

Disobedience and Authority

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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 better information than 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.

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1. Introduction

The allocation of authority is a critical part of the architecture of an organization. The traditional view is that decision rights ought to be placed in the hands of those with relevant information – retained by the manager when coordination is important and delegated to subordinates when their local expertise is critical (Simon, 1945/1997; Barnard, 1938/1968; Arrow, 1974). A more recent literature formalizes this tradeoff, showing how decision rights affect incentives to acquire and accurately communicate information as well as impact agency problems (Aghion and Tirole, 1997; Dessein 2002; Marino and Matsusaka, 2005). Yet even when information and agency conditions are such that a manager would like to make the decision, casual observation suggests 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.

While the idea that authority is limited by ineffective enforcement was noted in the classic texts on management and organization, it is largely absent from the modern

literature.¹ The purpose of our paper is to spotlight the importance of disobedience for the allocation of authority in organizations by developing a formal framework, tracing out its implications, and suggesting its empirical relevance. Our main theoretical contribution is to identify the enforcement tools available to managers and analyze when authority is and is not limited by the effectiveness of those tools. One critical tool is the threat of dismissal: “Within the firm, the sanctions which authority can use are basically those of hiring and firing” (Arrow, 1974, p. 71). Authority is limited when workers do not fear being fired, or when the manager finds it very costly to find and train a replacement worker. Workers who are costly to replace or who do not mind looking for another job have more scope to disobey an order, and in our analysis end up being given more control over how they carry out their assignments.

One implication is that if white collar workers are more costly to replace than blue collar workers, as survey evidence suggests, 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 implies that authority hinges not only on an internal calculus involving hidden information or action, as in the traditional approach, but on surrounding market conditions because a worker’s cost of being fired depends on

¹ For example, “Disobedience to orders, organized or unorganized, frequently sets limits to authority,” Arrow (1974, p. 75); “Now a most significant fact of general observation relative to authority is the extent to which it is ineffective in specific instances. It is so ineffective that the violation of authority is accepted as a matter of course and its implications are not considered,” Barnard (1938/1968, p. 161); “The real limiting factors [in a military operation] are the psychological factors which determine when the soldiers will refuse further obedience to commands,” Simon (1945/1997, p. 200). Landier et al. (2005) and Van den Steen (2005) are two recent papers that also consider disobedience in a model of authority.

the quality of the external labor market. A broadening and deepening of labor markets that reduces a worker's cost of finding a new job would make workers less obedient and result in more worker autonomy, consistent with a long run trend that some have observed (Simon 1945/1997, Ch. 7). Similarly, to the extent that workers are more difficult to fire in Europe than the United States, our model suggests that European managers will have less authority over their workers.

Monetary incentives are another important tool to enforce commands. 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, the effect of introducing monetary incentives depends on the firm's cost of dismissing a worker. When the firm's dismissal cost is low, monetary incentives can lead to more centralization by allowing the manager to enforce a command that would not be enforceable with only the threat of dismissal. When the firm's dismissal cost is high, monetary incentives can lead to more delegation by making the threat of dismissal less credible. One implication is that new information technologies that allow more accurate monitoring of worker performance and hence facilitate formal incentive contracts will lead to more delegation for workers that are costly to replace, consistent with evidence in Moers (forthcoming).

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. If there are certain jobs for which decisions must be delegated, it is important to fill those jobs with workers whose preferences are aligned with the organization's interests. In contrast, for jobs where workers will be told what to do, preference alignment is less important than having workers whose actions have a large effect on payoffs. Thus, to the extent that white collar workers are intrinsically 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, and other attributes. We show that a manager with empathy for his workers tends to delegate more because he seeks to avoid giving orders that are 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.

In addition to linking our results to existing empirical studies, we provide some new 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 often associated with Aghion and Tirole (1997) considers the limits on authority that arise from the principal's limited information.² 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 transferred 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

² Work in this vein includes Holmstrom (1977, Ch. 2), Dessein (2002), Prendergast (2002), Zabojnik (2002), Marino and Matsusaka (2005), and Alonso and Matouschek (2006). The theoretical tradeoffs affecting the incentive to acquire and transmit information were also developed by Gilligan and Krehbiel (1987, 1989) in the context of legislative organization.

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 organization, and plays a role in Van den Steen (2005), who studies how authority influences the tradeoff between coordination and the motivation of agents.

