 1$, $H_C = p_\alpha / \delta$, where subscripts indicate the optimal values for centralized and decentralized jobs.⁸ Firms will care more about recruiting workers that share their values for white collar jobs than blue collar jobs ($\alpha_D > \alpha_C$). Along these lines, Simon (1991, p. 34) observes, "Pride in work and organizational loyalty are widespread phenomena in organizations . . . These traits are more strongly evident among skilled and managerial employees than among employees engaged in very routine work." Conversely, managers will place a greater emphasis on

⁸ The optimal quantities do not depend on own prices because of linearity in the V functions.

the marginal product of decisions when hiring blue collar than white collar workers ($H_C > H_D$) assuming that blue collar workers have less discretion in what they do.⁹

B. Managerial Traits

A variety of evidence suggests that managers may be “hardwired” to take different approaches to their jobs. For example, Simon (1945/1997) notes psychological evidence that some managers may covet power more than others, and that some workers may be predisposed to obey order more than others. Dial and Murphy (1995) argue that some managers may be unwilling to lay off workers when the firm ought to downsize and Bertrand and Schoar (2003) provide evidence that managers differ not only in ability but in attitudes toward risk. Here we sketch an approach to the relation between authority and managerial traits.

One possible trait is empathy with workers. A manager may find it personally costly to dismiss a worker because of empathy or because firing a worker will subject the manager to criticism from others (Dial and Murphy, 1995). We can model this as a disutility e from dismissing a worker. The incentive compatibility condition for an “empathetic” manager (so defined) is

$$(ICP') \quad s_p < \beta(H - L) - e .$$

Introduction of empathy shifts left the line dividing full delegation from centralization in Figure 1. Therefore, an empathetic manager delegates more.

⁹ If L is nonzero, it can be shown that the marginal product of the worker choice, $H - L$, is larger for the centralized than delegation situation.

Interestingly, an empathetic manager also is less likely to have a worker disobey an order – not because workers reciprocate his concern, as it might appear, but because he avoids giving orders that will be disobeyed.

Another difference between managers is their attraction to power (Simon, 1945/1997, pp. 206-207). Some managers may derive utility from the exercise of power per se. We can model this as a positive utility o from giving a command. This extension does not change the separation constraints or the tradeoff between (obedient) centralization and delegation (which we have assumed always favors centralization). It does change the tradeoff between delegation and centralization with disobedience, however, with centralization now preferred if

$$(5') \quad c / \delta(1 - \alpha) + s_p < \beta(H - L) + o.$$

In Figure 1, the boundary between the two regions shifts right. Thus, a manager who enjoys the exercise of power is more willing to choose centralization with disobedience. Such a manager would give more orders than a “regular” manager, but also would experience more disobedience and end up dismissing more workers. Since the manager’s payoff may or may not coincide with the firm’s payoff (about which our model says nothing), giving an order that is disobeyed may or may not be good for the firm. It could be good by allowing the manager to identify and replace a bad worker. On the other hand, many organization scholars view disobedience as disruptive to the organization. Managers who “become unbalanced by a delusion of power” and give

orders that are disobeyed, writes Barnard (1938/1968, p. 168), “are often guilty of ‘disorganizing’ their groups.”¹⁰

C. Span of Control

In information-based theories such as Aghion and Tirole (1997) and Garicano (2000), a manager’s span of control is limited because information cost rises with the number of subordinates. Yet one can imagine situations in which the principal’s information cost is independent of the number of subordinates, for example, when a general decides whether his army should attack from one direction or another, or when a sales manager sets a marketing strategy. In such cases, information considerations do not appear to limit the span of control. This section shows how a desire to control disobedience may limit the span of control even when information considerations do not. The limit arises because the principal’s cost of replacing a worker is likely to be increasing in the number of workers dismissed (Arrow, 1974, p.71): “Clearly, if enough workers disobey orders, they cannot be enforced. . . . The firm simply cannot afford to fire them all.”

