Empowerment in Teams: When Delegation Prevents Collaboration

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Abstract

Many companies empower employees without delegating to them. However, the economic literature on empowerment implies, if not assumes, that delegation is always empowering. While delegation is empowering in a single-agent context, we show that it may be disempowering with multiple collaborative agents. Delegation to an agent may disempower him indirectly by demotivating his collaborator. We show that the possibility that delegation can disempower causes the principal to retain decision rights precisely when delegation is most profitable in a single-agent environment. Our results imply a managerial role in empowering a collaborative team with heterogeneous preferences.

JEL Codes: D21, D23, D25. **Keywords:** Delegation, Strategy

1 Introduction

In the early 2000's, Apple's industrial designers were widely considered among the most empowered in the industry. While other designers haggled with management about design specifications, Apple's designers could focus on designing beautiful products (Wilson (2014)). When Apple engineers doubted a design's feasibility, executives told them to 'figure it out' (Carr (2013)). However, Apple executives did not blindly follow the designers' judgement. CEO Steve Jobs was famous for holding design proposals to exacting standards,

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once requesting 50 design iterations for a cardboard box before seeing one he approved (Isaacson (2011)).

In what may appear a contradiction, Apple designers were simultaneously powerful and powerless. They were powerful in that their best designs always received the necessary organizational support; excellent designs would not be sidelined by narrow-minded engineers. However, designers were powerless in that Steve Jobs frequently rejected their proposals. This contradiction among allegedly empowered employees begs the question of what empowerment means; empowered employees are definitionally powerful (hence the 'power' in empowerment), but powerful in what sense?

Economists traditionally think of empowerment as meaning 'having the power to make decisions', meaning a manager empowers by delegating decision rights.[1] Perhaps viewing 'empowerment' as nearly synonymous with 'delegation' is an artifact of modelling assumptions. Because these have historically been principal-agent models with a single agent, the only limit to the agent's (employee's) success is the principal's (manager's) temptation to make decisions that undermine the agent, which is solved by delegation.

However, the agent's success faces another potential obstacles when the principal manages two collaborative agents (i.e. complementary efforts). The agent's success can now be undermined both by the principal's discretion and by the teammate's reluctance to collaborate. For example, the success of a proposed design at Apple can be thwarted by either Jobs rejecting it or engineers failing to implement it well. While delegation to the first agent disciplines the principal's discretion, it may deter the second agent's collaboration. As a result, giving an agent the power to make his own decisions may render him powerless to achieve success.

In this paper, we propose a broader conception of empowerment that allows for it to be discussed in richer settings, including Apple. Consistent with some other literatures, we define empowerment as meaning 'having the power to achieve success through hard work'.[2] In short, empowerment is the

[1] A canonical examples is Aghion and Tirole (1997). We provide a more thorough literature review in Section 1.1.

[2] This is consistent with the definition of empowerment used in Conger and Kanungo

strength of the link between employee effort and the intrinsic desirability of the outcome.[3] This alternative definition of *empowerment* may seem pedantic because delegation is empowering in single-agent contexts.[4] However, our primary result is that delegation can disempower in a multi-agent context. As a result, having multiple agents leads the principal to retain decision rights precisely when delegation would most increase profits in a single-agent setting.

To explore these issues, we build a model in the spirit of Aghion and Tirole (1997), hereafter noted as AT97, but with two agents who have differing preferences. As in AT97, the divergence in preferences between the principal and the first agent is one determinant of the principal's willingness to delegate to that agent. However, there is now a second determinant: the second agent behaves differently depending on whether or not the principal delegates to the first agent. In some respects, delegation is replacing the second agent's boss with the first agent, who has different preferences from both the principal and second agent. The second agent changes his behavior because the principal and first agent's differing use of ex-post decision-rights changes the second agent's ex-ante incentives.

In our basic model, we explore both when delegation empowers and when it is optimal. We show that delegation disempowers when (1) the agents' efforts are most complementary and (2) the principal's preferences are well aligned with the sum of the agents' preferences. Conditions (1) and (2) correspond, respectively, to the importance of obstacles to employee success that centralization (i) removes (coworkers not collaborating) and (ii) introduces (principal

(1988), which describes empowerment as 'self-efficacy', deliberately differentiating it from delegation. Outside of the social science literature, our use of *empowerment* is also consistent both with the computer science community's use of the term (e.g. Klyubin et al. (2005)) and with many common uses of the term.

[3] We include the word 'intrinsic' to note that we are not talking about monetary compensation. We also note that punishing low effort is not empowering, as we discuss in the literature review.

[4] The Apple case illustrates a situation where an employee is empowered by a manager who not only does not delegate, but is unusually willing to intervene in decision making. There are ample examples where an employee has decision rights but is not empowered. For instance, imagine an HR director who has authority to unilaterally set company policies, but no one obeys the policies or is punished when they disobey. She would not be considered empowered.

intervening against agents' interests). These conditions cause the principal to retain decision rights when she would otherwise delegate in a single-agent environment. Because most single-agent models imply that delegation empowers, in these models, delegation is optimal when the agent's moral hazard is not too large. However, condition (2) for when delegation disempowers in our model coincides with the agent facing low moral hazard. In short, introducing collaborative agents causes the principal to centralize precisely when delegation is the most attractive without collaborative agents.

However, this model is thus far silent on the most salient part of Steve Jobs' management style; more than simply not delegating, he held designers to an unusually high standard. To move closer to describing Jobs' approach, we then enrich our basic model to introduce the idea of standards. Specifically, we allow agents to perform higher-quality work at a higher effort cost, and we allow the principal to commit to reject low-quality work. Both the findings and intuition are similar to those of our primary results. While a single-agent model would conclude that standards are always disempowering, they can empower in team settings by ensuring that both agents collaborate.

In a sense, our argument is to the the single-agent empowerment literature, such as AT97, as Holmstrom (1982) is to the single-agent incentive-contracting literature. Each argues that one role of a manager is to improve incentives for a group of employees working on a common project, a role that disappears when there is only a single employee. However, we take different approaches to a similar argument. Being a part of the incentive-contracting literature, Holmstrom (1982) showed that a manager (principal) can solve the free-rider problem using incentive contracts available only because the manager can break the budget-balance constraint. In contrast with the incentive-contracting literature's focus on the extrinsic motivation caused by different incentive contracts, the empowerment literature analyzes the intrinsic motivation caused by different decision-making processes. Being a part of this literature, we show that a manager can reduce the buy-in problem (i.e. inefficiently little collaboration by one agent disincentivizes the other from collaborating) using a decision-making process available only because the centralized manager's preferences cause his ex-post decisions to differ from those of a delegatee (agent).

1.1 Literature Review

Many of the seminal papers in the delegation literature (Aghion and Tirole (1997), Baker et al. (1999), Dessein (2002)) study situations with a single principal interacting with a single agent. In each of these cases, the lack of a second agent ensures that the principal's temptation to violate the agent's interests is the primary obstacle to employee success. As a result, delegation is empowering. A similar dynamic appears in Van den Steen (2010), but because of diverging beliefs rather than diverging preferences.[5] In contrast with this literature, we focus on situations in which the principal manages multiple agents.

In our model, the principal acts as a decision intermediary who, similar to the delegation literature, (1) is partially aligned with the sum of the agents' preferences and (2) must rely on intrinsic motivation, not contracting, for effort incentives. Showing that the principal retaining authority can increase agent utility is not a new concept. As Alonso et al. (2008) and Rantakari (2008) show, having the manager make decisions that are a convex combination of both units' local conditions, and thus internalizing externalities, can improve profits for both units. However, these papers preclude effort choices. Upon adding a pre-stage effort decision to obtain a signal about each unit's local condition, delegation is more empowering than centralization. Our paper reaches the opposite conclusion in that delegation may be disempowering.[6]

There is a literature, such as Szalay (2005) and Newman and Novoselov (2009) which alters the information structure of AT97 to make formal delegation demotivating. In both of these papers, delegation demotivates because

[5] See Bolton and Dewatripont (2010) for more on single agent delegation or Gibbons and Roberts (2010) for more on how delegation relates to motivation in the single-agent case.