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, and span of control. 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 revenue 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 $H > 0$ if the action is a_i , and zero if the action is a_{-i} .

The agent can be one of two types, and the type is not known by either the principal or agent initially. A "good" agent has preferences congruent with the principal's preferences, while a "bad" agent's preferences run in opposition to the principal's interests. Specifically, in state i , a good agent receives private benefits $b > 0$ from action a_i , and receives zero from action a_{-i} . In contrast, a bad agent in state i receives b from action a_{-i} , and receives zero from action a_i . Since the principal's payoffs depend on the state, whether the agent is good or bad also depends on the state. One way to think about this is that the agent knows which action he prefers to take (sell product A or B, teach cases or theory), but does not know if that action is in the principal's interest (because the agent does not know the state). An agent is "good" if what he likes to do happens to be what is good for the principal, and the agent is "bad" if he likes to do what is bad for the principal.

Payoffs as a function of states and actions are summarized in Table 1.³ 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 $2H$.

³ The payoff matrix in Table 1 essentially mirrors Aghion and Tirole (1997), including the normalization to zero of the principal's and agent's low payoff. All of our propositions and main comparative static implications continue to hold if the low payoff is nonzero.

B. Information

Neither the principal nor the agent knows the agent's type at the time of hiring, but they both know that their preferences are congruent (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 congruent (good) is β . The parameters α and β may differ if the principal has learned something about the incumbent agent at some time before the start of our model.⁴ A bad agent's desire to appear to be a good agent is what may induce him to obey an order from the principal.

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 zero. 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 might discover that he is better able to sell one of the firm's products than the others, 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 .

⁴ Separate congruence parameters for incumbent and replacement workers allow 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.

C. Authority and Disobedience

If an order is given, the agent may 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 a particular 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 no 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 of zero.⁵ The separation 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,

⁵ Allowing the agent to obtain private benefits in his new job would not affect our qualitative results.

and gives an order that the agent obeys. His expected utility in this case of “centralization” is

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

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’s choice produces H or zero depending on his type. All revenue from the project is discounted because it arrives 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

$$(2) \quad V^D = 2\delta\alpha H .$$

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

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

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 is large), that is, it is an “important” decision from the principal’s perspective.⁶ These tradeoffs are fairly standard in models of delegation, and appear in a variety of models where the principal’s orders are automatically accepted by the agent (for example, Aghion-Tirole, 1997; Baker et al., 1999). Since we are primarily interested in the factors that limit authority, except where noted we will assume throughout that c is sufficiently small so that (3) holds, meaning that the principal always prefers centralization to delegation when centralization is feasible.

B. Disobedience

If the agent disobeys an order from the principal, 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 subsequently replaces the agent (“centralization with disobedience”) is

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

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

⁶ Our result that centralization is more valuable when α is low stems from the fact that a good agent makes the right choice from the principal’s perspective, while 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.

be revealed and replaced in the second period by a new draw from the distribution.⁷ 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

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

Given our assumption that c is small enough so 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 $-\delta s_p + \delta \beta H \geq 0$. The principal's incentive compatibility condition for feasible centralization is then

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

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

⁷ 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.

is that the agent can choose his preferred action without consequence from the principal. A bad agent disobeys if $b - \delta s_A \geq \delta b$. 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 appropriately 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. Survey evidence indicates that managers and professionals are more costly to replace than manual workers, secretaries, and administrative and technical assistants.⁸ Our model thus implies that managers and professionals will be given more decision rights, which may explain why white collar workers seem to have more autonomy in how they perform their jobs 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. Similarly, because workers are easiest to fire in the private

⁸ See the series of surveys by the Chartered Institute of Personnel and Development available at <www.cipd.co.uk/subjects/recruitmen/general/recruitretnt.htm>, for example, Tables 26 and 28 in *Recruitment, Retention, and Turnover 2004: A Survey of the UK and Ireland*.

sector, more difficult to fire in government jobs (because of civil service laws), and extremely difficult to fire in higher education (because of tenure), our model implies significant centralization in firms, moderate centralization in government, and extensive delegation in universities. This squares with the assessment of George P. Shulz, former U. S. Secretary of State and the Treasury, who was also a top executive at Bechtel Group and dean of the University of Chicago's graduate school of business: "In private enterprise you give an order and expect it to be carried out. In government, you give an order and hope that it will be carried out. And in higher education, you give no orders."⁹

The cost of replacing a worker is likely to be lower in a large firm than a small firm because large firms have more co-workers that can step in and cover for a dismissed worker until a replacement is found. Therefore, workers in small firms should have more autonomy than workers in large firms. We provide evidence on this implication later.

