Leadership, Coordination and Corporate Culture*

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Abstract

What is the role of leaders in large organizations? We propose a model in which a leader helps to overcome a misalignment of followers' incentives that inhibits coordination, while adapting the organization to a changing environment. Good leadership requires vision and special personality traits such as conviction or resoluteness to enhance the credibility of mission statements and to effectively coordinate agents around them. Resoluteness allows leaders to overcome a time-consistency problem that arises from the fact that leaders learn about the best course of action for the organization over time. However, resoluteness also inhibits bottom-up information flow from followers. The optimal level of resoluteness depends on follower's signal quality and the corporate culture of the organization.

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"One of the most important prerequisites for trust in a leader is steadiness. The need for reliability is not only ethically desirable, it is generally a practical necessity. A leader who is unpredictable poses a nerve-wracking problem for followers. They cannot rally around a leader if they do not know where he or she stands." Garder (1990)

1 Introduction

This paper considers two key challenges facing leaders in large organizations: developing a successful mission for the organization and building high-performance teams. Developing a successful mission is a dynamic process that involves listening and incorporating new information about changes in the organization's environment. Team building involves aligning followers' incentives in order to facilitate coordination, information sharing, and the emergence of a productive corporate culture. Facilitating coordination is challenging because coordination is an activity that naturally has positive spill-overs. Thus, it typically benefits the organization more than it benefits the follower privately. A leader can be a mechanism for resolving this incentive misalignment, if he can credibly commit to a course of action. The leader's dilemma is that he would like to base the organization's mission on all the relevant information about the environment available to him. But, since information about the environment trickles in over time, the leader may then be led to revise the organization's direction as new information becomes available. His desire to modify the direction of the organization over time thus undermines his ability to coordinate actions and build high-performance teams.

In this paper we consider how particular personal attributes such as *steadiness* or *resoluteness* help a leader to overcome this *dilemma*. The management literature on leadership has emphasized several key personality traits of good leaders. Among the most often mentioned are good communication skills, team spirit, integrity, and resoluteness. The first empirical study by economists that looks at the personal traits of leaders, Kaplan, Klebanov, and Sorensen (2011), considers which caracteristics determine the professional success of CEO candidates involved in buyouts or venture capital transactions. Interestingly the study finds that, contrary to received wisdom which emphasizes the 'team player' qualities of leaders, the traits that are the strongest predictors of success are execution skills and resoluteness. A general lesson from their study is that leaders should try to avoid changing direction over time and therefore should not seek too much feed-back from others in the organization.

Our model explains why resoluteness can be a desirable trait for a leader, and how it helps a leader in coordinating team actions. Our model further shows that if followers can signal their information about the state of nature through their action choices, then followers' expectations of how much *'listening'* the leader will do can be self-fulfilling. That is, if they expect the leader to pay attention to the information conveyed through their action choices then they will be induced to signal this information, while if they expect the leader to rely mostly on his own information then followers will give up on signaling through their actions and only worry about coordinating their actions with others. We suggest that the resulting multiple equilibria can be interpreted as different *corporate cultures*. Finally, the model explains why renegotiation-proof incentive contracts that reward commitment to an initial plan of action cannot obviate the need for resolute leaders.

More specifically, we capture the basic leadership problem in a simple setup involving four stages. In the first stage, the leader observes a first signal of the environment the organization is likely to be in. Based on that signal, the leader can define a mission or overall strategy for the organization. In a second stage, the other members of the organization – the followers – decide how closely they want to stick to the leader's strategy. They may not be inclined to blindly follow the leader's proposed strategy because they also observe signals about the state of nature, and they may come up with different forecasts of what the ultimate direction for the organization will be. In a third stage the leader receives a second signal. This signal could be an aggregate of the signals of the followers or simply new information that becomes available. The leader implements the organization's strategy given all the information he has available. Since the followers have already acted, the leader at this point is no longer concerned about coordinating their actions. The leader's only remaining goal is to adopt a strategy for the organization that is best given all the information he has. In the fourth and last stage, once the strategy has been implemented, the organization's payoff is realized. It will be higher the better adapted the strategy is to the environment and the better coordinated all the members' actions are.

