A Theory of Status and Coordination in Organizations

Wing Man Wynne Lam

Norwich Business School and Centre for Competition Policy, University of East Anglia, Norwich Research Park, NR4 7TJ, Norwich, United Kingdom; email: wing.m.lam@uea.ac.uk

Abstract

Firms can motivate workers by offering them social status. Much of the literature argues that a rise in status is a powerful work incentive while ignoring its impact on coordination. This paper shows that when workers need to collaborate while having individual vested interests, status differences may reduce the organization value by distorting efforts from different workers. However, status differences can increase the organization value when status effects changes in both authority allocation and cost of taking actions amongst workers. These results have practical implications for human resource management and promotion policies.

JEL Classifications: D21, L23, M51.

1 Introduction

Effective coordination is key to the success of many organizations, where competing objectives exist across different units. For example, when employing new marketing channels through mobile computing and social networks, the IT department may favour sophisticated design while the marketing department may prefer simplicity and user-friendliness. If the two departments fail to coordinate, marketing activities will not be effective and this will lead to lost sales. Also, academics and industry practitioners may need to collaborate on innovative projects (e.g. the Knowledge Transfer Partnerships in the UK), but academics want to maximize the impact of research outcomes, whereas industry practitioners want to maximize profit. In policy decisions, economists and lawyers sometimes design competition policies together, despite having differing policy preferences (e.g. efficiency in economics vs. ethics and morality in law). Facing such issues, organizations can confer status on a project leader or a commissioner. However, as evidenced in the literature, status leads to authority and also generates differences in the costs of taking actions amongst workers (e.g. making coordinating efforts and requesting necessary resources). This can have different consequences for the behaviour of the leader and that of the follower.[1] Hence, it is a priori unclear whether conferring status to workers is beneficial from

[1]See, for instance, Homburg and Jensen (2007), Eckel and Wilson (2007), Eckel et al. (2010), Groysberg et al. (2011).

the point of view of the firm.

To address such issues, this paper develops a theory to examine the impact of introducing status within organizations and its practical implications for human resource management. In particular, it addresses the following questions: how does status affect the way workers coordinate with each other? Under what conditions is it beneficial for the firm to introduce status differentiation? Furthermore, how does status affect the design of jobs on the career ladder and, in particular, should promotions involve empowering the leader to take a very different or broadly similar role?

More specifically, consider a firm consisting of teams with two workers (who could equally be interpreted as two departments or firms in an alliance). The total output of the team depends on how well the workers coordinate: it is maximized when both workers coordinate perfectly, i.e. when they choose the same action. However, each worker has a most preferred action (the vested interest), and incurs a compromising cost if this action is different from the most preferred one. Such compromising cost can include any effort cost a worker incurs in order to coordinate, physically or psychologically. Each worker obtains half of the team's output net of his compromising cost. The firm owner can choose whether to promote one of the workers as the leader. In the absence of promotion, both workers have an identical status, whereas in the case of promotion, the leader receives a higher status than the other.

In contrast to most of the literature that relates status to monetary incentives,[2] we consider two consequences of status: First, introducing a status difference decreases the perceived compromising cost (i.e. the actual compromising cost adjusted for status concerns) of one worker but increases the perceived compromising cost of the other worker. The perceived cost can differ from the actual cost due to purely psychological reasons (Goldhamer and Shils, 1939; Podolny, 1993) or more tangible costs such as access to resources or information (Rich, 1982). Second, introducing a status difference empowers the leader to instruct the follower in what action to take, which the follower chooses to obey or not. If the follower disobeys, he incurs a cost, which is increasing in the leader's status. This is consistent with Castellucci and Piazza (2014), who argue that a higher status may come with more authority. Similarly, Lucas and Baxter (2012) documented a number of reasons as to why status leads to authority, one of which being that

[2]Postlewaite (1998) compares different approaches to model status: people either value status itself or seek status for another purpose. However, the literature focuses largely on monetary incentives. For instance, Frank (1984) empirically shows that workers care about their relative ranking in a company. In particular, workers at the top are willing to accept a remuneration that is lower than their productivity (Lazear and Rosen, 1981; Lazear, 1989, 1991). In contrast, this paper focuses on nonmonetary sources of status, which is also realistic, and Hirsch (1976) provides many such examples.

high-status individuals are perceived to be more competent and they hold more valuable resources than low-status individuals. In summary, status here effects changes in both authority allocation and cost of taking actions, widely acknowledged to be present in various literatures, but how status affects coordination through these mechanisms has been rarely, if ever, studied. Each of these mechanisms is discussed in detail in Sections 2.2 and 2.3.

The objective of the firm is to choose the organizational mode maximizing its value, which is measured by the difference between output and actual costs of the workers. That is, the perceived cost does not affect the organization value directly, but only indirectly through its impact on each worker's action. A similar approach is taken by, for instance, Besley and Ghatak (2008), who show that status incentives can increase effort, reduce the optimal monetary incentives and therefore raise expected profits. In their model, the main difference between monetary and status incentives is similar to those discussed within this paper: whereas monetary pay is costly for the firm, the allocation of status is 'free' given an amount of resources. For instance, this could be job titles, office space, information access, administrative assistance and resources in academic, political and many other organizations. Usually, what matters for these organizations is the total amount of resources spent—on office space, equipment, and papers for example—but not how these resources are distributed amongst workers of different ranks and how such unequal distribution changes workers' perceived costs.[3]

We show that introducing a status difference increases output but causes distortion to the way workers coordinate: on the one hand, a status difference has a positive effect on the organization value as it lowers the average cost of compromising; on the other hand, it has a negative effect as it may induce too much compromising effort from the worker with the lower perceived cost, and too little from the worker with the higher perceived cost. When status only leads to cost differences but not authority, it is never to the firm's benefit to introduce a status difference if the impact of status on the perceived costs of high and low status workers is of the same magnitude (see Proposition 1). However, it is beneficial to introduce a small status difference if status benefits the lower perceived cost worker more than it hurts the higher perceived cost worker (see Proposition 3). In the case where status also leads to authority, status differentiation increases the firm's profit for a wider range of parameters. In particular, a small status difference is always beneficial when the impact of status on costs is symmetric. This is because the leader has an additional instrument, which is the power to make recommendations, to improve coordination (see Proposition 2). This implies that it can be beneficial for the firm to

[3]We present an example of waiting time in Section 2.4. In such situations, the firm bears only the actual cost of actions, whereas the workers bear the additional cost of waiting.

introduce status differences when status confers authority, in addition to its impact on perceived costs.

The result also indicates that horizontal compression of status differences for individuals with similar jobs are more likely to be beneficial than vertical compression of status differences across differing jobs. This has interesting implications for the design of employees' tasks in promotions. If promotion involves changes in responsibilities, for example, from routine tasks performed by junior workers to supervisory or more creative tasks performed by managers, the firm may benefit from introducing more differential treatment between senior and junior employees compared to the case where responsibilities remain the same on the promotion ladder. This explains why, in practice, some workers receive longer vacations, a larger and better equipped office, and other perks owing to seniority in a company; and sometimes this is even more significant when the roles of the leaders change upon promotion.