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 worker characteristics 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

⁹ The quote is attributed to Shultz by former U. S. Senator and Washington governor Daniel Evans (McReynolds, 2005, p.23).

toward more autonomy in the workplace (Simon, 1945/1997, Ch. 7). 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). Our analysis suggests that workers in economies with less developed labor markets will be given less flexibility in how they accomplish their tasks than workers in developed economies, and workers in a town dominated by a single employer will have fewer decision rights than workers in a city with competing employers. Similarly, to the extent that it is more difficult for firms to fire workers in Europe than the United States (due to labor laws) and a worker's cost of being fired is lower in Europe than the United States (due to more generous unemployment insurance), our model predicts greater worker autonomy in Europe.

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 their future relationship. 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 delegate more, assuming their separation costs do not change.¹⁰

The discount rate is also important in Baker et al. (1999), but it works in the opposite direction. In their 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. Alonso and Matouschek (2006) present a repeated game model which predicts that the principal will delegate if the discount rate is high, as in our model, but they focus on the trade off between information loss under centralization and agency problems under delegation rather than disobedience.

¹⁰ An alternative formulation of the model would let $1 - \delta$ be the probability that the firm goes out of business or is forced to lay off the worker in the second period. If worker and firm do not otherwise discount the future, it can be shown that payoffs and incentive conditions are identical to the current formulation.

3. Congruence, Private Benefits, and Task Importance

The parameters α , b , and H have already been discussed in the literature. A 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 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.¹¹ 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,

¹¹ This is the effect of marginal private benefit. An increase in the absolute level of private benefits (which would require abandoning our normalization to zero of the agent's private benefit from his disliked action) would work in the opposite direction, by making the agent more obedient for fear of losing the rents associated with his current job.

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. This section adds monetary incentives to the model, with several goals in mind. The first is to show that our results on separation costs are robust to inclusion of incentive contracts. More substantively, we are interested in how the availability of monetary incentives influences the allocation of authority: are monetary incentives complements or substitutes for delegation? This sheds light on differences in centralization between organizations that can use strong monetary incentives, such as firms, and organizations that cannot, such as government. It also provides insight into how new information technologies that allow finely tuned performance measurement, and hence greater use of monetary incentives ("management by objective"), may change the use of authority in the workplace. And finally, we want to explore how availability of monetary incentives affects the principal's welfare.

We extend the model by assuming that in each period the principal and agent can sign a one-period contract conditional on output, and the agent is protected by limited liability so that each period's wage is nonnegative.¹² To minimize rents received by the

¹² Allowing the contract to be conditional on whether an order is obeyed would not change anything. We do not consider multi-period contracts.

agent, the principal sets the wage equal to zero when output is zero. 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 the expressions come from. Also, we restrict our analysis to the case $(1 - \beta)H < b \leq H$, omitting the less interesting cases where it is efficient to let the agent choose his preferred action ($b > H$) or where it can be shown that separation costs do not play a role ($b \leq (1 - \beta)H$).¹³

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 benefit 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 hand, the principal always gives monetary incentives to a bad agent because $H - b \geq 0$. If the agent's type is unknown, the principal gives an incentive contract if

¹³ 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.

$H - w_2^* \geq \alpha H$ or $(1 - \alpha)H \geq b$. Observe that the principal is more willing to give monetary incentives when the agent is known to be bad than when the type is uncertain.

Given that $(1 - \beta)H < b$, 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 $-s_p + \beta H \geq H - b$, or

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

Note that the cost of separation still matters here, but s_p^{**} is less than $\beta H = s_p^*$, 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 with the threat of firing alone 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. Suppose the principal is informed and $(1 - \beta)H < b \leq H$.

(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

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

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.

Centralization with obedience is only feasible in regions I and II of Figure 2. In region III, the bad agent never obeys and is dismissed, so the principal faces a choice between delegation and centralization with disobedience. In region IV, the availability of monetary incentives may give rise to a new decision making arrangement in which the

principal gives an order but instead of firing a disobedient agent, retains the agent and uses monetary incentives in the second period. For expositional convenience, we refer to this situation as “suggestion.” We shall use the term “authority” to mean centralization, with or without obedience, and suggestion, that is, any situation in which the principal gives an order.