To study this idea, we assume the principal’s marginal cost of dismissing the m -th worker is an increasing function $s_p(m)$.¹¹ The principal is willing to dismiss at most m^*

¹⁰ To make normative claims about the wisdom of giving orders that are disobeyed would require a model in which disobedience could be optimal. For example, in Landier et al. (2005), a subordinate’s refusal to implement a manager’s project can prevent bad projects from being selected in the first place. Alternatively, workers might disobey the manager because they believe the manager’s orders are harmful to the organization’s mission.

¹¹ More generally, the marginal cost of dismissal might depend on the total number of workers as well as the number fired, because there may be less disruption from a given number of dismissals in a large than a small organization.

workers, the greatest m such that $s_p(m) < \delta\beta(H - L)$. Worker separation costs are assumed to be large enough to induce obedience if disobedience results in certain dismissal (that is, ICA holds). Once an order is given, workers independently and simultaneously decide whether to obey or disobey, knowing their own type but without knowing the realized types of their coworkers. The manager observes worker choices sequentially and must make a final retention/dismissal decision on each case as it comes before him.¹² For example, a general gives orders to all soldiers at the same time but instances of disobedience come to his attention in an unpredictable order. If a disobedient worker is dismissed with probability q , then a bad worker chooses to obey if $qs_A > b(1 - \delta) / \delta$. This incentive compatibility condition defines the critical probability that results in obedience:

$$(10) \quad q^* = b(1 - \delta) / \delta s_A.$$

If $q < q^*$ then no bad agent will obey.

We want to identify the largest number of workers, S , that can be given orders *that will be obeyed*. Specifically, we seek a span of control in which disobedience cannot arise in any possible Nash equilibrium. Disobedience is most difficult for the principal to

We could incorporate this by specifying as $s_p(m, S)$, where S is the total number of workers. Disobedience would still limit the span of control if the separation cost is concave in S .

¹² Alternatively, we could also assume the manager randomizes which workers to punish from the set of disobedient agents. Either assumption prevents the manager from committing to a particular sequence of punishment, such as punish person A first, punish person B second, and so on. If such commitment is possible, the manager can guarantee universal compliance.

control in the equilibrium where every bad agent chooses to disobey if any disobey, what might be called the “rebellion” equilibrium. In this case, which sets the limit on S , a bad worker’s probability of being dismissed for disobedience depends on the realized number of bad workers, x . If $x \leq m^* - 1$, the worker will be dismissed with certainty, while if $x > m^* - 1$, he will be dismissed with probability $m^* / (x + 1)$. Given a span of S agents, x follows a binomial distribution $B(x; S - 1, 1 - \alpha)$, and

$$(11) \quad q(S; m^*, \alpha) = \sum_{x=1}^{m^*-1} B(x; S - 1, 1 - \alpha) + \sum_{x=m^*}^S \frac{m^*}{x + 1} B(x; S - 1, 1 - \alpha).$$

The maximum span of control that cannot be overwhelmed by rebellion is the solution to

$$(12) \quad q(S; m^*, \alpha) = q^*.$$

Equations (10)-(12) characterize the maximum span of control. One comparative static implication, consistent with the paper’s theme that centralization is limited by separation costs, is that the optimal span of control increases in the agent’s separation cost and decreases in the principal’s separation cost. If white collar workers are more costly to replace than blue collar workers, as we suggest above, our analysis implies that a manager will have fewer white collar workers than blue collar workers under his direction, and that hierarchies will be flatter at the bottom than at the top. It is also straightforward to establish that the maximum span of control is increasing in congruence and decreasing in the agent’s private benefits.

Equations (10)-(12) also suggest the centralization in a hierarchy is sensitive to tipping problems. As long as the probability of dismissing a disobedient worker is kept above q^* , then all workers will follow orders. If the probability falls below q^* , however, there can be a discrete jump in disobedience as all of the bad workers disobey. When a manager begins to lose control, it may quickly spread into a general “rebellion” as the ability to punish becomes ineffective.

6. Evidence

A central feature of our framework is that authority is limited by the cost of enforcing a command. As a result, the optimal assignment of decision authority depends not only on the information and private benefits of individuals in the organization, but also on the firm’s cost of replacing workers and the cost for workers to find alternative employment. This section reports some empirical evidence on the relation between decision authority and the fallback options of workers and firms.