[6] We assume that there is a single decision right, whereas Alonso et al. (2008) and Rantakari (2008) assume two. Using their framework, centralization can be more empowering to agent 1 than is delegating a decision right to each agent. However, notice that this is an imperfect analogy to delegation in our model. A better analogy would be delegating both decision rights to agent one, which would always empower agent one in their model.

the principal loses the ability to punish low effort. We do not consider punishments, themselves, empowering, even if they incentivize effort. After all, an employee who is told he will be fired if he ever takes a break has strong effort incentives, but he would not be considered empowered.[7] As a result, these papers are silent on empowerment.

Instead, we consider an environment with multiple agents. In the multi-agent literature on incentivizing effort, delegation is generally not the primary consideration. As a result, we focus on the literature where the principal has a role in improving team effort incentives, and we analogize this role to centralization. In these models, such incentives do not come through empowerment. Sometimes they come through the principal's ability to write a first-best incentive contract (Holmstrom (1982)). Other times they come through the principal's ability to monitor (Alchian and Demsetz (1972), Halac et al. (2021b)), or otherwise punish agents (Bonatti and Hörner (2011)). None of these forces are directly empowering. Furthermore, because agent efforts are not assumed to be complementary, the effect of incentive contracts, monitoring, or punishments on the first agent's effort does nothing to empower the second agent, which is the fundamental empowering mechanism in our paper.

We see our paper as being closest to Halac et al. (2021a), which concerns motivating a collaborative team using incentive contracts. The authors address only extrinsic motivation, rather than empowerment. Relatedly, delegation and decision-making dynamics are also absent. However, the complementarity of agent efforts cause the first agent's incentive contract to incentivize the second agent (provided the second agent has an incentive contract). This leads to a buy-in effect, where agent two is motivated when agent one responds to a steep incentive contract by working hard.

[7] High standards in our model could be framed as a punishment. However, the high standards are not empowering themselves. Instead, they are empowering because of their effect on the complementary efforts of other employees. Returning to Apple for an analogy, our claim is not that Jobs' high standards were empowering simply because they forced designers to do high-quality work. Rather, the designers high quality work motivated the engineers to do high-quality work, which in turn empowered the designers because of complementary efforts.

2 Model

The organization is composed of a principal (manager, she) and two agents (employees or divisions, he). After describing the game's timing, we elaborate on each step in more detail: (i) The principal assigns the control right to one of the three parties, (ii) the two agents individually and simultaneously gather information about the projects' payoffs, (iii) the agent(s) who do not have control of the decision right communicate publicly about the information they received, and (iv) the controlling party picks if and which project to implement. We will solve for a Perfect Bayesian Equilibrium.[8] To be consistent with the literature, we assume the principal can contract on the governance structure which implies she will maximize joint surplus.[9] However, the principal cannot contract on project realizations. Appendix Section 6.2 relaxes these assumptions and finds similar results.

Projects.– The agents screen amongst four a-priori identical projects on behalf of the principal. Each project has two dimensions of quality, one pertaining to each agent. Agent i's quality dimension, Q_i, can be either Good(G) or Bad(B). A projects value to agent i when implemented is a function of (Q_i, Q_{-i}). All agents prefer $(Q_1, Q_2) = (G, G)$ to any other project. The next best project for agent i is $(Q_i, Q_{-i}) = (G, B)$, followed by (B, G), and an extremely unappealing (B, B). Finally, there always exists the option to implement no project, ensuring both agents receive 0 utility. The agents' utilities are summarized in the following table.

[8]There exists a unique equilibrium by backwards induction with informative communication on path.

[9]Joint surplus is the sum of all parties payoffs.

Proj. implemented	U^1	U^2
(G,G)	1	1
(G,B)	$1-2\tau$	$-1-2\epsilon$
(B,G)	$-1-2\epsilon$	$1-2\tau$
(B,B)	$-\infty$	$-\infty$

Table 1: Each agent's payoff when a project of quality (Q_1, Q_2) is implemented.

We will explain the parameters and features of the agents' payoffs after describing the information structure and presenting Table 2.[10] When the principal implements a project, she receives the sum of the agents' payoffs. However, with probability $1-\alpha$, implementing a project requires the principal to pay an implementation cost M. With complementary probability, α, implementation is costless. We call the parameter α *principal alignment* because it is the probability that the principal's implementation preferences align with the sum of the agents' preferences. To maintain this interpretation, we assume $M > 2$.[11]

Information.– We assume that players have the same uniform prior about project identities. After incurring private cost $g(e_i)$, agent i learns Q_i for all four projects with probability e_i, otherwise learning nothing.[12] Note that agent i cannot independently learn Q_j, but as discussed in the next paragraph, agents can communicate about their projects. After the agents communicate, the principal observes the implementation cost.[13]

[10]Note that setting the value of (G,G) to 1 is a normalization. Further, setting the value of (B,B) to be extremely negative ensures agent's must acquire some information before implementing a project. Finally τ reflects how much better a (G,G) is to an intermediate project.

[11]$M > 2$ guarantees that the principal never implements when facing a non-zero implementation cost. Other M's may be appropriate, but this choice is most consistent with the analysis in Aghion and Tirole (1997). Further, this payoff structure could be framed as agents maximizing their divisions' revenues, with only the principal internalizing the corresponding cost.

[12]In Section 4 we endogenize the information acquisition choice.

[13]This is equivalent to AT97 except (i) the principal's cost of acquiring information being 0, and (ii) the information each party has is incomplete and complementary to the other parties information. Similar to AT97, we assume the principal realizes their alignment after

To help explain the payoff parameters, we calculate each agent's expected payoffs as a function of all learned information, assuming that best project is implemented. Note that all parties agree on which project is best, though they may differ on whether they prefer to implement no project at all. These payoffs are summarized in the following table.

i Informed	$-i$ Informed	U^i	U^{-i}
Y	Y	1	1
Y	N	$1-\tau$	$-\epsilon$
N	N	$-\infty$	$-\infty$

Table 2: Expected Utilities as a Function of Learned Information Assuming a Project is Implemented.

These payoffs have three important features. First, an agent prefers to implement a project if and only if he is informed. Second, the principal prefers to implement a project if and only if both implementation is costless and at least one agent is informed. We assume a vanishingly small ϵ to ensure the first two features hold for all parameter values. Third, each agent's information becomes more valuable when the other agent is informed.[14] This increase in the value of information is indexed by $\tau \in [0,1]$, or the need for teamwork.[15]

Communication.– After observing his signal of project quality, each agent sends a public message, m_i, about his observed information.

Delegation.– Before agents search for information, the principal can formally delegate authority to an agent. If the principal does so, the delegatee

the agent's effort, however in both our setting and theirs if it was technologically feasible for the principal to discover their alignment first it would be optimal for them to do so.

[14]There are at least two reasons why agent 1 prefers (G,G) to (G,B). The first is due to intrinsic motivation story in which a (G,G) project is more successful than a (G,B) project and thus gives the agent more utility. A second is that, there exists an additional ex-post implementation cost that agent 1 must bear more of under (G,B) than under (G,G), causing agent 1 to prefer (G,G).

[15]The case in which τ is less than 0 or greater than 1 corresponds to tournaments or coordination games which may be of interest, but are not in line with the message of this paper.

agent will later choose which project to implement. Otherwise, the principal will retain authority, which we call *centralization*. We refer to this choice as the *governance choice*.

Empowerment.– Informally, we say an agent is empowered to the degree his effort influences outcome desirability. Formally, empowerment is the marginal utility to the agent of effort in equilibrium, excluding effort costs.[16]

Definition 1 *The **empowerment** of agent i, η_i, is*

$$\eta_i = \sum_j \frac{\partial P_j}{\partial e_i} U_{i,j}. \tag{1}$$

Here, $P_j = \mathbb{P}(outcome\ j)$, $U_{i,j}$ is the utility agent i garners from outcome j, and e_i is evaluated at the equilibrium level of effort.

Before analyzing empowerment within the full model, we summarize a similar analysis of a single-agent version. In such a model, delegation is always empowering. While delegation motivates the agent, it introduces moral hazard as the agent may implement projects with high implementation cost. As a result, delegation is optimal when that moral hazard is low (high α).

3 Empowerment and Delegation

In this section, we first solve the model under each of delegation and centralization. Afterwards, we show that centralization empowers more than delegation does when principal alignment is high. We show that centralization is also Pareto optimal in such contexts. After giving necessary and sufficient conditions for optimality, we show that delegation is optimal for only low or intermediate principal-agent alignment, if ever.

[16] What we define as empowerment, could potentially also include pay incentives and punishment for low outcomes since both would effect the marginal utility of outcome. We do not view these as empowering, but since these are not allowed in the model, our mathematical definition aligns with what is normally referred to as empowerment.