We can now establish that the results developed earlier between authority and separation costs are robust to the introduction of monetary incentives.

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 but not the other way around.*

B. How Monetary Incentives Change Authority

This section studies how the allocation of authority varies depending on whether monetary incentives are or are not available. We can then ask, for example, how does centralization in government jobs where political considerations limit the use of monetary incentives, compare to centralization in firms? And will firms delegate more or less if new information technology allows better measurement of worker performance and closer links between pay and performance? The next proposition shows that monetary incentives can both complement and substitute for centralization.

Proposition 3. *If monetary incentives become available, then for $s_p \geq s_p^{**}$, the optimal decision arrangement can change from centralization to delegation or suggestion but not the other way around, while for $s_p < s_p^{**}$, the optimal decision arrangement can change from delegation or centralization with disobedience to centralization but not the other way around.*

In simple terms, Proposition 3 suggests that monetary incentives can lead to less centralization when s_p is large, and can lead to greater centralization when s_p is small. Intuitively, availability of monetary incentives changes the tradeoffs in two ways. First, monetary incentives may make the threat of dismissal less credible because the principal can fall back on cash incentives in the second period instead of firing the worker and suffering the deadweight cost of dismissal. The cut-off level for s_p in the principal's (ICP) condition declines from s_p^* to s_p^{**} , which may force a switch from authority to delegation when s_p is greater than s_p^{**} by making centralization infeasible.

In the other direction, monetary incentives can be combined with the threat of dismissal to augment the principal's power to sanction. If the principal is willing to replace a bad agent ($s_p < s_p^{**}$) but the agent's separation cost is so low that the threat of dismissal alone cannot prevent disobedience, adding monetary incentives may boost the cost of dismissal enough to get compliance, and make centralization feasible when it would not be otherwise (region II in Figure 2). When s_p is small, monetary incentives can lead to more authority by strengthening the principal's ability to enforce commands.

A typical finding in the literature is that more effective monetary incentives lead to more delegation since there is less need to control a worker when he is motivated by cash incentives (Holmström and Milgrom, 1991; Prendergast, 2002). A similar relationship arises in our model, but it appears because centralization becomes infeasible not because centralization becomes less desirable. Our analysis also shows that the effect can work in the other direction, which happens when monetary incentives strengthen the principal's sanctions enough to make centralization feasible.

Proposition 3 also adds an interesting comparative static implication to the discussion: monetary incentives substitute for centralization when the principal's separation cost is high, and complement centralization when the separation cost is low. As noted above, white collar jobs have higher separation costs for the principal than blue collar jobs. Our model thus suggests availability of monetary incentives is likely to increase delegation for white collar workers, and increase centralization for blue collar workers. A recent empirical study by Moers (forthcoming), finds that better monetary incentives lead to more delegation in a sample of managers, consistent with our prediction. Our analysis would also imply that in environments where monetary incentives are scarce for exogenous reasons, such as government bureaucracies, white collar workers will have relatively more autonomy than their private sector peers, while blue collar workers will have less than their private sector peers.

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.*

Monetary incentives can be a problem for the principal by making it more difficult to credibly threaten a worker with dismissal. To see this, suppose that centralization is optimal when monetary incentives are unavailable. The principal can elicit good behavior from the bad agent in the first period at no cost with the threat of dismissal. When monetary incentives are available, the threat of dismissal may not be credible, and the principal may be able to elicit good behavior only by paying for it. Thus, the principal may be forced to use a more costly tool to gain compliance.

Proposition 4 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 ramifications for an organization's hiring policy. When decisions must be delegated to a particular job holder, it changes the type of worker that the firm would like to have in that job. To analyze this, suppose $s_A \geq s_A^*$ and consider two jobs, one with low separation cost for the principal so centralization is optimal (that is, $s_p \leq s_p^*$) and the other with high separation costs so that delegation is optimal, respectively called the "blue collar" and "white collar" jobs for short. Workers are characterized by α and H ; 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. 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?

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 α 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 zero.