The data are drawn from the *National Organizations Survey, 1996-97 and 2002* (Kalleberg et al., 2001; Smith et al., 2005). These surveys of managers and personnel officers contain a variety of information on employment policies, contracts, benefits, and the structure of organizations from across the United States. Our analysis uses data on corporations with at least 20 employees. Summary statistics of the variables we use are in Table 2.

One question asked in the survey is

How much choice do (workers) have concerning the best way to accomplish their assignments?

- 1) *No choice*
- 2) *Small amount*
- 3) *Moderate amount*
- 4) *Large amount*
- 5) *Complete choice*

The responses to this question are what we seek to explain. The dependent variable in all regressions takes on a value 1-5 corresponding to the answers. High values mean the firm has delegated authority to workers.

Table 3 reports the regressions. The first three columns use data from the 1996-97 survey and the last three columns use data from 2002. We do not combine the samples because the questions asked differ somewhat between the two surveys. We first investigate how the firm's cost of replacing a worker affects authority. In column (1), worker choice is regressed on a variable measuring how difficult it is for the firm to replace a worker. Our theory implies that workers will be given more discretion as the cost of replacing them rises. The coefficient on the proxy for replacement costs (0.11) is positive and different from zero at better than the 5 percent level.

The second column investigates how the worker's cost of leaving the firm affects authority. Each firm was asked if it had provided worker training in the previous two years, and if so, if the training was valuable for other employers or only the firm itself. Based on the responses, each firm could be assigned to one of four categories: provided only general training, provided only firm-specific training, provided both general and firm-specific training, and provided no training. Dummy variables for the first three categories are the explanatory variables in column (2). To the extent that general training

increases an employee's outside options, our model suggests that the employee ends up with more decision authority. Consistent with this implication, the coefficient on general training (0.37) is positive and highly significant. The effect of firm-specific training is ambiguous in our model, possibly implying a modest effect on delegation. The coefficient (0.18) is smaller than for general training and not statistically distinguishable from zero. The coefficient on the intermediate variable (0.24) is between the other two.

In column (3), the variables for firm and worker separation costs are included in the regression at the same time as well as two other control variables. The number of employees is included as a measure of firm size to capture the possibility that the amount of delegation is different in large and small firms. The estimate on firm size (-0.04) indicates that large firms delegate less. The other control variable is a dummy variable equal to 1 if the firm sells a product instead of only a service. This is included to allow the amount of delegation to vary with the nature of the business. As can be seen, firms that sell products give workers less choice than service firms, all else equal, and the difference is significantly different from zero. This could be seen as consistent with information theories if worker information is more important in service firms than firms selling a product. When the controls are included, the coefficients on the critical variables increase in magnitude. A high cost of replacing a worker and firm-provided general training continue to be positively related to the amount of authority given a worker in carrying out his or her assignments. Both coefficients are significantly different from zero at the 5 percent level or better.

The other three regressions use data from 2002. The 2002 survey was significantly different than the 1996-97 survey, so the estimates serve as something of a

robustness check. The dependent variable remains the 1-5 categorical response to the question of how much choice workers have in carrying out their assignments. In column (4), worker choice is regressed on the firm's difficulty of hiring a replacement, as in column (1). The coefficient (0.21) is positive and statistically different from zero. Again we see that firms give their employees more authority when replacements are costly to hire.

In column (5), worker choice is regressed on a dummy variable for firm-provided training. The 2002 survey does not include information that can break down training into general and firm-specific. The summary statistics for Table 2 indicate that most training in 1996-97 was general in nature. If the same pattern holds in 2002, then we can interpret the coefficient on the job training variable as largely due to the effect of general training. Consistent with this interpretation, the coefficient on job training is positive (0.22), however it is not significantly different from zero.

In column (6), the regression includes both explanatory variables as well as three additional control variables. One control variable, as before, is the number of employees. The coefficient (-0.17) again is negative but not different from zero at conventional levels of significance. The two other control variables are the fraction of employees earning less than \$10 per hour (\$20,000 per year), and the fraction earning between \$10 and \$15 per hour (\$20,000 to \$30,000 per year). The omitted category is the fraction of employees earning more than \$15 per hour. These variables may capture differences in the skill level (or information) of workers. Consistent with existing theory, workers in the lowest wage category (interpreted as least informed) are given less freedom in how they complete their assignments. Workers in the middle wage category appear to have no more or less

authority than high wage workers. As for the variables of primary interest: the coefficient on the difficulty in hiring a replacement (0.30) remains positive and is significant at better than the 1 percent level, while the coefficient on the training variable is positive (0.17) but too noisy to distinguish from zero.