Adopting a novel approach of modelling status, this paper contributes to the literature by considering the effect of status on coordination. The existing literature focuses either on the work motivation effect of status or on the signaling effect of status. On work motivation, theories in the tournament literature show that when agents care about their relative ranking in organizations, status can be used to provide work incentives; see, e.g. Moldovanu et al. (2007), Auriol and Renault (2008), Dubey and Geanakoplos (2010). However, the tournament literature treats agents separately while this paper provides a model that explains the effect of status on coordination by allowing agents to work in teams. In addition, this literature largely focuses on monetary incentives (e.g. wages) and shows that status can benefit firms through manipulating worker's perceived payoffs. In our setup, the benefit of status originates from its role in enhancing coordination instead. On signaling, the literature shows that status can generally improve the matching of workers and firms (Fershtman et al., 2006). Since matching is positively assortative, i.e. the best job is allocated to the most successful candidate, workers will care about their relative position in the population. Still, the element of coordination is missing.

This paper is also related to the literature on internal organization of firms, which studies coordination vs. specialization. See, for example, Hart and Moore (2005), Dessein and Santos (2006), and Alonso et al. (2008), although they do not consider status. For surveys on promotions, see Gibbons and Waldman (1999), Waldman (2013), and Lazear and Oyer (2013). Also see Fama (1980), Gibbons and Murphy (1992), and Holmström (1999), who provide models that explain how the prospect of promotion creates incentives yet do not focus on coordination. In summary, existing models on status and promotions capture work incentives but lack coor-

dination between workers, whereas existing models on internal organization allow coordination but lack status. This paper explores the interaction between these interesting features, which so far the literature has largely ignored.

2 Theoretical model

Consider a firm consisting of teams with two workers, 1 and 2, who take actions $a \in [0,1]$ and $b \in [0,1]$ respectively. The success of the organization depends on the coordination between the two workers: the firm obtains a revenue of one with probability $1-(a-b)^2$, which is maximized when $a = b$.[4] The revenue is shared equally between the two workers. For example, revenue-sharing schemes are commonly used in partnerships, joint ventures, and cooperatives. Moreover, a change in bargaining power further from one-half does not affect the results qualitatively, as does the introduction of wages (see Section 3.4). Thus, for expositional simplicity, we focus on equal shares.

The firm owner can confer different status on workers, for example, through titles, access to resources, authority, etc. Let s denote the worker's status. Status is valued in relative terms: if worker 1 has status s, then worker 2 has status $-s$. Assume without loss of generality that $s \geq 0$. Status affects the costs for the workers in two ways. First, it changes the perceived compromising cost of each worker, which consists of the actual cost of compromising (that is, deviating from one's most preferred action) and the cost due to status (that is, cost of social comparison, or cost from unequal access to resources and information). More specifically, worker 1 perceives a total cost of $(1+f(s))(1-a)^2$ for taking action a, where $(1-a)^2$ is the actual cost of compromising and $f(s)(1-a)^2$ is the cost due to status difference. Worker 2 perceives a total cost of $(1+f(-s))b^2$ for taking action b, which can be decomposed in a similar way. Clearly, the cost-minimizing action is $a = 1$ for worker 1, and $b = 0$ for worker 2, meaning each worker has a vested interest. Thus, $1-a$ and b can be seen as a compromise that each worker makes in order to coordinate with one another.

In this section, we assume the function $f(\cdot)$ is symmetric in the sense that $f(s) = -f(-s)$ with $f(0) = 0$ and $|f(s)| \leq 1$. In addition, $f(s)$ is continuously differentiable and monotone (either monotonically increasing or monotonically decreasing). This assumption allows us to illustrate the role of authority and status in facilitating coordination in a succinct way, but we will discuss the asymmetric effect of status in Section 3.2.

Second, status may come with authority which empower the leader (worker 1) to get his way

[4] This is a standard way to model coordination in the literature such as Dessein and Santos (2006) and Alonso et al. (2008).

by making a recommendation to the follower (worker 2), and the follower incurs a disobedience cost if he does not follow the recommendation. More specifically, suppose worker 1 makes a recommendation b_l to worker 2. Since worker 2 has effective control over action b, he can choose whether and to what extent to follow the recommendation. However, if he decides to disobey worker 1, he incurs an additional cost of $g(s)(b-b_l)^2$, where $g(s)$ is continuous with $g(0) = 0$ and $g'(s) > 0$ for $s \geq 0$.[5] That is, the cost of disobeying is zero when there is no status difference; the lower the worker's status, the higher the cost of disobeying. For example, guilt is one form of emotional distress that can be associated with the failure to act in a way desired by others, and frequently arises in interpersonal relationships, as found by Baumeister et al. (1994).

We focus on the situation that the leader can only make reasonable recommendations such that $b_l \in [0, 1]$.[6] It is clear that worker 1 will always recommend $b_l = 1$ when he has authority, so as to induce more coordination effort from worker 2.[7] Hence, in the following, we focus on $b_l = 1$ and then the total costs of workers 1 and 2, denoted $c_1(s, a)$ and $c_2(s, b)$ respectively, are given by

$$c_1(s, a) = (1 + f(s))(1 - a)^2,$$

and

$$c_2(s, b) = (1 + f(-s))b^2 + g(s)(b - 1)^2.$$

For simplicity, we also assume that each worker gets an outside option of zero value by working alone.

The value of the team is defined by the total revenue minus the total actual costs:

$$V = 1 - (a - b)^2 - (1 - a)^2 - b^2, \tag{1}$$

which depends directly on the actual cost of taking actions. The reason is that for the firm, what usually matters are the total actual costs but not the distribution of psychological or physical costs arising from status differences (Goldhamer and Shils, 1939; Podolny, 1993). Consider the example of waiting costs which we analyse further in Section 2.4: a high status worker may have priority access to resources and thus a lower waiting cost (such as queuing time for a photocopy machine). This comes at the cost of the lower status worker, who incurs a larger waiting cost. However, what matters more for the firm is the total amount of resources demanded by the leader and the follower (such as machines and papers) rather than these time costs. Workload allocation provides another example. A fixed amount of workload needs to be allocated amongst

[5] Strictly speaking, $g'(s) > 0$ for $s > 0$ and the right derivative $g'(0^+) > 0$.

[6] The qualitative result remains the same even if the leader can make recommendations with $b_l > 1$, which means that the leader recommends the follower to make more coordination effort than necessary.

[7] We provide a formal proof of this point in the proof of Proposition 2.

seniors and juniors. It is common that seniors have the priority to choose their favourable time slots (e.g. teaching timetables in academia and meeting slots in businesses) and venues (e.g. a well-equipped vs. ill-equipped lecture and meeting rooms), while juniors have to wait and potentially choose an unfavourable time slot or venue. All that matters for the organization is that all workload is allocated (i.e. the lecture and the meeting have taken place) but not how it is allocated. More generally, leaders have better access to resources and less interference when pursuing these resources than followers. Although these costs from status difference do not affect the organization value directly, they affect it indirectly through their impacts on each worker's action.