Solving the 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.¹⁴ 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 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.¹⁵ Marino (2006), in a hidden information model where the principal relies on communication from the agent about investment opportunities, also shows that managers may place a higher value on ability when decisions are centralized. The demand for talent is high in that context because low ability agents are particularly likely to distort information when the principal makes the decision.

¹⁴ The optimal quantities do not depend on own prices because of linearity in the V functions.

¹⁵ If the payoff in the low state is nonzero, it can be shown that the marginal product of the worker choice not the level, is larger for the centralized than delegation situation.

B. Managerial Traits

Some evidence suggests that managers may be “hardwired” to take different approaches to their jobs. For example, Simon (1945/1997, commentaries on Ch. 7, 10) notes psychological evidence that some managers may covet power more than others, and that some workers may be predisposed to obey orders more than others. Similarly, Dial and Murphy (1995) argue that some managers may be unwilling to lay off workers when the firm ought to downsize. 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

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

Empathy shifts the line dividing full delegation from centralization to the left in Figure 1. An empathetic manager delegates more. 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 assume always favors centralization). It does change the tradeoff between delegation and centralization with disobedience, however, with centralization now preferred if

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

In Figure 1, the boundary between the two regions shifts to the right. Thus, a manager who enjoys exercising 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. While we have implicitly assumed that the manager’s payoff coincides with the firm’s payoff, one can imagine environments in which this is not true, in which case giving an order that is disobeyed is not necessarily bad for the firm. It could be good by making it less costly for 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.”¹⁶

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

¹⁶ Landier et al. (2005) study another potential benefit from disobedience: a subordinate’s refusal to implement a manager’s project can prevent bad projects from being selected in the first place.

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 $s_p(m)$. The principal is willing to dismiss at most m^* workers, the greatest m such that $s_p(m) < \delta\beta H$. 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.¹⁷ 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

¹⁷ 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.

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:

$$(11) \quad q^* = b(1 - \delta) / \delta s_A.$$

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*.¹⁸ 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 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

$$(12) \quad q(S; m^*, \alpha) = \sum_{x=1}^{m^*-1} B(x; S - 1, 1 - \alpha) + \sum_{x=m^*}^S \frac{m^*}{x + 1} B(x; S - 1, 1 - \alpha).$$

¹⁸ As we have already mentioned, it would be natural to let the marginal cost of dismissal also depend on the total number of workers, S , because there may be less disruption from a given number of dismissals in a large than a small team. We could incorporate this by making s_P a decreasing function of S . Disobedience would still limit the span of control if the separation cost is sufficiently convex in m and S .

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

$$(13) \quad q(S; m^*, \alpha) = q^* .$$

Equations (11)-(13) 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 maximum span of control increases in the agent's separation cost and decreases in the principal's separation cost. Because white collar workers are more costly to replace than blue collar workers, as discussed 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 (11)-(13) also suggest that 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. We might expect that co-workers can

more easily cover for a fired worker in a large than small firm, making a large firm's separation cost lower than a small firm's. Consistent with this view, 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. 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 manufacturing firms. 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 worker autonomy in carrying out 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 expertise) of workers. Consistent with existing theory, workers in the lowest wage category (interpreted as least expert) are given less freedom about how to 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 of 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 distinguishing feature 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.¹⁹

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 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

¹⁹ The main finding from Table 3 are robust to a firm cutoff size of 30 workers, and to logistic regressions that measure autonomy as a discrete variable with 1 indicating “complete” or “a lot” of choice.

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. 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 is 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 monetary incentives

(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 $(H - s_A^* + s_A) + \alpha H \geq \alpha H + \alpha H + (1 - \alpha)(\beta H - s_p)$, 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 $(H - b / \delta) + \alpha H \geq \alpha H + \alpha H + (1 - \alpha)(H - b)$, which reduces to $\delta(1 - \alpha) \geq 1$ and can never hold. ||

Proof of Proposition 2

Let $D_R \equiv V_R^A - V^D$ denote the principal's net payoff from authority rather than delegation in region R . Simple algebra gives $D_I = \delta(1 - \alpha)H - c$, $D_{II} = \delta[(1 - \alpha)H - s_A^* + s_A] - c$, $D_{III} = \delta(1 - \alpha)(\beta H - s_p) - c$, and $D_{IV} = \delta(1 - \alpha)(H - b) - c$. Observe that $D_I = D_{II}$, $D_{II} = D_{III}$, and $D_{III} = D_{IV}$ on the boundaries between the respective regions, $D_{IV} < D_I$, and $D_{IV} < D_{II}$ (the last inequality follows because D_{II} increases in s_A , the smallest s_A within region II is on the boundary between regions II and III where $D_{II} = D_{III}$, and

$D_{III} = D_{IV}$ on the boundary between regions III and IV). Hence, D (weakly) decreases in s_p and increases in s_A . This implies that an increase in s_p or a decrease in s_A cannot cause a switch from delegation to authority.