To sum up, a central implication of our analysis is that authority is limited by the firm's cost of replacing a worker and by a worker's cost of finding a new job. Two national surveys of organizations generally support this implication. Workers are given more choice in how they go about accomplishing their assignments when it is difficult for the firm to replace them, and when the workers have good outside job prospects.¹³

6. Conclusion

In a general sense, our paper is intended to suggest that the emerging theory of authority hinging on agency and information problems is missing an important ingredient. Managers of an organization can give orders, but they rely on the willingness of subordinates to carry them out. In a world of imperfect contracting, a manager may not be able to enforce compliance with his instructions and this may *compel* him to delegate decision rights to workers – even if the manager has superior information or the agent's private benefits will lead him astray. Our paper explores the consequences of this reasoning for the allocation of decision-making authority within organizations. In our theory, the key variables determining decision-making arrangements are the worker's separation cost if he is dismissed and the firm's cost of hiring a replacement. We formalize the intuition that high worker separation costs promote centralization, while

¹³ The main finding from Table 3 are robust to a firm cutoff size of 30 workers, and to logit regressions that measure autonomy as a discrete variable with 1 indicating “complete” or “a lot” of choice.

high replacement costs for the firm lead to greater delegation, and provide evidence from a sample of firms consistent with these implications.

Assigning an important role to the possibility of disobedience adds an intuitive dimension to the theory of authority, and also revives a theme that was central to classic treatments of organization such as Barnard (1938/1968) and Simon (1945/1997). It also provides a natural explanation for anecdotes that are not easy to square with information theories, such as why professors are delegated more decision rights (for example, over work hours, attire, and content) than workers in firms, even though professors do not have an obviously larger information advantage over their “manager” (the dean or department chair) than workers in corporations (because professors have tenure). A model with disobedience also has implications for the role of monetary incentives, which we show can increase or decrease the manager’s authority, and can even make the manager worse off. We also show that the inability to enforce orders has implications for hiring policy, managerial style, and the span of control. For example, in jobs where significant decision authority must be delegated, the manager will make a greater effort to hire workers that share his values, while in jobs that are centralized, the manager will emphasize ability when hiring.

There are a number of interesting avenues for future research. Our model does not distinguish the manager’s from the organization’s interests, so it not well suited for studying when disobedience might be efficient for an organization. Incorporating agency problems between the shareholder and managers is a natural extension, one that Landier et al. (2005) explore. Our analysis, in keeping with the rest of the economics literature, emphasizes monetary and employment sanctions as the foundation for authority.

However, as Simon (1945/1997, p. 184) observes, “There are a number of other . . . factors which may induce acceptance of authority in organization. . . . The social sanctions are the first to be noted, and perhaps the most important. Not only does society set up the individual expectations of obedience in certain social situations, but the individual who fails to accept his role will feel, in one way or another, the social disapprobation of his fellows.” Another interesting extension would be to explore how social sanctions affect the benefits and costs of disobedience and centralization. Such an extension would capture an effect that seems important a priori, and would allow analysis of how and when organizations should nurture social sanctions and rewards in order to affect organizational performance (Lazear, 1991).

Appendix

Proof of optimal contract when b is high.

(a) If $s_p \leq s_p^{**}$ and $s_A < s_A^*$, then a disobedient worker is replaced and if monetary incentives are used in the first period, $w_1^* = s_A^* - s_A$ from (8). Since a bad agent obeys in the first period only if monetary incentives are provided, monetary incentives are optimal in the first period if

$$(H - s_A^* + s_A) + (\alpha H + (1 - \alpha)L) \geq (\alpha H + (1 - \alpha)L) + \alpha H + (1 - \alpha)(\beta H + (1 - \beta)L - s_p),$$

which reduces to condition (9). If $s_A \geq s_A^*$, then a bad agent will obey without monetary incentives given the credible threat of firing.