To begin, consider the situation where one agent chooses both actions a and b, which corresponds to the case of centralization (or the first-best). Since there is only one agent, there is no concern for status, that is, $s = 0$. The agent solves

$$\max_{a,b}(1-(a-b)^2)-(1-a)^2-b^2,$$

which yields the following optimal actions:

$$a^*_{FB}=\frac{2}{3};\;\; b^*_{FB}=\frac{1}{3}.$$

Then the level of compromise is given by $1-a^*_{FB}=b^*_{FB}=1/3$. At this level of compromise, the value of the team is $2/3$ and each worker obtains an expected payoff of $1/3$.

2.1 Identical status

When two workers have identical status (i.e. there is no cost advantage and no authority), worker 1 chooses his action so as to maximize his expected payoff:

$$\max_{a}\frac{1}{2}(1-(a-b)^2)-(1-a)^2.$$

Similarly, worker 2 solves

$$\max_{b}\frac{1}{2}(1-(a-b)^2)-b^2.$$

The Nash equilibrium is given by

$$a^*_{team}=\frac{3}{4};\;\; b^*_{team}=\frac{1}{4},$$

which yields a payoff of $5/16$ for each worker, and $5/8$ for the team. The level of compromise is given by $1-a^*_{team}=b^*_{team}=1/4$. The NE exhibits less coordination than the first-best because each worker obtains only half of the benefits from coordination.

2.2 Differentiated status without authority

Consider first the case in which the leader has a higher status but does not have authority, i.e. he cannot make any recommendation to the follower. Status differences can exist without differences in authority in the context where two departments or firms (for instance, universities and investment banks) need to cooperate on a project. The higher-status investment banks or universities do not necessarily have authority over lower-status investment banks or universities. On the other hand, the case with authority fits cases where promotion entails more high-level decision making and some sort of authority over low-level workers and is discussed in Section 2.3. Specifically, suppose now that worker 1 is promoted to be the leader and enjoys a higher status s. Such a promotion changes his cost of compromising to $(1+f(s))(1-a)^2$, and whether this change in cost is a decrease or an increase depends on the sign of f'. Similarly for the follower: worker 2's cost of compromising changes to $(1+f(-s))b^2 = (1-f(s))b^2$. Worker 1 therefore solves

$$\max_a \frac{1}{2}(1-(a-b)^2) - (1+f(s))(1-a)^2,$$

whereas worker 2 solves

$$\max_b \frac{1}{2}(1-(a-b)^2) - (1-f(s))b^2.$$

The equilibrium actions are given by

$$\begin{aligned} a^* =& \frac{1}{2}\frac{(3-2f(s))(1+f(s))}{2-f^2(s)}, \\ b^* =& \frac{1}{2}\frac{1+f(s)}{2-f^2(s)}. \end{aligned}$$

When status affects the cost of compromising in a symmetric way, we show that

Proposition 1. *Without authority, when status has a symmetric effect on high- and low-status workers (that is, $f(s) = -f(-s)$ for any $s > 0$), a status difference always reduces the value of the organization, V.*

Proof. See Online Appendix. □

Proposition 1 shows that if the benefit of increasing a worker's status equals the cost of decreasing another worker's status, then it is desirable for the firm to give equal treatment to its workers. Notice, however, that

Corollary 1. *For any s, a status difference improves coordination, that is, $\partial(a^* - b^*)/\partial s \leq 0$.*[8]

Proof. See Online Appendix. □

[8]The inequality is strict for any $s > 0$.

Thus, even with symmetric effects, status difference improves coordination because the worker with the lower cost of compromising is more willing to coordinate. However, this also explains why status difference may hurt the organization, since most coordination efforts are now provided by one worker. Such a situation is not desirable for the firm, as it prefers more balanced coordination efforts (recall that the first-best is $1 - a^*_{FB} = b^*_{FB} = 1/3$). The results in Proposition 1 and Corollary 1 do not depend on whether it is less costly for the high-status worker to compromise (that is, $f' < 0$) or the low-status worker to compromise (that is, $f' > 0$). As long as the effect of status on these costs of compromising is symmetric, any status difference leads to a lower organization value. Therefore, when status differences affect workers symmetrically, it is optimal for the firm to compress these differences 'horizontally', i.e. for workers who perform similar jobs without one being able to play a different role in making recommendations. The reason is that the benefit of improved coordination is not enough to compensate for the cost of effort distortion, which provides an alternative reason as to why status may be detrimental to organizations.

2.3 Authority

Next, we consider status differences that lead not only to a change in costs but also to more authority. While the allocation of authority has been studied in the literature on organizations (Aghion and Tirole, 1997; Van den Steen, 2010), coordination between agents has not. Unlike these existing models, this paper emphasizes how status and authority affect coordination.

Suppose that worker 1 is the leader. He decides on action a, and now he also makes a recommendation $b_l = 1$ to worker 2. Introducing status has two effects: First, as before, the leader's perceived cost of compromising is changed to $(1 + f(s))(1 - a)^2$, while the follower's perceived cost is changed to $(1 - f(s))b^2$. Second, the follower chooses action b taking into account whether and to what extent to obey the leader's recommendation. In case of $b \neq 1$, there is a cost of disobedience given by $g(s)(b - 1)^2$. The payoff of the leader is

$$\pi_l = \frac{1}{2}(1 - (a - b)^2) - (1 + f(s))(1 - a)^2,$$

and that of the follower is

$$\pi_f = \frac{1}{2}(1 - (a - b)^2) - (1 - f(s))b^2 - g(s)(b - 1)^2.$$

Thus, given the recommendation made by the leader, $b_l = 1$, there is an equilibrium in the second stage, denoted by (a^*_v, b^*_v), where the two workers choose their actions such that

$$a^*_v \in \arg\max_a \pi_l,$$
$$b^*_v \in \arg\max_b \pi_f.$$

In this situation, we show that:

Proposition 2. *With authority, introducing a small status difference increases the value of the organization, that is, $dV/ds > 0$ at $s = 0$.*

Proof. See Online Appendix. □

That is, it is always optimal to introduce a small status difference, even when status has symmetric impacts on the perceived costs of the workers. In other words, the presence of authority is sufficient to offset the negative impact of status on organization value when status only causes changes in the perceived costs, as identified in Proposition 1. However, introducing a large status difference may still reduce organization value, and the optimal degree of status difference may be intermediate and depends on the specific forms of $f(s)$ and $g(s)$. This can be illustrated in the following special case where social comparison and disobedience costs are of similar magnitudes (that is, $g(s) = |f(s)|$):

Corollary 2. *If $g(s) = |f(s)|$, the value of the organization is maximized at a status difference such that $f(s) = -1/2$ when $f(s) < 0$, or $f(s) \approx 0.11$ when $f(s) > 0$.*

Proof. See Online Appendix. □

In summary, Proposition 2 and Corollary 2 show that with authority, introducing a small status difference generates a first-order improvement in coordination which benefits the organization, in contrast to the case without authority where a small status difference has only a second-order impact on coordination. Specifically, with authority, we have $\frac{\partial(a_v^* - b_v^*)}{\partial s}|_{s=0} = -\frac{3}{16}g'(0^+) < 0$, whereas without authority, we have $\frac{\partial(a^* - b^*)}{\partial s}|_{s=0} = 0$. Intuitively, with authority, the leader is able to impose additional disobedience cost on the follower, which induces more coordination effort from the follower. Such an improvement in coordination is sufficient to overcome the distortion created by disproportionate coordination effort and increases the organization value. However, as status difference becomes larger, the distortion due to unbalanced coordination effort becomes more significant, which eventually renders further status differential undesirable. Moreover, Corollary 2 shows that the optimal status difference is lower when $f(s) > 0$, i.e. when the leader has higher perceived compromising costs. This is because, in this case, the leader exerts too little coordination effort without authority, and, with authority, he compromises even less. In other words, while a larger status difference improves coordination, it also increases distortion. In contrary, in the case of $f(s) < 0$, coordination improvement comes together with a reduction in distortion (for sufficiently small status difference). Hence, the

optimal level of status difference is lower when the leader has higher perceived compromising costs.