The model considers a *resolute* leader who attaches an exaggerated information value to his initial information, or on the signals he processes himself. In other words, a resolute leader trusts his own initial judgement more than a rational leader would and discounts information subsequently learned from others. He therefore tends to define a strategy for the organization based disproportionately on his own best initial assessment of the environment the firm finds itself in.

The reason that such resoluteness is valuable is that the conflicting desires to coordinate followers and adapt the mission create a time-consistency problem. The leader would like followers to believe that his mission statement is what he will ultimately implement. But followers know that ex-post the leader will want to revise the organization's strategy in response to new information after they have acted. This is what causes them to be insufficiently coordinated, as each attempts to guess how the leader will revise the organization's strategy in light of what they know about the environment. A resolute leader who puts too little weight on new information from other members is more likely to follow through with the initial mission, which helps coordinate followers' actions around that mission. We show that this coordination benefit outweighs the potential maladaptation cost as long as the leader's determination is not too extreme.

Our model predicts that resoluteness is most valuable when the leader and followers are equally informed about the environment. When followers have little information, they have little reason to act differently from what the leader prescribes. Following the leader's direction, they coordinate closely. Likewise, when followers are very well informed, their assessments of the environment coincide and they also choose similar actions. It is in-between where coordination problems are most severe and the value of a resolute leader is greatest. Thus, one test of the theory could be to determine whether a leader's resoluteness (as measured by Kaplan, Klebanov, and Sorensen (2011) for example) has a hump-shaped relationship with a measure of a leader's information advantage vis-a-vis followers.

We can combine both *top-down* and *bottom-up* information flows in our model by letting the leader's second signal take the form of an aggregate of followers' signals. In this variant of our model, the leader learns by observing followers' actions, which imperfectly convey their signals. In such a situation, letting followers base their actions on the signal they observe has more value for the organization, as this transmits more information about the state of the world to the leader. Since less coordination brings about better adaptation, observing actions moderates the benefits of leader resoluteness. In this setting, *resolute leaders make bad listeners* and learn little, thereby destroying value. A leader's failure to listen to followers is especially costly when followers have very precise information.

In this setting, our second main result is that observing followers' actions creates a feedback effect that can generate *multiple equilibria*: If followers expect the leader to ignore the information from their actions, then the leader will not learn anything new and his initial mission statement is the best estimate of the organization's final action. Accordingly, when followers use the leader's announcement and not their private information to form actions, then the leader rightly ignores the aggregate action because it is uninformative. On the other hand, if followers expect the leader to listen carefully to the average action in revising the organization's policy, then they want to use their private signals to influence the organization's policy change through their actions. We suggest that an organization's *corporate culture* may determine which equilibrium prevails, so that our model can capture the hysteresis aspect of corporate culture emphasized in the management literature.

Finally, while resoluteness helps a leader to commit to "staying the course" it also raises the risk for the organization of pursuing the wrong strategy. One might wonder, therefore, whether there aren't better ways of achieving commitment, such as writing a contract that penalizes the leader for vacillating. Our third main result is that such contracts are not *renegotiation-proof*. Just as the leader would like to commit to a course, achieve coordination, and then adjust to the optimal circumstances, the organization would like to choose a contract that induces strong commitments and then amend that contract to allow the leader to adapt his strategy to the changing environment.

An apt recent example of a business leadership situation that our model attempts to capture is that of Sony Corporation. At the time when Sony recruited its new CEO, Sir Howard Stringer, its old business model, electronics appliance manufacturing, had been threatened by the growing importance of internet applications and software development. To adapt, Stringer and top Sony management put together a major new strategy centered around the expansion of high-definition digital technology and the development of Sony's new Blu-ray standard.