3.1 Equilibrium Decision Making

Without loss of generality, the principal will delegate the decision right to agent 1 if she chooses to delegate at all. We can now solve the game by backwards induction. We assume a truthful equilibrium. To see why such an equilibrium exists, recall that the undesirability of (B,B) projects sufficiently disincentivizes suggesting a random project. Furthermore, concealing information cannot increase the likelihood of any desirable outcome.

Given truthful communication, we now show the decision rules as a function of information discovered. First, under centralization, the principal accepts the best project if and only if both implementation is costless and at least one agent is informed. At least one agent being informed prevents a (B,B) outcome, ensuring the project yields positive expected profit. Second, under delegation, agent 1 (the delegatee) accepts the best project if and only if he is informed. Table 3 gives the resulting conditional expected payoffs.

Gov	A^1 Informed	A^2 Informed	U^P	U^1	U^2
C	Y	Y	2α	α	α
C	Y	N	$\alpha(1-\tau)$	$\alpha(1-\tau)$	0
C	N	Y	$\alpha(1-\tau)$	0	$\alpha(1-\tau)$
C	N	N	0	0	0
D	Y	Y	$2-(1-\alpha)M$	1	1
D	Y	N	$(1-\tau)-(1-\alpha)M$	$(1-\tau)$	0
D	N	Y	0	0	0
D	N	N	0	0	0

Table 3: *Gov* corresponds to governance structure (Centralized or Delegated). The second and third columns correspond to if Agent 1 and Agent 2 respectively had a successful search. The fourth through sixth columns give the expected payoffs of each player.

Here are the resulting expected payoffs under delegation, as a function of effort.[17]

$$U_d^1 = e_1 e_2 + (1-\tau) e_1 (1-e_2) - g(e_1) \tag{2}$$

$$U_d^2 = e_1 e_2 - g(e_2) \tag{3}$$

$$U_d^p = \Big(2 - M(1-\alpha)\Big) e_1 e_2 + \Big((1-\tau) - M(1-\alpha)\Big) e_1 (1-e_2) \tag{4}$$

Similarly, here are the (symmetric) payoffs as a function of efforts under centralization.

$$U_c^i = \alpha e_i e_{-i} + \alpha(1-\tau) e_i (1-e_{-i}) - g(e_i) \tag{5}$$

$$U_c^p = (2\alpha) e_1 e_2 + \alpha(1-\tau)(e_1(1-e_2) + e_2(1-e_1)) \tag{6}$$

Now we compare the two agents' efforts via their reaction curves. First, under centralization, the first order condition of agent i's payoffs yields the following

$$g'(e_i) = \alpha(\tau e_{-i} + 1 - \tau). \tag{7}$$

As discussed in the following paragraph, we impose the following assumptions on $g(\cdot)$ to yield desirable properties.

Assumption 1 *The cost of acquiring information, g, satisfies $g'(0) = 0$, $g'(1) > 1$, $g''(x) > 1$ and $g''(x) > g'(x)$ for all $x \in [0,1]$, and g' is log concave.*

The conditions on $g'(0)$ and $g'(1)$ ensures the solution corresponds to a probability. Assuming $g'' > 1$ implies that the first-order approach yields the unique maximum of the agents' problem.[18] Finally, the conditions of $g' < g''$ and log concavity of g' are sufficient to establish that the principal's utility is convex in α.[19]

[17] The subscript on the utility functions denotes the governance choice with c, d denoting centralization, delegation, respectively.

[18] The study of equilibrium selection amongst multiple equilibrium is of interest, e.g. Halac et al. (2021a), but is beyond the scope of this paper.

[19] The final two conditions are sufficient for convexity of the principal's profit function. A necessary and sufficient condition is the following ODE: $g'g''' + \frac{2g'g''}{e+\frac{1}{\tau}-1} < 2(g'')^2$. It is worth noting that any cost functions satisfying this ODE, when applied to the AT framework,

Under delegation, the reaction curves are asymmetric, as follows.

$$g'(e_1) = \tau e_2 + 1 - \tau \quad (8)$$

$$g'(e_2) = e_1 \quad (9)$$

Information complementarity leads both reaction curves to be upward sloping, as under centralization. In other words, complementary information is the foundation for the *buy-in effect*, which we define as the increased empowerment of one agent when the second agent works harder.

Definition 2 *The* ***buy-in effect*** *for agent i is the marginal effect of an increase in* e_{-i} *on agent i's empowerment,* η_i*, at equilibrium levels. Hence the buy-in effect is* $\frac{\partial \eta_i}{\partial e_{-i}}$.

In our model, the buy-in effect is caused by agent j's information improving the likelihood that agent i's information yields a (G,G) project, increasing the benefit of search to agent i.[20] By contrast, information is substitutable across teammates in many other models (e.g. in AT97 if we frame the principal and agent as teammates), causing a negative buy-in effect. The complementary efforts that undergird our results are a feature of many real world environments.[21]

3.2 When Delegation Disempowers

We now compare the empowering effects of centralization and delegation. Under delegation, agent 1 approves projects if and only if his search was successful. Meanwhile the centralized principal rejects projects when implementation costs are high. Because centralization's decision rule results in successful searches not influencing project selection, centralization can disempower

yields a unique cutoff, with delegation being optimal if and only if principal alignment is above said cutoff. Finally, note that many explicit functional forms satisfy this condition such as any quadratic $g(e) = \frac{k}{2}e^2$ where $k > 1$.

[20]Hence, while the ability to generate information is not complementary, the value of information is complementary across agents.

[21]For instance, Apple Design cannot independently learn the technical difficulties of building a specific phone.

agent 1. However, centralization's advantage is that the principal's intermediate preferences allow her to accept agent 2's preferred projects when agent 1 would not. By accepting more of agent 2's proposed projects, the principal increases the value of agent 2's information, thereby directly motivating him and indirectly empowering agent 1 through the buy-in effect.

Centralization is empowering when the second agent's temptation to shirk undermines the first agent's success more than the principal's temptation to not implement projects does, which happens for high τ and α. The intuition is formalized in Lemma 1 below.

Lemma 1 *There exists an $\alpha^* < 1$ such that both agents are more empowered under centralization than delegation when α, the principal alignment, is larger than α^*. Moreover, α^* is decreasing in τ, the need for teamwork, when $g(\cdot)$, the cost of acquiring information, is quadratic.*

The proof for the above lemma and all further statements are in the Appendix. The intuition for Lemma 1 is that centralization empowers agent 1 when (i) it motivates agent 2 and (ii) the buy-in effect is strong enough for this motivation to empower agent 1. For (i) to hold, the the principal's preferences must be closer to those of agent 2 than the preferences of agent 1 are, which happens for high α. For (ii) to hold, buy-in must matter, so τ must be large.

3.3 Optimal Governance

To help understand when centralization is optimal more generally, we first analyze when it is Pareto optimal.[22] More specifically, when centralization is empowering (high α), all parties prefer it to delegation. By contrast, in a single-agent model, *delegation* is optimal for high α. Notice that empowered agents in our model both exert more effort and have higher utility because empowerment is the lone incentive. Under high principal alignment, both agents prefer centralization. The principal similarly prefers centralization because it

[22]Here, Pareto optimal refers to all parties preferring centralization without any side-transfers.

leads to better ex-post decision making (for the principal) and the agents find more information. This argument is formalized as follows.

Corollary 2 *If $\alpha > \alpha^*$, all parties prefer that the organization be centralized.*

However, because parties often prefer different governance choices, we now analyze when delegation or centralization maximizes total surplus. Remember, we assume that the principal can contract only on governance choice. Thus the principal's choice of governance maximizes total surplus. Given the effort choices derived by Equations 7 and 8, one can calculate profits under each governance structure.

To analyze the principal's governance choice, we consider how profits vary with α under delegation and centralization. Under delegation, decision making and agent utilities are invariant to α. However, the principal's utility function is linear in α as α influences the conditional probability of the implementation cost M, implying profits are linear in α.

Meanwhile, Assumption 1 implies that profits are convex in α under centralization. The intuition is that effort choices increase in α and the conditional probability of implementation cost M decreases in α. Since these forces interact multiplicatively, profit is convex. Finally, Corollary 2 shows profit is higher at $\alpha = 1$. Combining these results, we get that delegation is optimal for only intermediate or low levels of principal alignment, if ever, as follows.