This result extends the literature on status as follows. The basic result of this literature is that workers are willing to work hard to improve their status in organizations, and therefore status generates work incentives (Moldovanu et al., 2007; Auriol and Renault, 2008; Dubey and Geanakoplos, 2010). However, agents in these models do not differ in their favourite choice of action. In fact, differences of opinion between individual workers and departments within a firm on production—ranging from product design to input sourcing, manufacturing and delivery of the final product—are very common. When vested interests are at work, we show that too large a difference of status distorts how workers coordinate. This result highlights that the cost of status should be traded off against the benefit of raising work incentives emphasized in the literature.

2.4 An illustrative example

We now present an example of status as priority access to resources to illustrate our main results and generate further insights. Specifically, we consider a simple model of prioritization in a $M/M/1$ queuing problem.[9] Worker 1 (respectively Worker 2) chooses his action, i.e. the level of compromise, $(1-a)$ (respectively b), which has a cost of $(1-a)^2$ (respectively b^2) to the worker and to the firm. In addition, each worker may face a higher or lower waiting time when, for instance, requesting access to a resource like copy machine. For simplicity, we assume that each worker generates such requests at a constant Poisson rate of 1.[10] When both workers have equal status, each worker's expected waiting time per request is given by

$$w^e = \frac{1}{\mu - 2},$$

where μ is the capacity of the copy machine. When one worker has a higher status s and becomes the leader, we assume a share s of his request is prioritized, i.e. we focus on $s \in [0,1]$ in this section. Thus his expected waiting time per request is

$$w^l = s\frac{1}{\mu - s} + (1-s)\frac{\mu}{\mu - 2}\frac{1}{\mu - s}.$$

The waiting time per request of the low status worker, i.e. the follower is

$$w^f = \frac{\mu}{\mu - 2}\frac{1}{\mu - s}.$$

[9] See, for instance, Kleinrock (1975).

[10] That is, for the purpose of illustration, we assume that the rate of request is independent of the level of compromise.

It is easy to check that $w^f(s=0) = w^l(s=0) = w^e$. We can write the payoff of the leader as

$$\pi_l = \frac{1}{2}(1-(a-b)^2) - (1+f(s))(1-a)^2,$$

where $f(s) = w^l - w^e$, and the payoff of the follower as

$$\pi_f = \frac{1}{2}(1-(a-b)^2) - (1+f(-s))b^2 - g(s)(b-1)^2,$$

where $f(-s) = w^f - w^e$. That is, we assume that the total waiting time experienced is proportional to the actual cost of actions and hence positively related to the coordination effort. Furthermore, we have normalized $f(s)$ so that $f(0) = 0$ and it is straightforward to check that $f(s) = -f(-s)$, i.e. we consider an example with symmetric effects of status on the two workers.

Figure 1a shows the organization value under different organizational modes and different parameters. The dotted line shows that without authority, status difference always reduces organization value. In all the other three cases with authority, organization value is higher when status difference is relatively small. Comparing the solid line and the dashed line, we can see that status is more beneficial when the capacity is relatively small, since the waiting cost is more sensitive to status. Comparing the solid line and the dashdotted line, we can see that a large status difference is more beneficial when the disobedience cost is lower, as the distortion due to authority is lower. This is further demonstrated in Figure 1b, where the total coordination effort $(1-a+b)$ is generally higher under authority and even more so when authority is stronger (i.e. when disobedience cost is higher).

3 Discussion

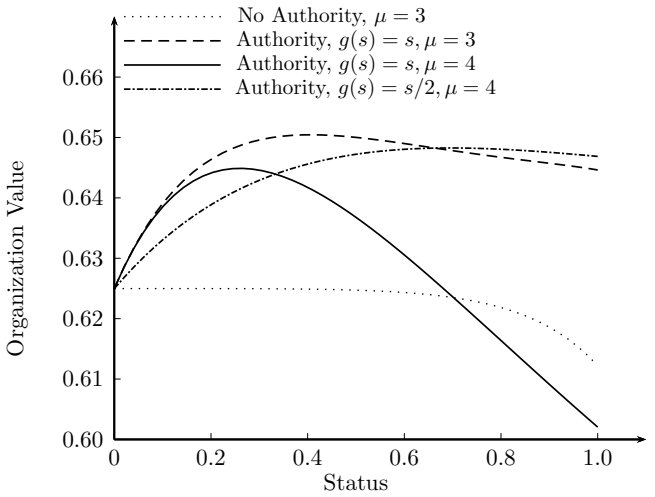
In this section, we discuss alternative modelling of status, asymmetric impact of status, the importance of coordination, and the consequence of introducing wages in more detail.

3.1 Alternative modelling of status

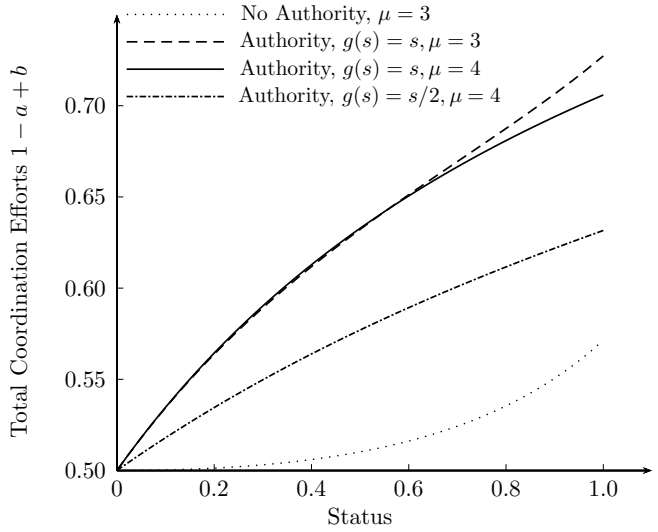
We consider two alternative modelling of status. First, we consider when the worker with the higher status can choose his action (i.e. his level of compromise) as a Stackelberg leader; then, we consider when status does not affect the perceived cost of compromising but changes the perceived utility.