As in our model, the success of this change depended critically on adaptation and coordination. Stringer needed to adjust course as new information about the technology's capabilities arrived. At the same time, he had to project an unwavering commitment to the new HD technology. Sony's product engineers, software developers and retailers would have each liked to devote only a small amount of time or resources to Blu-ray devices and content, until it was clear whether or not Blu-ray would succeed or promptly be replaced by a new, improved standard.[1] Yet, only if all parties embraced Blu-ray, could it succeed, leaving everyone better off. The benefit of Stringer's resolute leadership style was that it helped to coordinate Sony's workers to fully invest in new Blu-ray-specific skills, content developers to produce abundant Blu-ray-specific content and retailers to stock Blu-ray products. The downside of his single-minded pursuit of this mission was that it deterred followers from exploring other technologies that could have led the organization to a better outcome. Thus, by firmly rallying the whole organization around the new Blu-ray technology, Stringer risked committing the whole corporation to an obsolete or losing technology.

Another area where team-building is essential is in military battle. As history has shown, coordination and the concentration of force on the weakest flank of the enemy is key to victory. But continual evolution of the enemy's defenses means that new information is constantly arriving. A coordination problem arises because each lieutenant is guessing where his ultimate battlefield will be. A general has to be wary that constantly amending his orders invites lieutenants to use their own heterogeneous information to guess what the next set of orders will be and risks dispersing the troops to different anticipated battlefields. As in our model, the general needs to convince his lieutenants that he will stay the course long enough to muster the full force of his army, but not too long to risk being outflanked by the enemy.

[1] See "In Blu-ray Coup, Sony Has Opening But Hurdles, Too" by Sarah Mcbride, Yukari Iwakane and Nick Wingfield, 7 January 2008, *Wall Street Journal*.

2 Related Literature

The leader of a large organization has many roles. In addition to team-building and developing a mission, a leader is also a motivator and a communicator. The existing economics literature on leadership focuses on these latter two tasks. Although some of these papers also feature a role for coordination of followers and overconfident leaders, three key ideas differentiate our paper: 1) that a leader exists to remedy a misalignment of followers' coordination incentives, 2) that the ability to renegotiate contracts creates commitment problems that personal characteristics of a leader can overcome, and 3) that the personal characteristics of a leader affect the flow of information from followers to leaders and thus the culture of the organization. There is also a vast management literature on leadership that touches on these themes. In what follows, we discuss each of these branches of the literature in more detail.[2]

Leader as motivator. One of the earliest economics papers on leadership is by Rotemberg and Saloner (1993). They consider a principal-agent model where the agent exerts effort to develop new ideas, and then a CEO accepts or rejects each idea. The agent is rewarded only if her idea is accepted. The CEO may be *empathic*, meaning that he may give weight to the agent's utility when evaluating ideas. There is then a tradeoff for the organization: the more empathic the CEO the greater the agent's incentive to devise new ideas, but the more bad ideas are approved. Rotemberg and Saloner show that a moderately empathic CEO is optimal for the firm. He provides the agent with some incentive to exert effort, but also rejects the worst ideas she proposes.

In Aghion and Tirole (1997), both the principal and the agent can develop new ideas. When both parties come up with a new idea, the party with formal authority decides which idea to pursue. But when only one party develops an idea, that party gets to implement its idea. Their theory suggests why, even though a CEO has no formal authority, she can still have real authority and can assume a leadership role if she is the developer of new ideas.

[2]For a more extensive discussion of the economics literature on leadership, see Bolton and Dewatripont (2011).

In a subsequent article, Rotemberg and Saloner (2000) also extend their earlier model to consider two activities of the firm, each run by an agent who can exert effort to develop new ideas. One of the activities is more likely to generate valuable improvements. They show that CEO *bias* in favor of the more promising activity acts like a commitment device that gives the agent in the more promising activity greater incentives to exert effort. Such a bias can be interpreted as *vision* and firm *focus*.