(b) If $s_p > s_p^{**}$ then a disobedient agent is not replaced and a bad agent disobeys without monetary incentives. Since the optimal first period wage is $w_1^* = b / \delta$ from (8), monetary incentives are optimal in the first period if

$$(H - b / \delta) + (\alpha H + (1 - \alpha)L) \geq (\alpha H + (1 - \alpha)L) + \alpha H + (1 - \alpha)(H - b),$$

which reduces to $\delta(1 - \alpha) \geq 1$ and can never hold. ||

Proof of Proposition 2

When $b \leq (1 - \beta)(H - L)$, the principal will use monetary incentives in the second period if the agent's type is bad or unknown. Since monetary incentives assure obedience, there is no point in replacing a bad agent with an unknown agent in the second period. Since dismissal is never optimal, authority is not used regardless of separation costs. The rest of the proof considers the case where $(1 - \beta)(H - L) < b \leq H - L$.

(a) Principal's separation cost. If $s_p > s_p^{**}$, authority is not optimal even if the principal is informed (Figure 2), so an increase in s_p into or within this range can never result in a shift from delegation to authority. When $s_p \leq s_p^{**}$, authority is used (as opposed to suggestion) if the principal chooses to become informed. An increase in s_p alters the optimal decision-making arrangement only if it causes the principal to begin using monetary incentives, crossing from region I to region II in Figure 2. Recall that only a disobedient agent receives an incentive contract in the second period. The difference between the principal's payoff from using authority (V^A) versus delegation (V^D) in region I comes from being able to replace the agent in the second period if the agent turns out to be bad, less the cost of firing and the cost of becoming informed and giving an order, the value of which is

$V^A - V^D \equiv D_I = \delta(1 - \alpha)(\beta H + (1 - \beta)L - L - s_p) - c$. The difference in region II comes from obedience of the bad agent in the first period that is purchased at the price of monetary incentives $w_1^* = s_A^* - s_A$ for both agents (and the cost of being informed), the value of which is $V^A - V^D \equiv D_{II} = \delta(H - s_A^* + s_A - \alpha H - (1 - \alpha)L) - c$. Observe that D_I is decreasing in s_p , D_{II} is independent of s_p , and $D_I = D_{II}$ on the boundary between

the two regions. Suppose delegation is optimal in region I ($D_I < 0$) given some s_P . If s_P increases, causing a shift to region II, then delegation must be optimal in region II, as well ($D_{II} < 0$).

(b) Agent's separation cost. The agent's separation cost has no effect on the decision arrangement when $s_P > s_P^{**}$ (Figure 2). When $s_P \leq s_P^{**}$, an increase in s_A can cause a transition through regions I, II, and III. Using the fact that D_{II} is increasing in s_A and the argument in the preceding part of the proof establishes that a shift from region I to II caused by an increase in s_A can never change the optimal decision arrangement from authority to delegation. Within region II, an increase in s_A increases the payoff of authority relative to delegation. In region III, the difference between the principal's payoff from authority versus delegation comes from the compliance of the bad agent in the first period (which does not require monetary incentives) and the cost of being informed, the value of which is $D_{III} = \delta(1 - \alpha)(H - L) - c$. Since D_{II} is increasing in s_A , D_{III} is independent of s_A , and $D_{II} = D_{III}$ at the border, an increase in s_A that causes a shift from region II to region III cannot change the optimal decision arrangement from authority to delegation. ||

Proof of Proposition 3

Suppose $b \leq (1 - \beta)(H - L)$. As discussed in the proof of Proposition 2, authority is never optimal for private benefits this low. The principal always prefers to use monetary incentives. Therefore, introduction of monetary incentives can never make authority optimal.

Suppose $(1 - \beta)(H - L) < b \leq H - L$ and $s_p^{**} < s_p < s_p^*$ (region IV in Figure 2). As in the previous case, when monetary incentives are available, the principal cannot credibly threaten to replace a disobedient agent – he would rather retain the agent and place him on an incentive plan than pay the separation cost – and centralization is not feasible. Again, introduction of monetary incentives can never make authority optimal.