High status worker as a Stackelberg leader

We first consider the high status worker as a Stackelberg leader and show that first-mover advantage does not improve organization value, whether there is a cost difference or not. Specifically,



(a) Organization Value



(b) Total Coordination Efforts

Figure 1: An Example of Status as Priority Access to Resources

we allow the the high status worker (say, worker 1) to choose his action, i.e. his level of compromise, before the low status worker (say, worker 2). As in the main model, we consider the symmetric case with $f(-s) = -f(s)$. The problem of worker 2, given a and $f(s)$, is given by

$$\max_b \frac{1}{2}(1 - (a - b)^2) - (1 - f(s))b^2.$$

The best reply of worker 2 is then given by

$$b^*(a, s) = \frac{a}{3 - 2f(s)}.$$

The problem of worker 1, given $f(s)$, is then

$$\max_a \frac{1}{2}(1 - (a - b^*(a, s))^2 - (1 + f(s))(1 - a)^2.$$

Taking differentiation with respect to a yields

$$a^*(s) = \frac{2(1+f(s))}{2(1+f(s)) + \left(\frac{2(1-f(s))}{3-2f(s)}\right)^2},$$

which leads to

$$b^*(s) = \frac{2(1+f(s))}{(3-2f(s))(2(1+f(s)) + \left(\frac{2(1-f(s))}{3-2f(s)}\right)^2)}.$$

At $(a^*(s), b^*(s))$, the organization value is

$$V = \frac{8(1-2f)(3-2f)^2}{(11+4f^3-6f^2-7f)^2},$$

which is always smaller than $5/8$ for $f(s) \in [-1, 1]$. That is, when a worker empowered by a higher status can act as the first-mover, this always reduces the organization value. To see the intuition, note that when $f(s) = 0$, we have $a^*(0) - b^*(0) = 6/11$, which is higher than $1/2$. This means that when status comes with a first-mover advantage without changing the compromising costs, it results in less coordination compared to the situation without status. The reason is that the high status worker tends to compromise too little and 'forces' the low status worker to compromise too much, which is detrimental to the organization value. When status also leads to changes in compromising costs, one worker may be more willing to compromise, however, in the symmetric case, this is not enough to compensate for the distortion created by first-mover advantages.

Status-augmented utilities

We now consider status as a factor that influences utility directly instead of the perceived cost of actions. Specifically, a higher status increases the perceived utility of the high status worker and decreases that of the low status worker. In addition, there is a cost of disobedience when the follower does not follow the recommendation of the leader. We can then write the payoff of the leader as[11]

$$\pi_l = (1+\hat{f}(s))\frac{1}{2}(1-(a-b)^2) - (1-a)^2,$$

and the payoff of the follower as

$$\pi_f = (1-\hat{f}(s))\frac{1}{2}(1-(a-b)^2) - b^2 - \hat{g}(s)(b-1)^2,$$

with $\hat{f}(0) = 0$, $\hat{g}(0) = 0$, $\hat{f}(s) \leq 1$, and both $\hat{f}(s)$ and $\hat{g}(s)$ increasing for $s \geq 0$. We can rewrite the payoffs as

$$\pi_l = (1+\hat{f}(s))\Big[\frac{1}{2}(1-(a-b)^2) - \Big(1 - \frac{\hat{f}(s)}{1+\hat{f}(s)}\Big)(1-a)^2\Big],$$

[11]Note that we keep the assumption that status has symmetric effects on the utilities of the two workers.

and

$$\pi_f = (1-\hat{f}(s))\Big[\frac{1}{2}(1-(a-b)^2) - \Big(1+\frac{\hat{f}(s)}{1-\hat{f}(s)}\Big)b^2 - \frac{\hat{g}(s)}{1-\hat{f}(s)}(b-1)^2\Big].$$

The equilibrium actions then depend on status in the same way as in our main analysis when we define

$$f(s) = -\frac{\hat{f}(s)}{1+\hat{f}(s)} \text{ and } g(s) = \frac{\hat{g}(s)}{1-\hat{f}(s)}.$$

Since the organization value does not directly depend on $f(s)$ and $g(s)$, this means that all our results carry through. That is, it is beneficial for the firm to introduce status difference only when it comes with authority, in addition to its impact on subjective utilities.

3.2 Asymmetric impact of status

So far we have focused on the situation where the impact of status is symmetric on the high- and low-status workers, that is, $f(s) = -f(-s)$. Clearly, when the impact of status becomes asymmetric, the result will depend on the shape of $f(s)$. To gain more insights, let us focus on small status differences, i.e. when s is close to zero. Different from our main analysis where $f(s)$ is continuously differentiable, we assume that $f(s)$ has a kink at $s = 0$, that is, $f'(0^+) = lim_{s\to 0^+} f'(s) \neq lim_{s\to 0^-} f'(s) = f'(0^-)$,[12] but we maintain the assumption that $f(s)$ is monotone (either monotonically increasing or monotonically decreasing). For example, this can arise from reference-dependent preferences (Kahneman and Tversky, 1979). First, when there is no authority, we show that:

Proposition 3. *Without authority, introducing a small status difference increases the value of the organization, V, compared to the case of identical status if and only if*

$$f'(0^+) < f'(0^-). \tag{2}$$

Proof. See Online Appendix. □

Condition (2) provides a simple rule to evaluate when a firm should differentiate status amongst workers: namely, when a small status difference has a larger impact on the low cost worker (represented by the high status worker when $f(s)$ is decreasing or the low status worker when $f(s)$ is increasing) than on the high cost worker. For example, this condition is likely to be satisfied when status generates extra benefit: if a manager who receives benefits afforded by status generates more benefit through successful business deals, which outweighs the losses generated from a junior employee who does not receive these benefits, then it is profitable for

[12] This also contributes to the literature which usually assumes that $f(s)$ is continuously differentiable at zero; see Hopkins and Kornienko (2004, 2010).

the firm to raise the status of senior management.[13] In contrast, Condition (2) is likely to fail when workers are loss-averse (i.e. the cost of low status is larger than the benefit of high status).

Now consider the case with authority. As before, suppose that the leader is constrained in his recommendation such that $b_l \in [0, 1]$. We show that:

Proposition 4. *With authority, introducing a small status difference increases the value of the organization if and only if*

$$f'(0^+) < f'(0^-) + 3g'(0). \tag{3}$$

Proof. See Online Appendix. □

Clearly, Equation (3) is less stringent than Equation (2) regardless of the sign of f'. Thus, it is more likely that status differences increase the organization value with authority compared to without. The intuition is similar to Proposition 2 and Corollary 2. Authority expands the range of parameters where a status difference raises the organization value as the leader can make a recommendation to induce the follower to compromise more. Thus, the negative effect of status, which arises because of imbalanced coordination efforts is mitigated by improved coordination, and this increases the organization value.