Hermalin (1998) considers a *moral hazard in teams* problem where organizational output depends on all members' efforts and where all members share the aggregate output. The leader has private information about the return to effort and uses that information to *motivate* team members to work hard and dissuade them from free-riding. Hermalin shows that a leader who exerts effort (*leads by example*) can signal that the return to effort is high, which motivates his team. While the misalignment of incentives bears some resemblance to our model, the two frameworks really describe different types of organizations. Leading by example might be more successful in a small organization where followers observe the leader's actions. Resolute mission statements are more appropriate for a large organization where most followers have no personal contact with their leader.

Leader as communicator. One of the models structurally most similar to our own is by Dewan and Myatt (2008). Followers in their model would like to coordinate, but cannot because they do not know what others believe. Thus, the role of the leader is to communicate information that can facilitate coordination. Dewan and Myatt show that the leader's *clarity in communication* is relatively more important than his *accuracy* because clarity ensures that all followers interpret the leader's message in the same way, allowing them to coordinate.

Majumdar and Mukand (2007) model a leader who is able to coordinate agents if he is thought to be able to correctly identify circumstances when change is possible, and if he is able to communicate with a sufficiently large number of followers. Similarly, Ferreira and Rezende (2007) consider a leader's choice about whether to publicly announce a strategy or not. Career concerns allow the announcements to be credible and thus to induce a complementary action by a follower. But public announcements also limit the firm's ability to adapt to change. A better leader in this model is one with more precise information.

While the idea of the leader as a mechanism for achieving coordination is similar, these papers characterize a good leader as an information-provider. In contrast, we model a manager who faces the following strategic challenges: overcoming the followers' insufficient incentive to coordinate; resolving the time-consistency problem that arises when trying to use commitment to facilitate coordination; and listening enough to ensure that information continues to flow from followers up to the leader.

Some of these trade-offs our leader faces are similar to those in the organizational design problem of Dessein and Santos (2006). The success of their organization depends on coordinating many agents' tasks and adapting to a changing environment. But while they ask how such an organization should be designed, we study the role and optimal attributes of a leader.

Leader overconfidence. What we call *resoluteness* can be thought of as a form of *overconfidence*. A handful of papers explore the role of overconfidence in leadership. In Van den Steen (2005), managerial overconfidence helps attract and retain employees with similar beliefs. The resulting alignment of beliefs helps firms function more efficiently. When similar followers and managers are paired, the manager is more likely to implement ideas proposed by an employee. Because employees derive private benefits from having their ideas adopted, they exert more effort to identify new ideas, which benefits the organization.

Goel and Thakor (2008) consider a model where managers with unknown ability compete to become leaders and explain why overconfident managers are more likely to be chosen. In their model, managers choose a project and the manager with the best project outcome is selected as leader. Overconfident managers tend to make riskier project choices and are therefore more likely to be selected as leader. Similarly, Gervais and Goldstein (2007) introduce overconfidence into a moral hazard in teams problem akin to Hermalin (1998). In their model an overconfident leader tends to work harder and thus induces all other team members to exert more effort.

Finally, Blanes i Vidal and Möller (2007) study a similar problem of information communication as Ferreira and Rezende (2007). In their static leader-follower model, sharing hard information helps motivate the follower. But if the leader focuses too much on motivating the follower, it compromises her ability to make accurate decisions based on her own soft information. Blanes i Vidal and Möller (2007) then show that leader overconfidence (or, self-confidence in their terminology) may help improve decision-making.

These papers offer alternative explanations for the existence and success of overconfident or resolute managers, based on their ability to motivate followers to exert effort. Our paper complements this literature. It shows that the same personal characteristics that enable a leader to motivate followers also enable a leader with another aspect of his job: facilitating teamwork by overcoming barriers to coordination.

Management literature. Our approach to modeling leadership is informed by a vast management literature on leadership. A large portion of this literature is devoted to case studies or (auto)-biographies of business leaders,[3] which focus on personality traits and simple rules that make leadership more effective. Vision, judgement, charisma, resoluteness, as well as interpersonal, relational and communication skills are all commonly extolled. However, this biographical and case-based literature features such a wide variety of accounts and opinions about what matters that, unfortunately, few common themes emerge.