To see how monetary incentives can make authority optimal where it is not otherwise, consider the case $(1 - \beta)(H - L) < b \leq H - L$ but now suppose that $s_p < s_p^{**}$ and condition (9) holds, so that we are in region II of Figure 2. When incentive contracts are unavailable, from (5) authority is optimal if $c < \delta(1 - \alpha)(\beta(H - L) - s_p)$. When monetary incentives are available, from the definition of D_{II} (in the proof of Proposition 2) authority is optimal if $c < \delta(1 - \alpha)(H - L) - \delta(s_A^* - s_A)$. For parameters in this range (9), the second condition is satisfied whenever the first condition is satisfied, but the reverse is not true, meaning that availability of monetary incentives can lead to a shift from delegation to authority. ||

Proof of Proposition 4

Suppose $(1 - \beta)(H - L) < b \leq H - L$, and separation costs and the cost of becoming informed are such that centralization is feasible and optimal without monetary incentives, that is $s_p < s_p^*$, $s_A > s_A^*$, and (3) holds. The principal's payoff when monetary incentives are unavailable is given by V^C in (1). Suppose in addition that $s_p^{**} < s_p$. Then with monetary incentives, the principal is unwilling to dismiss a disobedient agent. He can delegate or suggest a course of action and use monetary incentives in the second period.

Full delegation provides a lower payoff than V^C by construction. The principal's payoff if he makes a suggestion is $V^S = -c + \delta(\alpha H + (1 - \alpha)L) + \delta H - \delta(1 - \alpha)b$. The difference between V^C and V^S is $-\delta(1 - \alpha)b < 0$. ||

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Figure 1. Limits to Centralization from Separation Costs

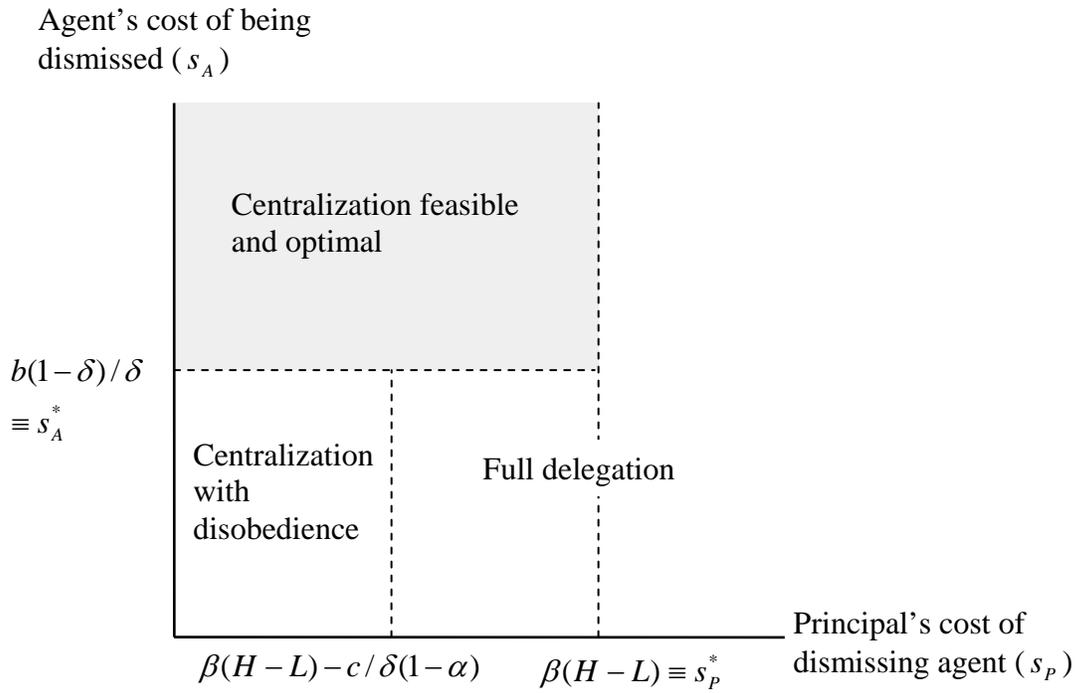
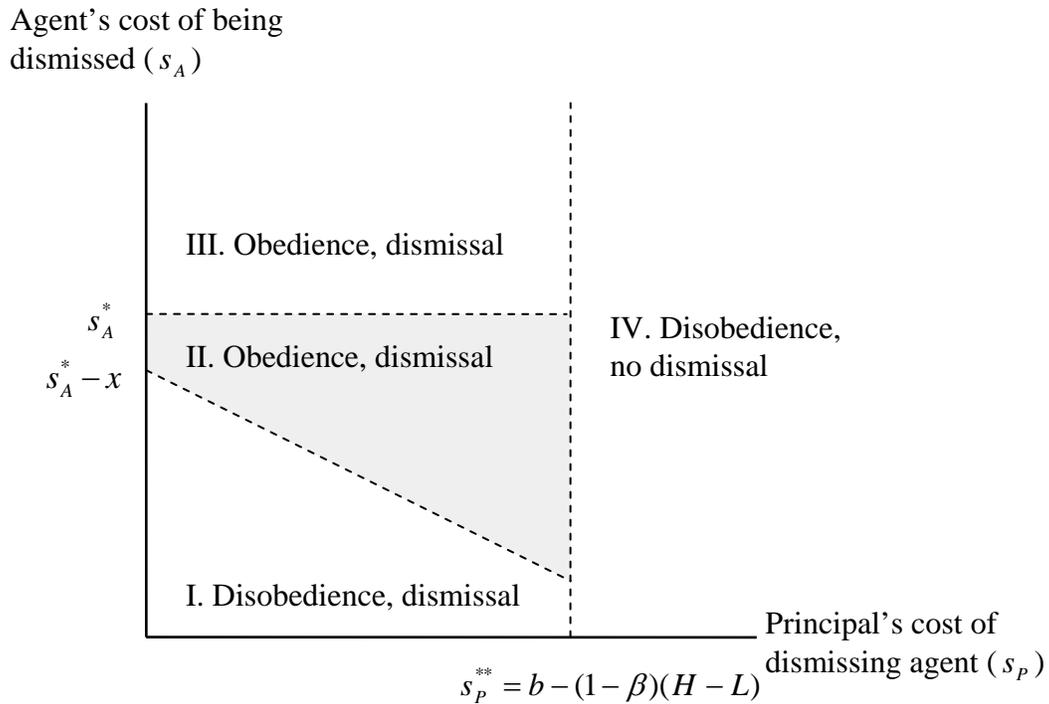