To see that an increase in s_p or a decrease in s_A can cause the decision arrangement to shift from authority to delegation, suppose s_p and s_A are such that we are in region II, s_A is close to s_A^* , and $c < \delta(1-\alpha)H$, so that centralization is feasible and optimal. Then if $c > \delta(1-\alpha)(H-b)$, an increase in s_p that induces a shift from region II to region IV will cause a change from centralization to delegation. Similarly, starting at the same point in region II, a decrease in s_A will cause a change from centralization to delegation if $\delta(1-\alpha)(H-b) < c < \delta(1-\alpha)H$ and if s_p is close to s_p^{**} , because $D_{III} = D_{IV}$ on the boundary between regions III and IV. ||

Proof of Proposition 3

As in the proof of Proposition 2, let D_R be defined as the principal's net payoff from authority rather than delegation in region R of Figure 2. Suppose $s_p > s_p^{**}$ (region IV). When monetary incentives are not available, centralization can be optimal and feasible when (ICA) holds and $s_p^* > s_p > s_p^{**}$. When monetary incentives are available, centralization is not feasible because 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. Therefore, introduction of monetary incentives can never make centralization optimal. The optimal arrangement with monetary incentives is delegation if $D_{IV} < 0$ and suggestion otherwise.

Now suppose $s_p \leq s_p^{**}$. In region I, regardless of the availability of monetary incentives, centralization is optimal if (3) holds and delegation is optimal otherwise (because (3) implies $D_I > 0$). Similarly, in region III, regardless of the availability of monetary incentives, centralization with disobedience is optimal if (5) holds and delegation is optimal otherwise (because (5) implies $D_{III} > 0$). In these two regions, introduction of monetary incentives does not change the optimal decision arrangement.

Finally, consider region II. Without monetary incentives, centralization is not feasible because $s_A \leq s_A^*$, so introduction of monetary incentives cannot induce a change away from centralization. When monetary incentives are available, centralization is feasible and optimal when $D_{II} > 0$. Therefore, introduction of monetary incentives can lead to a shift from delegation to centralization (if (5) does not hold) or from centralization with disobedience to centralization (if (5) holds). ||

Proof of Proposition 4

Suppose 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. The principal's payoff if he delegates is lower than V^C by construction. Alternatively, the principal can give an order and use monetary incentives in the second period, which yields $V^{CM} = -c + \delta\alpha H + \delta H - \delta(1-\alpha)b$. The difference is $V^C - V^{CM} = -\delta(1-\alpha)b < 0$. ||

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Table 1. Payoffs (P, A_G, A_B)

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

Note. This table shows the payoffs of the principal (P), good agent (A_G), and bad agent (A_B), 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 of 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 of 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%.