Proposition 3 *There exists an $\alpha_1 \geq 0$ and $\alpha_2 < \alpha^* < 1$ such that the principal prefers to delegate if and only if her alignment, $\alpha \in (\alpha_1, \alpha_2)$. Note that α_1 need not be less than α_2.*

To see why delegation is optimal for either low or intermediate levels of alignment, first consider Corollary 2, which implies that delegation is suboptimal for high principal alignment. Furthermore, delegation may be suboptimal for low principal alignment when implementation costs, M, are large because delegation leads the principal to pay these costs often.[23]

[23]Recall that single-agent models have delegation being optimal for *high* principal alignment.

Below, we parameterize the cost of acquiring information to generate comparative statics. Let the cost be $g(e) = \frac{k}{2}e^2$ where $k > 1$.

Proposition 4 *When the cost to acquire information is* $g(e) = \frac{k}{2}e^2$ *the comparative statics of* α_1, α_2 *w.r.t. the parameters* M, τ, k *are as follows.*

$$sgn(\frac{\partial \alpha_1}{\partial M}) = sgn(\frac{\partial \alpha_1}{\partial k}) \geq 0 \tag{10}$$

$$sgn(\frac{\partial \alpha_2}{\partial M}) = sgn(\frac{\partial \alpha_2}{\partial k}) \leq 0 \tag{11}$$

Further, α_1, α_2 *are unsigned with respect to* τ*, however* $\lim_{\tau \to 1} \alpha_2 = 0$.

Delegation is less advantageous when there is an increase in either the implementation cost (M) or the difficulty of the task (k). To see why, notice that while the delegatee's moral hazard increases in implementation costs, profits under centralization are invariant to implementation costs.[24] Additionally, motivating agents is harder when effort costs (k) increase. Because delegation's only benefit is its potential motivational influence, delegation becomes relatively less profitable in k. Finally, τ has a non-monotonic effect on governance choice because of the following two countervailing effects, as shown in the figure below.

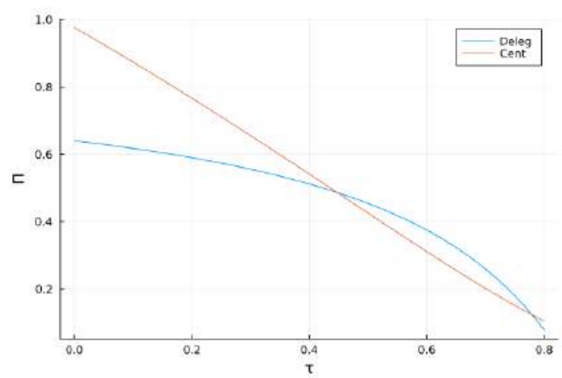


Figure 1: Profits under delegation and centralization while varying τ and fixing $\alpha = \frac{1}{2}$, $k = \frac{33}{32}$, and $M = \frac{9}{2}$. Centralization is in Orange and delegation in Blue.

[24]Implementation costs are paid only off-path under centralization.

To see why τ has a non-monotonic effect on governance choice, consider the following countervailing effects of τ on profit. Both of these effects are mediated by the demotivational effect of high τ, which happens because τ decreases payoffs when only one party is successful. First, effort decreases more with respect to τ under centralization than it does under delegation. Remember that τ directly influences both agents' ex-ante payoffs under centralization, whereas it directly influences only the delegatee's payoffs under delegation. As a result, delegation creates relatively better effort incentives as τ increases.

Second, low effort hurts profits more under delegation than under centralization. Notice that low effort makes a (GG)/(GB) gamble much more likely than a certain (GG) project, reducing the expected benefit of implemented projects under both centralization and delegation. However, because the principal also pays an expected implementation cost $(1-\alpha)M$ under delegation, the reduction in expected benefit of implemented projects is proportionally greater under delegation than under centralization. This second force benefits centralization as τ gets large, and it dominates the first force for high τ. Hence, centralization is optimal for high τ as stated in Proposition 4.

In this subsection we showed how the underlying logic behind when a principal chooses to delegate changes when we introduce multiple agents. First, delegation need not be empowering, and it is suboptimal when disempowering. Thus the intuition of many single-agent models does not extend to the many real-world scenarios where a manager oversees multiple employees working on inter-related tasks.

To see how considering our argument would change analysis of when to delegate, consider the problem of how to manage higher skilled workers, i.e. a lower k in Proposition 4.[25] The intuition from single agent models sug-

[25] Low k means the agent can relatively easily accomplish a task. We choose the interpretation that the agent is highly skilled. An alternative interpretation of a low k is that the task is routine. However, the model does not seem to apply to routine tasks because all actors in the model are ex-ante uncertain about the best course of action to take. That is, the principal relies on the agents for key information about what projects to pursue. By contrast, routine tasks are definitionally tasks that are regularly done in a fixed way. A manager of employees doing routine tasks should thus have little to no uncertainty about how these tasks should be done.

gests that managers should delegate to such workers to increase motivation.[26] However, with high-skilled workers in collaborative settings, the buy-in effect is particularly strong, suggesting that delegation may *decrease* motivation in these settings.

4 Empowerment and Standards

Our main analysis explains why delegation may be disempowering, but it does not describe some important features of the Apple case. That is, Steve Jobs's high standards seemed more important than the fact the he had the final say on decisions. Here, we extend our model to explain why high standards may be empowering. More importantly, we give the manager a new role in empowering employees.

In the bulk of the literature, managers empower by delegating.[27] In Section 3, we show that the principal may empower by retaining the decision right and serving as an intermediary, generally siding with the interests of both parties when they agree. Here the manager instead empowers employees by holding them to high standards to ensure that each employee can trust that his collaborators will do their part. To be precise, high standards on agent 1 allow agent 2 to know that agent 1 will do high-quality work. Because of complementary efforts, this knowledge motivates agent 2, which in turn empowers agent 1.

The empowering effect of high standards is striking because (i) it is the opposite of rubber-stamping (i.e. informal delegation) and (ii) it is disempowering in a single-agent environment. As with centralization, low standards may disempower in a multi-agent environment because of the buy-in effect.

[26] For example, Lo et al. (2016) models and empirically documents this within sales forces.
[27] E.g. Aghion and Tirole (1997), Baker et al. (1999), Rantakari (2012), and many others.

4.1 Modeling Standards

To model standards, we need to make one primary change to the model. Namely, we give the agents the ability to do high or low quality work. Previously we assumed agent i, at cost $g(e_i)$ could observe Q_i for all the projects with probability e_i. We call this a *complete* search. We will now assume that, instead, agent i can at cost $g(e_i)/2$ discover one project where $Q_i = G$ with probability e_i, which we call an *incomplete* search.[28] Now, when the agents choose how much information to acquire, they simultaneously choose which type to acquire.[29] We frame the complete search as being high-quality work because it yields more information and is costlier.

We simplify our analysis by assuming the organization is centralized. These results are robust to allowing delegation so long as M, τ, or α are sufficiently high.[30] The principal sets a *high standard* by implicitly demanding complete searches.[31] She sets a *low standard* by implicitly letting the agent choose the search type. We use the word 'implicitly' because, while the agent explicitly chooses the search type, the principal can implicitly choose the search type by strategically selecting the equilibrium of the communication game. We describe this mechanism in the following paragraph.

Because the principal can choose an equilibrium of the strategic communication game, high standards require no commitment assumptions. We assume that the low standards equilibrium corresponds to complete truth telling. Meanwhile, the high standards equilibrium corresponds to one where the principal assumes all messages are noise unless the agent suggests two projects to implement. In that case, the principal believes the message to be true. To see why high standards implicitly force the agent to choose a complete search, notice that a successful incomplete search results in only one project to be

[28]We set the cost of an incomplete search to be half the cost of a complete search because it yields half the information. This is related to Axiom 2 in Pomatto et al. (2018).

[29]For simplicity, we assume they can only acquire one or the other.

[30]We show this in Appendix Section 6.3 and also formally analyze the interaction between standards and delegation.

[31]One can show that, within this model, imposing high standards on only one agent is never optimal.

recommended. Under high standards, the agent must also suggest another (random) project if he wants for the information from his search to be used. However, he would not do so in fear of a (B,B) project. As a result, any information from an incomplete search is useless under high standards.