3.3 The importance of coordination

To better understand the results (i.e. how status affects the organization value through its impact on coordination), consider two slightly different settings, where there is no need for coordination. The first concerns independent production with interdependent payoffs: each worker still gets half of the team's output, which is now redefined as the sum of workers' compromise (that is, $1 - a + b$), so that there are no coordination issues. The problem of worker 1 becomes

$$\max_a \frac{1}{2}(1 - a + b) - (1 + f(s))(1 - a)^2,$$

which leads to

$$1 - \hat{a} = \frac{1}{4(1 + f(s))},$$

and it is independent of the choice of worker 2. Similarly, the problem of worker 2 is

$$\max_b \frac{1}{2}(1 - a + b) - (1 + f(-s))b^2,$$

[13] For example, in Belgium, there are so-called 'cafeteria plans', under which workers may receive different benefit packages in terms of day offs, access to company cars, business class travel, office space, IT equipment, priority in choosing different things, etc.

which leads to

$$\hat{b} = \frac{1}{4(1+f(-s))}.$$

Then the organization value, defined as $V = (1-a+b) - (1-a)^2 - b^2$, is now given by

$$V(s) = \frac{1}{4(1+f(s))} + \frac{1}{4(1+f(-s))} - \frac{1}{16(1+f(s))^2} - \frac{1}{16(1+f(-s))^2}.$$

When status has symmetric effects on workers' costs of compromising (that is, $f(s) = -f(-s)$), we can show that $V(s) > V(0)$ if the impact of status on costs is not too large.[14] Recall that in Proposition 1, when there is a need for coordination, a status difference always reduces the organization value with symmetric effects. In both cases, status has two effects. First, it increases the total compromise level, since both $1-a^*+b^*$ (in the case with coordination) and $1-\hat{a}+\hat{b}$ (in the case without coordination) are increasing in status differences. Second, status distorts how workers coordinate: while the firm prefers more balanced coordination efforts, status differences lead the worker, who has a lower cost of compromising, to compromise too much. We can show that the latter is the same in both cases, as $\frac{1-a^*}{b^*} = \frac{1-\hat{a}}{\hat{b}} = \frac{1+f(-s)}{1+f(s)}$. However, the former is weaker when there is a need for coordination than when there is not, that is, $\frac{\partial 1-a^*+b^*}{\partial s} < \frac{\partial 1-\hat{a}+\hat{b}}{\partial s}$. This result therefore highlights that the need for coordination creates some substitutability between workers' compromise, which leads to inefficient compromising efforts (the negative effect of status).

Alternatively, consider independent production with independent payoffs: each worker chooses an effort level e, which generates payoff e at a cost $(1+f(s))e^2$. Thus, when there is a status difference, the efforts are given by

$$e^+ = \frac{1}{2(1+f(s))}; \;\; e^- = \frac{1}{2(1+f(-s))},$$

where e^+ and e^- are the efforts of the high-status worker and the low-status worker respectively. The organization value now becomes

$$V = \frac{1}{2}\Big[\Big(\frac{1}{1+f(s)} - \frac{1}{2(1+f(s))^2}\Big) + \Big(\frac{1}{1+f(-s)} - \frac{1}{2(1+f(-s))^2}\Big)\Big].$$

Define $h(t) = \frac{1}{t} - \frac{1}{2t^2}$. Then we can easily show that $h(t)$ is maximized at $t=1$ for all $t \geq 0$, which implies that the organization value is maximized at $s=0$ and any status difference reduces the organization value. Since some status differences may be desirable in the case with coordination, this result highlights the role of status in raising the organization value via its impact on coordination (the positive effect of status).

In summary, in a model with interdependent production and interdependent payoffs, a status difference that helps improve coordination (as measured by the total coordination effort $1-a+b$) may also distort how workers coordinate (the choice of action with respect to the first-best).

[14] More precisely, $V(s) > V(0) = 3/8$ if $|f(s) - f(-s)| < 2\sqrt{3}/3$.

3.4 Wages

Instead of sharing the revenue equally, we can allow for a more general setting where a firm or a manager hires two workers, 1 and 2, and pays a status-dependent share of the revenue $w_1(s)$ to worker 1 and a share of $w_2(-s)$ to worker 2, where these wages can be different from one-half, but $w_1(s) + w_2(-s) \leq 1$. To illustrate, we consider the case without authority. Worker 1's problem becomes

$$\max_a w_1(s)(1-(a-b)^2) - (1+f(s))(1-a)^2,$$

and that of worker 2 becomes

$$\max_b w_2(-s)(1-(a-b)^2) - (1+f(-s))b^2.$$

The equilibrium actions are given by

$$\begin{aligned} a^*(s) =& \frac{(1+f(s))(1+f(-s)+w_2(-s))}{(1+f(s))(1+f(-s)) + w_1(s)(1+f(-s)) + w_2(-s)(1+f(s))}, \\ b^*(s) =& \frac{(1+f(s))w_2(-s)}{(1+f(s))(1+f(-s)) + w_1(s)(1+f(-s)) + w_2(-s)(1+f(s))}. \end{aligned}$$

Then the manager gets

$$\pi_F = (1-w_1(s)-w_2(-s))(1-(a^*(s)-b^*(s))^2).$$

Consequently, given wages $w_1(s)$ and $w_2(-s)$, introducing a small status difference is profitable if $\frac{d\pi_F}{ds}|_{s\to 0} > 0$, which can be simplified to

$$\begin{aligned} & (w_1(0)+w_2(0))(2+w_1(0)+w_2(0))(-w'(0^+)+w'(0^-)) \\ > & \ \frac{2(1-w_1(0)-w_2(0))}{1+w_1(0)+w_2(0)}(w_1(0)f'(0^+) - w_2(0)f'(0^-) - w'(0^+) + w'(0^-)). \end{aligned}$$

In the special case when the wages depend on status in a symmetrical way and thus the total wage (as a share of the revenue) does not vary with status, i.e. $w_1(s) - w_1(0) = w_2(0) - w_2(-s)$, the condition becomes

$$w_1(0)f'(0^+) < w_2(0)f'(0^-),$$

which is equivalent to Equation (2) if $w_1(0) = w_2(0)$. Thus, with wages, instead of comparing the marginal effect of status on workers' perceived costs of compromising, this new condition compares the wage-adjusted marginal effect of status.

4 Conclusion

It is common that organizations confer status to workers via promotion. While the literature typically focuses on how status concerns, at the micro level, affect work incentives within organizations, and at the macro level, the quality of matches between firms and workers and the

determination of equilibrium wage, this paper addresses their impact on the organization value when coordination is important and workers have vested interests.

There are several practical implications for human resource management. While it may be tempting to introduce status differentiation to motivate individuals to work hard as recommended by the tournament literature, we show that in a team, it is beneficial to do so only when status affects workers in an asymmetric way or when status confers authority. Specifically, in terms of companies' internal promotion strategy, the case of status differentiation without authority can be interpreted as the firm introducing status differentiation by promoting a worker to be the leader without changing his job duty, which means that he is responsible for the same task (that is, task a) before and after promotion. For example, in academia, the main responsibility of professors is to teach and to do research, whether they are promoted or not; the same holds for healthcare and other specialized professions. The case of status differentiation with authority can be interpreted as changing the leader's responsibilities upon promotion, for example, while he performs task a before promotion, he can also influence task b after promotion. This is applicable to many private and public sectors where managers perform a very different role from junior workers. The result then implies that status differentiation can be more beneficial to a firm when promotion involves a change in job responsibilities than when it does not.