Figure 1. Limits to Centralization from Separation Costs

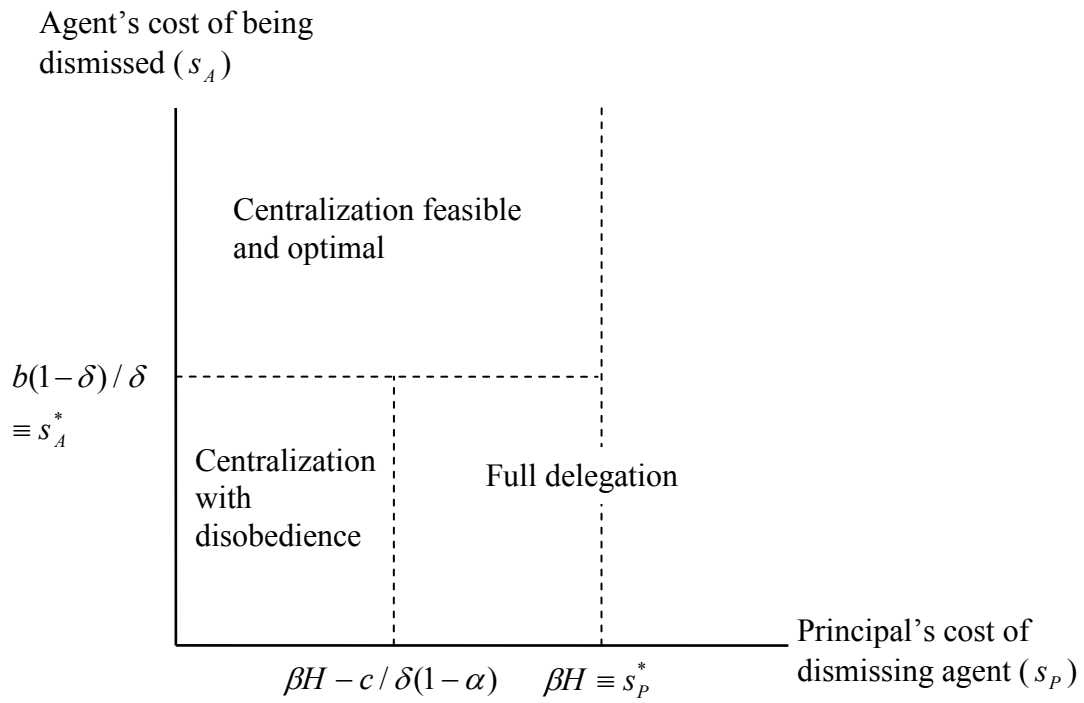
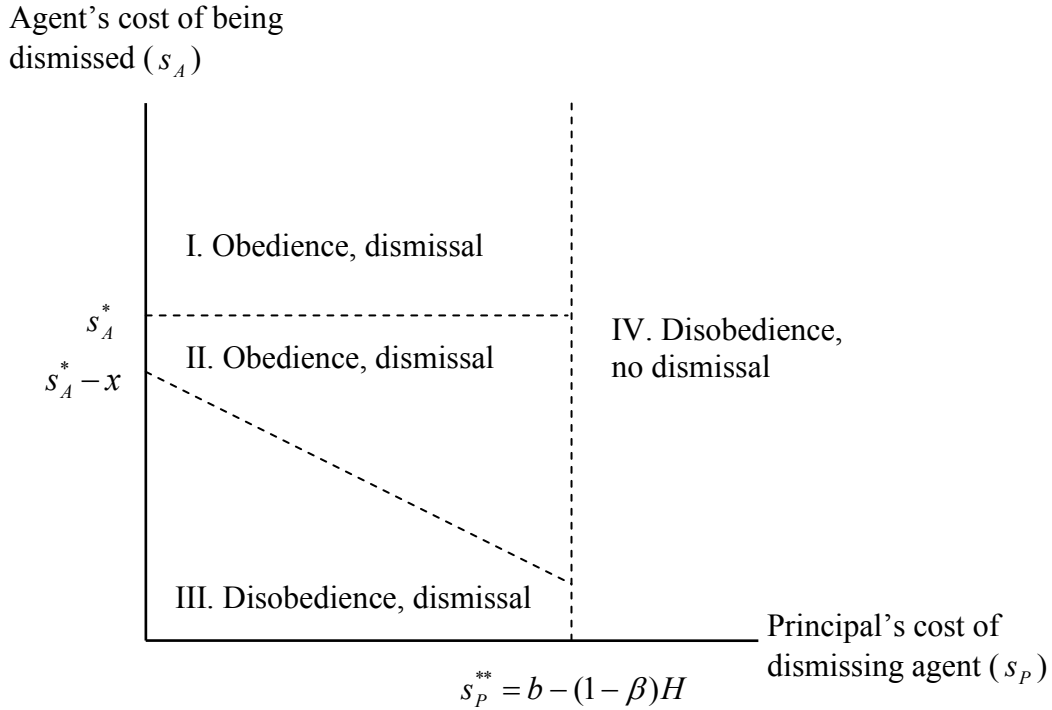


Figure 2. Obedience and Dismissal with Monetary Incentives



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 given only to an agent who was disobedient in the first period. The figure shows the configuration when $(1 - \beta)H < b < H$. On the vertical axis, $s_A^* \equiv b(1 - \delta) / \delta$ from (ICP) and $x \equiv (1 - \alpha)s_P + (1 - \alpha)(1 - \beta)H$.