Figure 2. Obedience and Dismissal when the Principal Gives an Order



Note. The figure shows the behavior of the bad agent and the principal's reaction to disobedience for various parameter configurations, assuming the principal is informed and gives a command. "Disobedience" means the bad disobeys an order. "Dismissal" means a disobedient agent is dismissed. Monetary incentives are used in the first period only in the shaded region. In the second period, monetary incentives are only given to an agent who was disobedient in the first period. The figure shows the configuration when $(1 - \beta)(H - L) < b < H - L$. On the vertical axis, $s_A^* \equiv b(1 - \delta) / \delta$ from (ICP) and $x \equiv (1 - \alpha)(1 - \beta)(H - L)$.

Table 1. Payoffs (P, A_B, A_G)

| | <u>Agent's action</u> | |
|---------------|-----------------------|-------------|
| | a_1 | a_2 |
| State $i = 1$ | $(H, 0, b)$ | $(L, b, 0)$ |
| State $i = 2$ | $(L, 0, b)$ | $(H, b, 0)$ |

Note. This table shows the payoffs of the principal (P), bad agent (A_B), and good agent (A_G), conditional on the state and the agent's action choice (a).

Table 2. Summary Statistics and Variable Descriptions

| | Mean | S.D. | Min | Max | N | Description |
|---|------|------|------|-------|-----|---|
| 1996-97 | | | | | | |
| Worker choice (1 = no choice, 5 = complete choice) | 3.17 | 0.90 | 1 | 5 | 321 | How much choice do employees have concerning the best way to accomplish their assignments? |
| Difficulty in hiring (1 = very easy, 4 = not at all easy) | 2.58 | 0.92 | 1 | 4 | 313 | How easy is it to hire employees with necessary skills? |
| General training (1 = yes, 0 = no) | 0.33 | 0.47 | 0 | 1 | 316 | Was there formal job training in last 2 years and were skills to a great extent useful to other employers? |
| General and firm-specific training (1 = yes, 0 = no) | 0.24 | 0.43 | 0 | 1 | 316 | Was there formal job training in last 2 years and were skills to some extent useful to other employers? |
| Firm-specific training (1 = yes, 0 = no) | 0.06 | 0.24 | 0 | 1 | 316 | Was there formal job training in last 2 years and were skills not at all useful to other employers? |
| Employees | 1.03 | 2.44 | 0.02 | 30.00 | 331 | Full time employees (in thousands) |
| Main business involves a product (1 = yes, 0 = no) | 0.56 | 0.50 | 0 | 1 | 331 | Main business can involve product, service, or both. This variable is 1 if product, or product and service. |
| 2002 | | | | | | |
| Worker choice (1 = no choice, 5 = complete choice) | 3.12 | 0.83 | 1 | 5 | 97 | How much choice do employees have concerning the best way to accomplish their assignments? |
| Difficulty in hiring (very easy = 1, not at all easy = 4) | 2.36 | 0.92 | 1 | 4 | 99 | How easy is it to hire employees with necessary skills? |
| Job training (1 = yes, 0 = no) | 0.76 | 0.43 | 0 | 1 | 100 | Was there formal job training in last 2 years? |
| Employees | 0.41 | 0.78 | 0.02 | 4.5 | 100 | Full time employees (in thousands) |
| Low wage employees | 0.26 | 0.28 | 0 | 1 | 94 | % employees earning less than \$10/hour |
| Middle wage employees | 0.30 | 0.23 | 0 | 1 | 89 | % employees earning \$10-\$15/hour |

Note. The sample includes only corporations (i.e. it excludes sole proprietorships and partnerships). Also, only firms with more than 20 workers in the core area are included. Worker choice, difficulty in hiring, and training variables apply only to core employees.

Table 3. Regressions Explaining the Amount of Choice Workers Have in Completing Their Assignments

| | 1996-97 | | | 2002 | | |
|---|-------------------|-------------------|--------------------|-------------------|-------------------|-------------------|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Difficulty in hiring (1=very easy, 4=not at all easy) | 0.11** (0.06) | ... | 0.09* (0.05) | 0.21** (0.09) | ... | 0.30*** (0.09) |
| Dummy=1 if firm provides mostly general training | ... | 0.37*** (0.12) | 0.38*** (0.12) | ... | ... | ... |
| Dummy=1 if firm provides general and firm-specific training | ... | 0.24* (0.13) | 0.30** (0.13) | ... | ... | ... |
| Dummy=1 if firm provides mostly firm-specific training | ... | 0.18 (0.22) | 0.31 (0.22) | ... | ... | ... |
| Dummy=1 if firm provides any kind of job training | ... | ... | ... | ... | 0.22 (0.20) | 0.17 (0.20) |
| Employees (thousands) | ... | ... | -0.04* (0.02) | ... | ... | -0.17 (0.11) |
| Dummy=1 if main business involves product | ... | ... | -0.27*** (0.10) | ... | ... | ... |
| % employees earning < \$10/hour | ... | ... | ... | ... | ... | -0.57* (0.32) |
| % employees earning \$10-\$15/hour | ... | ... | ... | ... | ... | 0.04 (0.39) |
| Intercept | 2.89*** (0.15) | 2.98*** (0.08) | 2.91*** (0.17) | 2.64*** (0.23) | 2.96*** (0.17) | 2.46*** (0.31) |
| R^2 | 0.013 | 0.031 | 0.074 | .051 | .013 | 0.159 |
| N | 310 | 313 | 309 | 97 | 97 | 86 |

Note. Each column is a regression. The main entries are the coefficients, and standard errors are in parentheses. The dependent variable is the numerical response to the question: How much choice do employees have concerning the best way to accomplish their assignments? (1 = no choice, . . . , 5 = complete choice). Variable definitions and summary statistics are in Table 2. Significance levels: * = 10%, ** = 5%, *** = 1%.