There are several directions in which this analysis can be extended. First, one may want to endogenize the choice of status. In this model, status is exogenously determined by the firm owner. It would be equally interesting to correlate status with workers' effort. For instance, workers may compete for a higher position, when the firm can promote—and thus award a higher status to—the worker who produces larger individual profits. That is, we can introduce a stage of competition for promotion before the coordination game considered in this paper. In this new stage, two workers with initially identical status compete for promotion, and the one who produces higher profit (or equivalently lower cost) wins the leading position and is awarded a higher status in the next stage. In such situations, although increasing status differentiation can improve coordination in the later stage, it may negatively affect coordination in the earlier stage as the prospect of promotion causes the workers to focus more on their own agenda rather than improving coordination. Second, this analysis abstracts from contracting problems. When actions are unobservable (hence, noncontractible), other more sophisticated compensation schemes might improve efficiency over the revenue-sharing schemes considered here. Although optimal contracts have been analysed extensively (Gibbons and Roberts, 2013), more research could be done on the comparison of status rewards and other incentive contracts.

Supplementary material

The Online Appendix is available on the OUP website.

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References

Aghion, P. and Tirole, J. (1997). Formal and Real Authority in Organizations. *Journal of Political Economy*, 105:1–29.

Alonso, R., Dessein, W., and Matouschek, N. (2008). When Does Coordination Require Centralization. *American Economic Review*, 98:145–179.

Auriol, E. and Renault, R. (2008). Status and Incentives. *RAND Journal of Economics*, 39:305–326.

Baumeister, R., Stillwell, A., and Heatherton, T. (1994). Guilt: An Interpersonal Approach. *Psychological Bulletin*, 115:243–267.

Besley, T. and Ghatak, M. (2008). Status Incentives. *American Economic Review Papers and Proceedings*, 98:206–211.

Castellucci, F. and Piazza, A. (2014). Status in Organizations and Management Theory. *Journal of Management*, 40:287–315.

Dessein, W. and Santos, T. (2006). Adaptive Organizations. *Journal of Political Economy*, 114:956–995.

Dubey, P. and Geanakoplos, J. (2010). Grading exams: 100, 99, 98,... or A, B, C? *Games and Economic Behavior*, 69:72–94.

Eckel, C., Fatas, E., and Wilson, R. (2010). Cooperation and Status in Organizations. *Journal of Public Economic Theory*, 12:737–762.

Eckel, C. and Wilson, R. (2007). Social Learning in Coordination Games: Does Status Matter? *Experimental Economics*, 10:317–330.

Fama, E. (1980). Agency Problems and the Theory of the Firm. *Journal of Political Economy*, 88:288–307.

Fershtman, C., Hvide, H., and Weiss, Y. (2006). Cultural Diversity, Status Concerns and the Organization of Work. *Research in Labor Economics*, 24:361–396.

Frank, R. (1984). Are Workers Paid their Marginal Products? *American Economic Review*, 74:549–571.

Gibbons, R. and Murphy, K. (1992). Optimal Incentive Contracts in the Presence of Career Concerns: Theory and Evidence. *Journal of Political Economy*, 100:468–505.

Gibbons, R. and Roberts, J. (2013). Economic Theories of Incentives in Organizations. In Gibbons, R. and Roberts, J., editors, *Handbook of Organizational Economics*, chapter 2, pages 56–99. Princeton University Press, New Jersey.

Gibbons, R. and Waldman, M. (1999). Careers in Organizations: Theory and Evidence. In Ashenfelter, O. and Cards, D., editors, *Handbook of Labor Economics*, volume 3, chapter 36, pages 2373–2427. North-Holland, Amsterdam.

Goldhamer, H. and Shils, E. (1939). Types of Power and Status. *American Journal of Sociology*, 45:171–182.

Groysberg, B., Polzer, J. T., and Elfenbein, H. A. (2011). Too many cooks spoil the broth: How high-status individuals decrease group effectiveness. *Organization Science*, 22:722–737.

Hart, O. and Moore, J. (2005). On the Design of Hierarchies: Coordination versus Specialization. *Journal of Political Economy*, 113:675–702.

Hirsch, F. (1976). *Social Limits to Growth*. Harvard University Press, Cambridge, MA.

Holmström, B. (1999). Managerial Incentive Problems: A Dynamic Perspective. *Review of Economic Studies*, 66:169–182.

Homburg, C. and Jensen, O. (2007). The Thought Worlds of Marketing and Sales: Which Differences Make a Difference? *Journal of Marketing*, 71:124–142.

Hopkins, E. and Kornienko, T. (2004). Running to Keep in the Same Place: Consumer Choice as a Game of Status. *American Economic Review*, 94:1085–1107.

Hopkins, E. and Kornienko, T. (2010). Which Inequality? The Inequality of Endowments versus the Inequality of Rewards. *American Economic Journal: Microeconomics*, 2:106–137.

Kahneman, D. and Tversky, A. (1979). Prospect Theory: An Analysis of Decision under Risk. *Econometrica*, 47:263–291.

Kleinrock, L. (1975). *Queuing Systems, Volume I: Theory.* Wiley, New York.

Lazear, E. (1989). Pay Equality and Industrial Politics. *Journal of Political Economy*, 97:561–580.

Lazear, E. (1991). Labor Economics and the Psychology of Organizations. *Journal of Economic Perspectives*, 5:89–110.

Lazear, E. and Oyer, P. (2013). Personnel Economics. In Gibbons, R. and Roberts, J., editors, *Handbook of Organizational Economics*, chapter 12, pages 479–519. Princeton University Press, New Jersey.

Lazear, E. and Rosen, S. (1981). Rank-Order Tournaments as Optimum Labor Contracts. *Journal of Political Economy*, 89:841–864.

Lucas, J. and Baxter, A. (2012). Power, Influence, and Diversity in Organizations. *The Annals of the American Academy of Political and Social Science*, 639:49–70.

Moldovanu, B., Sela, A., and Shi, X. (2007). Contests for Status. *Journal of Political Economy*, 115:338–363.

Podolny, J. (1993). A Status-Based Model of Market Competition. *American Journal of Sociology*, 98:829–872.

Postlewaite, A. (1998). The Social Basis of Interdependent Preferences. *European Economic Review*, 42:779–800.

Rich, W. (1982). The Effect of Status Conflicts on Productivity and Communication in Public Organization. *Public Productivity Review*, 6:93–101.

Van den Steen, E. (2010). Interpersonal Authority in a Theory of the Firm. *American Economic Review*, 100:466–490.

Waldman, M. (2013). Theory and Evidence in Internal Labor Markets. In Gibbons, R. and Roberts, J., editors, *Handbook of Organizational Economics*, chapter 13, pages 520–571. Princeton University Press, New Jersey.

Online Appendix - A Theory of Status and Coordination in Organizations

Wing Man Wynne Lam, Norwich Business School and Centre for Competition Policy, University of East Anglia.
Email: wing.m.lam@uea.ac.uk

Proof of Proposition 1

Substituting a^* and b^* into Equation (1), we obtain

$$V = \frac{5}{2}\frac{1-f^2(s)}{(2-f^2(s))^2}.$$

Moreover, it is easy to check that

$$\frac{dV}{ds} = -\frac{5f^3(s)}{(2-f^2(s))^3}f'(s),$$

which is always negative. Specifically, if $f'(s) > 0$, then $f(s) > 0$; if $f'(s) < 0$, then $f(s) < 0$.