Before analyzing the full model, we summarize an analysis of a single-agent version. In such a model, low standards are always empowering, but not always optimal. Low standards empower because they allow the agent to choose the incomplete search, which he prefers. However, the principal prefers complete searches, and high standards fix this externality. In what follows, we show that, first, having two agents allows high standards to be empowering and, second, high standards are always optimal when empowering.

To ensure analytical tractability, we assume $g(e) = \frac{k}{2}e^2$. Furthermore, we make a minor change to the permissible values of k. Previously assuming $k > 1$ was sufficient to ensure an interior value of e. Given the lower effort costs under low quality searches, we further restrict to $k > \frac{(3-\tau)(1+\sqrt{2})}{4}$.

4.2 When Standards Empower

We will now analyze the equilibrium under low standards. We solve the game via backwards induction. The principal continues to approve projects whenever implementation is costless and at least one agent successfully communicates information. Additionally, there always exists a truthful equilibrium of the cheap talk messaging game.

Consider the case when implementation is costless. Irrespective of the type of search, if only one agent is successful in his search, one of his suggested projects will be approved. If the search was incomplete, there will be only one project suggested. However, if the search was complete, i.e. results in two projects, both projects are a-priori identical so it is without loss to assume the principal randomizes.

If both agents are successful and their discovered projects overlap, then the mutually-suggested project must be GG, so it will be implemented. However if the discovered projects do not overlap, each agent would prefer to implement his own project. Now, consider the case where one agent conducted a complete search, the other agent conducted an incomplete search, and the sets do not overlap. Here, the principal will accept one of the projects from the complete search, now knowing the incomplete search must be a $(Q_i, Q_{-i}) = (G, B)$ project. However, when both agents conduct an incomplete search and the sets do not overlap, both projects give the principal the same expected utility. Hence, we model the principal as randomizing evenly between these projects.[32] Given the decision rules, we can now calculate the magnitude and types of information discovered in equilibrium.

Note that for a given agent, i, complete information is at most twice as valuable as incomplete information. Intuitively, this is the case due to linearity in expectation and the fact that two pieces of incomplete information replicates all the value of one piece of complete information.[33] As a result, there exists equilibrium where both players engage in incomplete information searches. We assume this to be the equilibrium under low standards.[34]

We now calculate the agents' efforts under low standards by solving the agents' (symmetric) first-order conditions, as follows

$$g'(e_i)/2 = e_{-i}(\frac{1}{4} + \frac{3}{8}(1-\tau)) + (1-e_i)(1-\tau). \tag{12}$$

The first part of the right hand side corresponds to the case when both agents are successful. With probability $\frac{1}{4}$, the information sets overlap, revealing the (G, G) project. With complementary probability, the information sets

[32] Under fairly general assumptions on $g(e_i)$, this is in fact optimal. For a detailed analysis on the incentives to bias towards one unit over the other see Rantakari (2021).

[33] To be more concrete, consider the case when agent i's counterpart is informed. Agent i's complete information is exactly twice as valuable as incomplete information (to agent i) because it doubles the likelihood of (i) overlapping information of a (G,G) project and (ii) agent i receiving a (G,G)/(G,B) gamble when the counterpart's incomplete information is not about a (G,G) project. However when agent i's counterpart is uninformed, incomplete and complete information are equally valuable.

[34] There are three reasons for selecting this equilibrium. The first is that this equilibrium exists for all parameter values, while equilibria in which the agents engage in complete searches with positive probability only exist in certain parameter ranges. Second, this is the adversarial equilibrium in the spirit of Halac et al. (2021a). Lastly, setting low standards may prime agents to believe that the resulting equilibrium will involve incomplete searches.

are disjoint and the principal chooses agent i's project with probability 1/2. Finally, he receives a GG/GB lottery when his partner is unsuccessful. Note that low standards are empowering for an individual agent when holding fixed his partner's effort magnitude and search type. However, low standards destroy the buy-in effect, even making it negative for $\tau < \frac{3}{5}$. When both agents pursue incomplete searches, agent 2's information can be used as either (i) a complement with agent 1's to find the (GG) project or (ii) a substitute to suggest a competing GG/GB lottery. The latter outweighs the former when τ is low.

Because high standards are always disempowering when holding the second agent's effort fixed, they are empowering only when doing so motivates significant buy-in to the collaboration. The following proposition outlines when such collaboration is achieved.

Proposition 5 *Let $g(e_i) = \frac{k}{2}e_i^2$. High standards are more empowering than low standards under centralization whenever $\alpha > \frac{4k}{3(1+\tau)}$.*

The intuition behind the proposition is that when τ or α are low, the buy-in effect is small, so high standards do not induce buy-in. Similarly when k is high, neither agent will ever exert high effort, killing buy-in.

4.3 Optimality of Standards

The trade-off between high and low standards depends on the effects of each choice on both ex-ante effort incentives and the link between search types and payoffs. In the previous paragraph, we analyzed the effort incentives. Here, we combine this analysis with a discussion of the relationship between search type and payoffs to the actors.

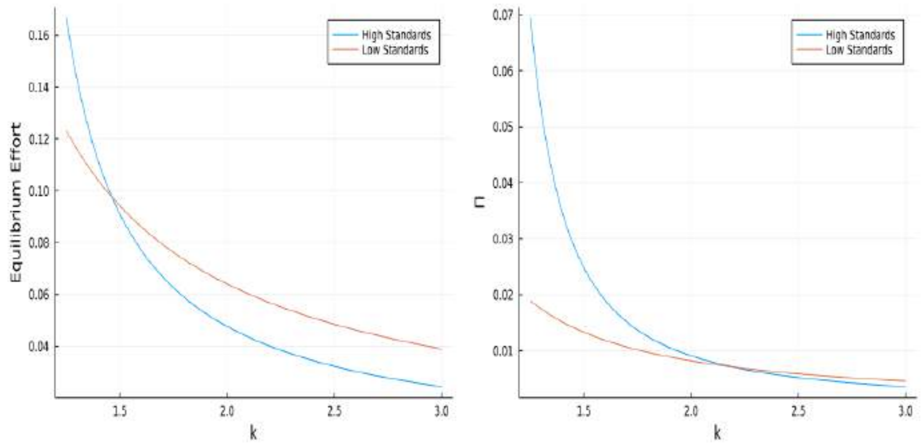
Complete searches are especially profitable when both efforts are high. In this case, there is a high probability that both agents' searches are successful, wherein complete searches guarantee a GG project. By contrast, low efforts yield a low probability of joint success. If only one search is successful, complete information is no more valuable than incomplete information. Thus the principal prefers high standards when effort levels are high (minimal chance of wasting information) and when τ is high (maximal need for complimentary information).

However, these conditions are, qualitatively, the same as when high standards empower (Proposition 5), because efforts are high when k is low and α is high. Hence, the intuition behind when standards are empowering, mirrors the intuition behind when they are optimal. The formal proposition is stated below.[35]

Proposition 6 *Let $g(e_i) = \frac{k}{2}e_i^2$, then high standards are more profitable under centralization whenever $\alpha > \alpha^*(k, \tau)$. Further, $\frac{\partial \alpha^*}{\partial k} > 0$ and $\frac{\partial \alpha^*}{\partial \tau} < 0$.*

Below we plot the equilibrium effort levels and profits under both high and low standards as a function of k fixing τ and α. In Subfigure (a) we plot the equilibrium effort levels under high and low standards in Blue and Orange, respectively. In Subfigure (b) we plot the equilibrium profits using the same color scheme. As the cost to acquire information decreases, one can see that high standards first become optimal and then eventually also become empowering.

[35]The statement can be extended with similar results for any monomial.



(a) Effort (b) Profits

Figure 2: Equilibrium efforts and profits:
Blue corresponds to low standards and Orange corresponds to high standards. The parameter choices for these plots are $\tau = .95$, $\alpha = 1$, and $g(e_i) = \frac{k}{2}e_i^2$.

Notice that introducing a second agent changes the underlying logic behind when high standards are empowering/optimal. With a singular strategic agent, high standards are always disempowering. However, when adding a secondary agent, high standards may empower, and, when they empower, they are also optimal.

Additionally, our notion of standards is different than in the classic literature. This literature frames lower standards as accepting projects the principal would prefer not to accept but that the agent wants (i.e. Baker et al. (1999)). However, in our setting the principal is in fact committing to reject projects that an agent wants implemented and so does the principal. Unlike the previous literature, this implies "the bar" is not only non-negative, but, notably, is positive.

5 Conclusion

We showed that adding collaborative agents can cause delegation to be disempowering when it is otherwise empowering. We then analyzed the influence of this logic on when principals choose to delegate and performed a similar analysis for the principal's decision to set high or low standards on employees.

The empowering effect of management practices depends on the source of obstacles to an employee accomplishing her goals. When the manager is the source of such obstacles, delegation (low standards) is relatively empowering. When coworkers are the source of these obstacles, centralization (high standards) is relatively empowering. We outlined this argument through the lens of a multi-agent model with complementary agent efforts. This enhances our understanding both of how managers empower employees and of when different management practices are optimal. While the demand for parsimony forces us to analyze the empowering effects of only delegation and standard setting, managers empower employees using a varied set of managerial approaches. Here, we include a brief discussion of possible extensions on these topics and how they might relate to collaborative teams.

Managers also empower by selecting interventions that benefit one group at the expense of another. For example, former Apple CEO Steve Jobs chose a competitive strategy and organizational processes that advantaged the design division over the engineering division, empowering the designers. Our model can easily be extended to give the principal the ability to choose a strategy when we frame the firm's strategy as the relative alignment of the principal with each agent. Such a model can yield that the maximally empowering strategy to an agent prioritizes his interests, but not maximally so. That is, agent 1 wants a strategy emphasizing his output. However, if the strategy completely devalued agent 2's output, agent 2 would become demotivated, which would disempower agent 1. As the efforts of the two divisions become more complimentary, the maximally empowering strategy becomes more balanced.

The manager's hiring decisions influence employee empowerment in ways that interact with the decision to set high standards. Specifically, imagine a manager choosing between hiring a specialist, who is extremely competent but is only partially interested in collaboration, and a generalist, who is less competent but wants to collaborate. If the manager hires a specialist, empowering a collaborative coworker will require setting high standards because the specialist will not internalize externalities on his own. However, if the manager hires a generalist, high standards may be redundant because the generalist will autonomously collaborate. Hiring generalists may thus serve as a substitute for setting high standards when it is either too costly or difficult to hold employees to high standards.

Our analysis on standard-setting contributes to the economic literature trying to understand the roles of a manager. Many economic models allow for managers to play an unrealistically limited role in at least one of the following senses. First, many models narrow the scope of a manager's role to be such that it is equally suited to managing one employee as to managing many (e.g. monitoring or assigning a decision right). These models preclude the managerial role of actively helping a team better collaborate, a role often emphasized in popular discussions of management. Second, in many models, the manager acts as a mechanism designer, meaning the manager creates a productive working environment and has little further involvement (e.g. writing incentive contract or choosing the boundary of the firm). Our model on standards overcomes both limitations as it allows the manager the roles of setting and enforcing high standards to ensure that teammates collaborate.

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6 Appendix

6.1 Proofs

Proof of Lemma 1. Let us first show that under delegation to agent 1 the effort by agent 1 is greater than the effort by agent 2. Suppose not, then

$$e_1^d < e_2^d \implies g'(e_2^d) > g'(e_1^d) \implies e_1^d > \tau e_2^d + 1 - \tau \tag{13}$$

$$\implies \tau(1 - e_2) > 1(1 - e_1) \implies \tau > 1 \Rightarrow\!\Leftarrow \tag{14}$$

Where the implications come from convexity of g, substituting the FOC of the agents, and then algebraic simplifications, respectively. This generates a contradiction since τ was assumed to be less than one.

Now for the main proof, proceed by contradiction: assume that the effort for agent 1 under centralization with $\alpha = 1$, e^*, is less than his effort under delegation, e_1^d. We can now show that e^* must also be less than agent 2's effort under delegation, e_2^d. Using equation 8, which corresponds to the FOC for an agent under delegation, we note

$$e_1^d > e^* \implies g'(e_1^d) > g'(e^*) \implies \tau e_2^d + 1 - \tau > \tau e^* + 1 - \tau \implies e_2^d > e^* \tag{15}$$

Now note Equation 7 states

$$g'(e^*) = \tau e^* + 1 - \tau. \tag{16}$$

Let us now replace e_2^d with e^* in the above equation. Note that

$$g'(e_2^d) - g'(e^*) > \tau(e_2 - e^*), \tag{17}$$

because for any $e \geq e^*$, $g''(e) > \frac{1}{2}$. This assertion follows from Assumption 1. Now, note this equation implies

$$g'(e_2^d) > \tau e_2^d + 1 - \tau, \tag{18}$$

but $g'(e_1^d) > g'(e_2^d)$ from step 1 of this Lemma. This implies

$$g'(e_1^d) > \frac{\tau e_2^d + 2 - \tau}{2} \tag{19}$$

which contradicts equation 8. Thus, the effort when $\alpha = 1$ is strictly higher under centralization.

Next, note that the effort under delegation is independent of α. Furthermore, the effort under centralization is increasing in α. This can be seen by applying the Implicit Function Theorem to Equation 4. Thus, there exists a cutoff value α^* such that for all $\alpha > \alpha^*$ agent 1 works harder under centralization than delegation.

Further, note that since the effort for agent 2 is strictly lower than agent 1 under delegation, but the same under centralization, the region where agent 2 works harder is a strict super set of the region where agent 1 works harder. Hence for all $\alpha > \alpha^*$ both agents work harder under centralization than delegation.

Note that in this model, empowerment is a monotone function of effort, hence if the agents work harder for a fixed set of efforts, they are also more empowered. ■

Proof of Corollary 2. Given Lemma 1, both agents' effort are higher under centralization when $\alpha > \alpha^*$. Additionally, there is better ex-post decision making since the principal never approves projects that give her negative utility. Hence, the principal prefers centralization to delegation when $\alpha > \alpha^*$. ■

Lemma 7 *The payoff to the principal is convex whenever* $g'g''' + \frac{2g'g''}{e+\frac{1}{\tau}-1} < 2(g'')^2$.

Proof of Lemma 7. The profit to the principal under centralization is

$$\Pi = 2\tau\alpha e(\alpha)^2 + (1-\tau)\alpha e(\alpha). \tag{20}$$

Note that if $\alpha e(\alpha)$ is convex in α then $\alpha e^2(\alpha)$ will be convex in α since

$$\frac{\partial^2(\alpha e^2(\alpha))}{\partial \alpha^2} = 2\Big(\alpha e'(\alpha) + e(\alpha)(\alpha e''(\alpha) + 2e'(\alpha)\Big) = 2\Big(\alpha e'(\alpha) + e(\alpha)\frac{\partial^2(\alpha e(\alpha))}{\partial \alpha^2}). \tag{21}$$

Hence, it suffices to show that $\alpha e(\alpha)$ is convex. Given that $\alpha \in (0, 1)$, this is equivalent to showing that $\frac{e''(\alpha)}{e'(\alpha)} > \frac{-2}{\alpha}$. Here, $e(\alpha)$ is determined by the FOC from Equation 7 as

$$g'(e) = \alpha(\tau e + 1 - \tau) \iff F := g'(e) - \alpha(\tau e + 1 - \tau) = 0. \tag{22}$$

Using the implicit function theorem can yield solutions for both the first and second derivatives of $e(\alpha)$.

$$\frac{e''(\alpha)}{e'(\alpha)} = \frac{\frac{-F_e^2 F_{\alpha\alpha} + 2F_e F_\alpha F_{\alpha e} - F_\alpha^2 F_{ee}}{F_e^3}}{-\frac{F_\alpha}{F_e}} = \frac{\frac{2F_e F_\alpha F_{\alpha e} - F_\alpha^2 F_{ee}}{F_e^3}}{-\frac{F_\alpha}{F_e}} \tag{23}$$

$$= \frac{F_\alpha F_{ee} - 2F_e F_{\alpha e}}{F_e^2} \overset{?}{>} \frac{-2}{\alpha} \tag{24}$$

$$\iff \frac{F_\alpha F_{ee} + 2\tau F_e}{F_e^2} \overset{?}{>} \frac{-2}{\alpha} \tag{25}$$

$$\iff \frac{(-g')g''' + 2\tau\alpha F_e}{F_e^2} \overset{?}{>} -2 \tag{26}$$

$$\iff \frac{g'g''' - 2\tau\alpha F_e}{F_e^2} \overset{?}{<} 2 \tag{27}$$

$$\iff g'g''' \overset{?}{<} 2F_e(F_e + \tau\alpha) \tag{28}$$

$$\iff g'g''' \overset{?}{<} 2F_e(g'' - \alpha\tau + \alpha\tau) \tag{29}$$

$$\iff g'g''' \overset{?}{<} 2(g'' - \alpha\tau)g'' \tag{30}$$

$$\iff g'g''' + \frac{2g'g''}{e + \frac{1}{\tau} - 1} \overset{?}{<} 2(g'')^2 \tag{31}$$