Proof of Corollary 1

We have

$$a^* - b^* = \frac{1-f^2(s)}{2-f^2(s)}.$$

Differentiating it with respect to s, we have

$$\frac{\partial a^* - b^*}{\partial s} = -\frac{2f(s)f'(s)}{(2-f^2(s))^2},$$

which is equal to zero at $s = 0$ and negative for any $s > 0$.

Proof of Proposition 2

We denote the equilibrium actions under authority by (a_v^*, b_v^*), for any given b_l, they are given by

$$\begin{aligned} a_v^* =& \frac{(1+f(s))(3-2f(s)) + 2g(s)(1+f(s)) + g(s)b_l}{g(s)(3+2f(s)) + 2(2-f^2(s))}, \\ b_v^* =& \frac{(1+f(s)) + g(s)(3+2f(s))b_l}{g(s)(3+2f(s)) + 2(2-f^2(s))}. \end{aligned}$$

Differentiating π_l with respect to b_l gives

$$\begin{aligned}\frac{\partial \pi_l}{\partial b_l} = 0 &\Leftrightarrow 2(1+f(s))(1-a_v^*)\frac{\partial a_v^*}{\partial b_l} - (a_v^* - b_v^*)\big(\frac{\partial a_v^*}{\partial b_l} - \frac{\partial b_v^*}{\partial b_l}\big) = 0 \\ &\Leftrightarrow 2(1+f(s))(1-a_v^*)\frac{\partial a_v^*}{\partial b_l} - 2(1+f(s))(b_v^* - a_v^*)\frac{\partial a_v^*}{\partial b_l} = 0 \\ &\Leftrightarrow b_v^* = 1.\end{aligned}$$

Hence, the leader will choose a b_l such that $a_v^* = b_v^* = 1$, which means the follower would get a negative payoff and thus violates the follower's participation constraint. Therefore, the constraint of $b_l \in [0,1]$ must be binding and we have $b_l = 1$. Given this, the equilibrium coordination efforts are

$$\begin{aligned}a_v^* =& \frac{(1+f(s))(3-2f(s)) + g(s)(3+2f(s))}{g(s)(3+2f(s)) + 2(2-f^2(s))}, \\ b_v^* =& \frac{(1+f(s)) + g(s)(3+2f(s))}{g(s)(3+2f(s)) + 2(2-f^2(s))}.\end{aligned}$$

Notice that, as $s \to 0$, the above (a_v^*, b_v^*) approaches the Nash equilibrium level. Hence, the participation constraint of worker 2 is satisfied for small status difference as his outside option is zero. Substitute (a_v^*, b_v^*) into the value of the team, we obtain

$$V(a_v^*, b_v^*) = \frac{2(1-f(s))[g(s)(3+2f(s))^2 + 5(1+f(s))]}{[2(2-f^2(s)) + g(s)(3+2f(s))]^2}.$$

Then, it is straightforward to show that

$$\frac{\partial V(a_v^*, b_v^*)}{\partial s}|_{s=0} = \frac{3}{32}g'(s)|_{s=0} > 0.$$

Proof of Corollary 2

Starting with the case of $f(s) < 0$ and $g(s) = -f(s)$, we have

$$V(a_v^*, b_v^*) = \frac{2(1-f(s))(5-4f^2(s)-4f(s)(1+f(s))^2)}{(4(1-f^2(s)) - 3f(s))^2}.$$

Setting the first order condition equal to zero yields

$$\frac{\partial V(a_v^*, b_v^*)}{\partial f(s)} = 0 \Rightarrow f(s) = -\frac{1}{2}.$$

It is easy to check that the second order condition is also satisfied. When $f(s) > 0$ and $g(s) = f(s)$, we have

$$V(a_v^*, b_v^*) = \frac{2(1-f(s))[f(s)(3+2f(s))^2 + 5(1+f(s))]}{(3f(s)+4)^2},$$

Similar as above, we have

$$\frac{\partial V(a_v^*, b_v^*)}{\partial f(s)} = 0 \Rightarrow f(s) = \frac{\sqrt{205} - 13}{12} \approx 0.11.$$

Proof of Proposition 3

Worker 1 solves

$$\max_a \frac{1}{2}(1-(a-b)^2)-(1+f(s))(1-a)^2,$$

whereas worker 2 solves

$$\max_b \frac{1}{2}(1-(a-b)^2)-(1+f(-s))b^2.$$

The equilibrium actions are given by

$$\begin{aligned} a^* =& \frac{2(1+f(s))(1+f(-s))+1+f(s)}{2(1+f(s))(1+f(-s))+1+f(s)+1+f(-s)}, \\ b^* =& \frac{1+f(s)}{2(1+f(s))(1+f(-s))+1+f(s)+1+f(-s)}. \end{aligned}$$

Substitute these solutions into the value function, the organization value is given by

$$V=\frac{2(1+f(s))(1+f(-s))(2(1+f(s))+2(1+f(-s))+1)}{[2(1+f(s))(1+f(-s))+1+f(s)+1+f(-s)]^2}.$$

We denote the right derivative as $V_s=\frac{\partial V}{\partial s}|_{s\to 0^+}$,[15] we obtain

$$V_s \propto f'(0^-)-f'(0^+).$$

Therefore, for small status differences (that is, $s\to 0$),

$$V_s>0 \text{ if and only if } f'(0^+)<f'(0^-).$$

Proof of Proposition 4

Similar argument to the proof of Proposition 2 shows that the leader always wants to recommend a larger b_l to the follower. As the leader is constrained in his recommendation, he is obliged to recommend $b_l=1$. Following the same steps as the proof of Proposition 2, it is straightforward to show that the equilibrium coordination efforts are

$$\begin{aligned} a^* =& \frac{2f(s)f(-s)+2f(s)g(s)+2f(-s)+3f(s)+3g(s)+3}{2f(-s)f(s)+2f(s)g(s)+3f(-s)+3f(s)+3g(s)+4}, \\ b^* =& \frac{2f(s)g(s)+f(s)+3g(s)+1}{2f(-s)f(s)+2f(s)g(s)+3f(-s)+3f(s)+3g(s)+4}. \end{aligned}$$

The organization value is

$$V=\frac{2(1+f(-s))(4f^2(s)g(s)+2f(-s)f(s)+2f^2(s)+12f(s)g(s)+2f(-s)+7f(s)+9g(s)+5}{[2f(-s)f(s)+2f(s)g(s)+3f(-s)+3f(s)+3g(s)+4]^2}.$$

[15] The right derivative exists as both $f(s)$ and $f(-s)$ are continuously differentiable for any $s>0$, hence V is also continuously differentiable for any $s>0$ (more precisely, right-continuous at $s=0$). Thus, we can take differentiation and then take the limit as $s\to 0^+$.

Then, we obtain

$$V_s \propto 3g'(0) + f'(0^-) - f'(0^+).$$

Thus, $V_s > 0$ if and only if

$$f'(0^+) < f'(0^-) + 3g'(0).$$