The expressions in Equation 23 come from the implicit function theorem for first and second derivatives, and the fact that $F_{\alpha,\alpha} = 0$. All remaining expressions are simplifications. ■

Lemma 8 *All functions, g, satisfying Assumption 1 satisfy the differential inequality in Lemma 7.*

Proof. Note that since $g' < g''$, it suffices to show

$$g'g''' < (g'')^2 \tag{32}$$

since we know $e < 1$. Manipulating the above condition generates

$$0 < 1 - \frac{g'g'''}{(g'')^2} \tag{33}$$

$$\iff 0 < \frac{\partial}{\partial x}\frac{g'}{g''} \tag{34}$$

$$\iff 0 > \frac{\partial}{\partial x}\frac{g''}{g'} = \frac{\partial^2}{\partial x^2} log(g'). \tag{35}$$

Where the last condition is the definition of log concavity. ■

Lemma 9 *The value to the agents under centralization is convex in α for any function satisfying Assumption 1.*

Proof. We know the agents' first order condition is the solution to

$$g'(e) = \alpha(\tau e + 1 - \tau). \tag{36}$$

Hence, we can think of the agents' effort as being derived from the following single agent optimization problem

$$U = \frac{\alpha\tau}{2}e^2 + \alpha(1-\tau)e - g(e). \tag{37}$$

We can view this as a function of α as

$$U(\alpha) = \max_e \frac{\alpha\tau}{2}e^2 + \alpha(1-\tau)e - g(e). \tag{38}$$

Note that each item in the maximand is convex in α (in fact it is linear), hence the maximum will also be convex. Thus we know

$$\frac{\alpha\tau}{2}e(\alpha)^2 + \alpha(1-\tau)e(\alpha) - g(e(\alpha)) \tag{39}$$

is convex. However, the agents payoff in equilibrium, is $\alpha\tau e(\alpha)^2 + \alpha(1-\tau)e(\alpha) - g(e(\alpha))$. Thus it suffices to show that $\alpha e(\alpha)^2$ is convex. However, by Lemma 7 we know that Assumption 1 implies $\alpha e(\alpha)^2$ is convex. Hence, the payoff to the agent under centralization is also convex for any cost function satisfying Assumption 1. ■

Proof of Proposition 3. The proof will proceed in three parts: first we will show that the payoffs under delegation are linear in α, second we will show the payoffs under centralization are convex in α, and finally we will show that centralization is preferred by the principal when $\alpha = 1$. Combining these three results shows that if delegation is ever optimal it can only be optimal for low or intermediate values of α. Furthermore, we know centralization is strictly better than delegation at α^* so the relevant upper bound must be strictly less than α^*.

Step 1: Lemma 1 implies that the efforts under delegation are independent of α. Hence, the payoff to the principal is linear in α since α only impacts the payoff conditional on effort.

Step 2: Lemma 7 shows this is true.

Step 3: At $\alpha = 1$, Corollary 2 implies the principal has a higher payoff under centralization. ■

Proof of Proposition 4.

Changes in M: Changing M has no effect on the effort incentives of either agent under either governance structure. Moreover, the payoff under centralization is independent of M. Hence, it suffices to consider what a change in B does to delegation. Increasing M, decreases the principal's profit under delegation for any α. Hence, if delegation was optimal for M, it will be optimal for $M - \epsilon$ for any positive ϵ. Using this, the result immediately follows.

Changes in k: Using the explicit functional form of the effort costs one can compute the efforts under delegation as

$$e_1^d = \frac{k(1-\tau)}{k^2-\tau} \tag{40}$$

$$e_2^d = \frac{1-\tau}{k^2-\tau}. \tag{41}$$

Meanwhile, under centralization the efforts are

$$e_1^c = e_2^c = \frac{\alpha(1-\tau)}{k-\alpha\tau}. \tag{42}$$

From here, one can get an explicit form of the profit function under both delegation and centralization as follows

$$\Pi^c = \frac{(3\alpha^2 k(-1+\tau)^2)}{(k-\alpha\tau)^2} \tag{43}$$

$$\Pi^d = \frac{k(-1+\tau)(-3+(3+2(-1+\alpha)M)\tau + k^2(-3+2M-2\alpha M+3\tau)))}{(2(k^2-\tau)^2)}. \tag{44}$$

One can note that the k's in the numerator cancel in both expressions. Thus upon simplifying the expression, we will be able to conclude that centralization results in a higher payoff if a polynomial that is of at most fourth order in k is positive. Denote this polynomial by f as follows.

$$f(k) = c_0 + c_1 k + c_2 k^2 + c_3 k^3 + c_4 k^4. \tag{45}$$

For our monotonicity result we want to show that if $f(k) > 0$ and $k' > k > 1$

then $f(k') > 0$. Below are the coefficients for $f(k)$

$$c_4 = -3 + 2M - 2\alpha M - 6\alpha^2(-1+\tau) + 3\tau \tag{46}$$

$$c_3 = \alpha\tau(3 + 2(-1+\alpha)M - 3\tau) \tag{47}$$

$$c_2 = (-3 + (3 - 12\alpha^2 - 2M + 2\alpha M)\tau + \alpha^2(9 + 2M - 2\alpha M)\tau^2 + 3\alpha^2\tau^3) \tag{48}$$

$$c_1 = -2\alpha\tau^2(3 + 2(-1+\alpha)M) \tag{49}$$

$$c_0 = \alpha^2\tau^2(\tau(2(\alpha-1)M - 3) + 3). \tag{50}$$

One can show that $c_4 > 0$ for all parameter values. Further, $c_2 \leq 0$ for all parameter values. The signs of the other coefficients are as follows

$$sgn(c_3) = sgn(3(1-\tau) - 2(1-\alpha)M) \tag{51}$$

$$sgn(c_1) = -sgn(3 - 2(1-\alpha)M) \tag{52}$$

$$sgn(c_0) = sgn(3(1-\tau) - 2\tau(1-\alpha)M). \tag{53}$$

We can now proceed by casework based on the signs of these terms. Denote by, e.g. $(-,+,-)$ the case where the sign of c_0 is negative, the sign of c_1 is positive, and the sign of c_3 is negative. There are now eight cases to consider.

1. (-,-,-): The polynomial is monotonic and we have our result.

2. (-,-,+): The polynomial is monotonic and we have our result.

3. (-,+,-): Note that Descartes rule implies that there either 3 or 1 zeros. If there is only one then the function is monotonic and we are done. Hence, assume there are three. Given the parameter restrictions implied by the model, we know that $f(1) < 0$ and $f'(1) > 0$. Hence, 2 of the zeros occur when $k < 1$. Thus, in the relevant region of parameter space the function has a single crossing of the x-axis.

4. (-,+,+): This case is impossible as $c_3 > 0 \implies c_1 < 0$.

5. (+,-,-): Descartes rule implies that there are only 2 or zero zeros. If there are zero, then centralization is more profitable than delegation for

all k. If there are 2, one can show the parameter restrictions imply that $f(1) < 0$, and hence the argument mirrors before.

6. (+,-,+): Again, there will be two or zero zeros. If there are zero, then, again, centralization is always preferred. If there are two, one can show the parameter restrictions imply that $f(1) < 0$ as before.

7. (+,+,-): Here, there are two zeros as well and the argument is similar to that above.

8. (+,+,+): Is impossible because $c_3 > 0$ implies $c_1 < 0$.

Changes in τ: Using the explicit form above, one can again compare the expressions for profit under centralization and under delegation and reduce this inequality to when a polynomial is positive. Here, this polynomial is at most third order. However, before analyzing this polynomial directly, it is helpful to make the following change of variables

$$t = \frac{\tau}{1-\tau}. \tag{54}$$

Now, instead of looking to zeros of the polynomial when $\tau \in (0, 1)$, we can look for zeros when $t \in \mathcal{R}^+$. This polynomial will again be a third order polynomial which is as follows

$$g(t) = 6\alpha^2(t - k^2(1+t))^2 + (k - \alpha t + kt)^2(-3 + 2(-1+\alpha)Mt + k^2(-3 - 2(-1+\alpha)M(1+t))) \tag{55}$$

$$:= a_0 + a_1 t + a_2 t^2 + a_3 t^3 \tag{56}$$

One can check that $a_3 > 0$ which will imply that as $t \to \infty$, or equivalently $\tau \to 1$, centralization will yield higher profits than delegation. ■

Proof of Proposition 5. Using the parametric assumptions, one can solve for the effort levels under both low and high standards as written below.

$$e^l = \frac{8\alpha(1-\tau)}{4k - 5\tau\alpha + 3\alpha} \tag{57}$$

$$e^h = \frac{\alpha(1-\tau)}{k - \alpha\tau}. \tag{58}$$

The resulting empowerment's, η as a function of equilibrium effort are thus

$$\eta^l = 2\alpha(\frac{5\tau - 3}{8}e + 1 - \tau) \tag{59}$$

$$\eta^h = \alpha(\tau e + 1 - \tau). \tag{60}$$

Where the 2 in front of the empowerment under low standards is due to the normalization explained in footnote **??**. From here one can use algebraic simplifications to derive high standards are more empowering whenever

$$\alpha > \frac{4k}{3(1+\tau)}. \tag{61}$$

■

Proof of Proposition 6. Using the efforts derived in Proposition 5 one can compare the profits to the principal under both high and low standards and derive the unique cutoff rule. Through tedious calculations, one can then show the cross partials needed for the result. ■

6.2 Extension With Pay

In this subsection, we consider an extension to the model presented in the main text where the principal can both perfectly observe and contract on effort. Note that in this model if the principal could contract on project implementation decisions, then the payoffs under centralization and delegation would be identical.

We now consider a pay scheme where the principal is able to contract on effort, e_i, and governance choice, g. Here, contracts are of the form

$$w_i = f(e_i, e_{-i}, g). \tag{62}$$

In cases like these it is hard to think about when an agent is more empowered under centralization or delegation as workers that have steep pay-for-performance contracts are not necessarily empowered. However, one result that we can carry over with only slight modifications is Proposition 4, namely that the principal does not delegate when alignment is high. In the case with performance pay we need a slight modification.

Proposition 10 *Suppose that effort is contractible, then for all $\alpha > \alpha^{*,p}$ the principal weakly prefers centralization with a strict preference whenever first-best effort levels are strictly below* 1.

The proposition does not state a necessary and sufficient condition for delegation to be optimal, but rather a necessary condition.[36] To begin, consider when $\alpha = 1$. This implies the principal accepts all projects the agent would under delegation, but additionally accepts projects only agent 2 wants accepted (which do not effect agent 1's effort incentives). If the projects that only agent 2 wants approved occur with positive probability, this strictly increases e_2 which weakly increases e_1 and thus strictly increases payoffs. These projects occur with zero probability under delegation only when $e_2 = 1$, which also implies $e_1 = 1$, which cannot happen so long as first best effort levels are below 1. Hence, if first best effort levels are 1, then both delegation and centralization yield identical payoffs for $\alpha = 1$. However, when first best efforts are below 1 the proposition holds. The $\alpha^{*,p}$ is then derived from continuity in the payoff functions.[37]

[36]Note that $g'(1) > 4$ is enough to imply the necessary condition.

[37]Note that when effort is contractible, under any assumption of the cost functions, the aggregate payoffs under both delegation and centralization are convex. Hence, in general, there can be countably many disjoint intervals in which the principal prefers centralization.

6.3 Delegatees with Standards

The analysis in the main text analyzes standards only under centralization. Here we extend the analysis to standards under delegation. Our main assumption is that an agent cannot hold himself to a high standard. Standards in our model come from a commitment to an uninformative strategic-communication equilibrium. However, this would not apply between a decision maker and himself. Further, as noted in Footnote 31, standards are only optimal if applied on both agents. Hence, standards are never optimal under delegation.[38]

Thus under delegation both agents take part in incomplete searches. If both agent's information sets overlap, this is the GG project and will be implemented. If both agents are successful but they do not overlap, agent 1 will pick his own project as this grants him strictly larger utility. Further, if agent 1 is successful but agent 2 is not this will be a GG/GB gamble that will be implemented. Finally, if agent 1 is unsuccessful, irrespective of agent 2, no project will be implemented. This yields the following payoffs under delegation.

$$u_1 = e_1 e_2 (\frac{1}{4}1 + \frac{3}{4}(1-\tau)) + e_1(1-e_2)(1-\tau) - g(e_1)/2 \tag{63}$$

$$u_2 = e_1 e_2 (\frac{1}{4}) - g(e_2)/2 \tag{64}$$

$$u_p = e_1 e_2 (\frac{1}{4}2 + \frac{3}{4}(1-\tau) - (1-\alpha)M) + e_1(1-e_2)(1-\tau-(1-\alpha)M) \tag{65}$$

When restricting to $g(e) = \frac{k}{2}e^2$, as the main analysis does, one can see that the effort of agent 1 under delegation with low standards is

$$e_1^d = \frac{8k(1-\tau)}{4k^2-\tau}. \tag{66}$$

[38] The analysis in Section 3 holds under the assumption that incomplete searches are not feasible. Else, a version of delegation that is not feasible is being compared to centralization.

Recall that the effort under centralization with low standards is

$$e_1^c = \frac{8\alpha(1-\tau)}{(3\alpha + 4k - 5\alpha\tau)}. \tag{67}$$

Note that a sufficient condition for centralization yielding higher profits is that the effort of agent 1 is higher under centralization. One can now compare the above two expressions to see this occurs whenever α, k, or τ is large enough. Further, when $\alpha = 1$ the condition simplifies to

$$\tau < \frac{3k}{5k-1}. \tag{68}$$

Finally, note that if M is sufficiently large the added effort is societally wasteful under delegation as effort yields to the implementation cost being used on path.

6.4 Non-Balanced Decision Makers

Recall, when the searches by both agents do not overlap, the manager is exactly indifferent to the two proposals. The principal need not choose each agents preferred project with equal probabilities. Let $f \geq \frac{1}{2}$ denote the probability she sides with agent 1 and we will call this the strategy of the firm.[39] Let us solve for the First Order Conditions of the agents given an f.

$$g'(e_1)/2 = \alpha e_2(\frac{1}{4} + \frac{3}{4}f(1-\tau)) + \alpha(1-e_2)(1-\tau) \tag{69}$$

$$g'(e_2)/2 = \alpha e_1(\frac{1}{4} + \frac{3}{4}(1-f)(1-\tau)) + \alpha(1-e_1)(1-\tau). \tag{70}$$

Given that f in our model is interpreted as firm strategy, the most natural assumption is that f is chosen before hiring employees. Thus we will assume that the principal maximizes joint surplus when choosing an f given the wages can be used to bind the participation constraints of the agents.

Proposition 11 *If $\tau > \frac{1}{2}$, then for any k, if the cost to acquire information*

[39]Due to the symmetry of the problem, it is without loss to assume $f \geq \frac{1}{2}$.

is of the form $\frac{k}{2}e^2$, it will be optimal to have a balanced f.

Proof. Given the first order conditions one can calculate the firm profit to be

$$\frac{-((4(-4+\alpha)\alpha k(-1+\tau)^2(8k^2+4\alpha k(-3+5\tau)+\alpha^2(9-18f(-1+\tau)^2+18f^2(-1+\tau)^2-24\tau+17\tau^2)))}{(4k^2+\alpha^2(-9f(-1+\tau)^2+9f^2(-1+\tau)^2+(3-4\tau)\tau))^2)} \tag{71}$$

One can now take the derivative of this expression with respect to f and show it is negative if $f > \frac{1}{2}$ whenever $\tau > \frac{1}{2}$.[40] This implies the optimal f will be positive. ■

For an example when a biased f is optimal, consider the case when $\tau = 0$, $k = 1$, and $\alpha = .5$. One can show that for a sufficiently high M delegation is never optimal. Further, given the low value of τ high standards with centralization is never optimal. Hence, the profit as a function of f is

$$\frac{7(2+1/4(9-18f+18f^2))}{(4+1/4(-9f+9f^2))^2}. \tag{72}$$

This is optimized at

$$f^* = \frac{1}{2} + \frac{\sqrt{5}}{6}. \tag{73}$$

[40]Note that $k > \frac{5}{2}$ also implies this condition.