The management literature on 'strategic leadership' discussed in Finkelstein, Hambrick, and Cannella (2009) is closest to our analysis. Early writings in this vein by Barnard (1938) and Selznick (1957) explore fundamental questions of leaders' power, leaders' effectiveness, and why leadership matters at all. They highlight the CEO's role in defining the firm's mission and fostering coordination. Based on a detailed CEO time-use study, Mintzberg (1973) describes the leader's roles in defining the firm's goals, in arbitration and decision-making, and in communicating with followers and outsiders. Whether CEOs are effective at all is a hotly debated issue. Effectiveness seems to depend on the external and social context of the firm (its environment and

[3]see, e.g. Gerstner (2003) writing on the turnaround of IBM or Welch and Byrne (2003) on Welch's leadership at General Electric.

its culture), the degree of organizational empowerment, and (most importantly for our purposes) on the leader's personal characteristics (see e.g. Pfeffer and Salanik (1978) and Hambrick and Finkelstein (1989)). Building on the behavioral theory of the firm of Cyert and March (1963), another branch of this literature stresses behavioral aspects of strategic leadership, such as the leader's limited attention (Aguilar (1967)) and the importance of past experience in shaping the CEO's values and cognition. In this body of work as well, personality traits of the leader, such as the leader's ability to thrive on ambiguity and risk (Gupta and Govindarajan (1984)), the leader's ability to inspire followers, his charisma, and importantly, his self-confidence are widely emphasized (Bass (1985)).

Thus our own model, where the leader's task is to communicate with followers, coordinate their actions and choose a direction for the firm, is consistent with the management literature's understanding of the role of CEOs. Furthermore, our exploration of the role of personal traits such as the leader's resoluteness as a key determinant of the leader's success is motivated by a vast body of evidence. The key difference of our approach is methodological, with a more systematic analysis of dynamic strategic interactions between leaders and followers in a formal model.

Corporate culture. Our paper also offers a new economic model and perspective on corporate culture. The dominant economic theory of corporate culture by Kreps (1990) is a relational-contract theory involving infinitely-lived firms and finitely-lived workers, who must be given incentives to exert costly effort. While we share Kreps' premise that corporate culture is related to endogenous equilibrium beliefs, he essentially equates corporate culture and the franchise value of the firm, while we see corporate culture more as something internal to the firm. In our model, corporate culture governs both top-down and bottom-up information flows. It is a set of beliefs about how agents' actions will be perceived by others. The idea that corporate culture is about agents' interactions with others and the information that interaction generates, is more consistent with the vast management literature on this topic.

The remainder of our paper is organized as follows. Section 3 presents our model of coordination and adaptation for the organization and the role of leadership in an organization facing this tradeoff. Section 4 shows why resoluteness is a valuable personal characteristic for a leader. Section 5 considers a slightly more general variant of our model, where the leader can obtain information from other members of the organization revealed by their actions. Section 6 introduces a board of directors who can write an incentive contract with a rational leader. Section 7 concludes with a summary and directions for future research. Finally, an appendix contains the proofs and the foundations for our objective function.

3 Model setup

The tension between coordination and flexibility arises first from changes in the environment, which require adaptation, and second from the gradual arrival of information about the environment. To illustrate this problem we consider a setting where the leader receives an exogenous signal in each of two periods. Based on his initial beliefs, the leader proposes a strategy for the organization around which other members can coordinate their actions. But the leader may change his mind and reorient the strategy following the arrival of the second signal. While the ex-post reorientation helps bring about better adaptation, the anticipation of possible changes in strategy also make it harder to coordinate followers' actions. The reason is that the followers also observe a private signal about the environment and use this signal to forecast possible reorientations of the organization's strategy.

We show that leader resoluteness is a valuable attribute in such a situation (Section 4). The more resolute the leader the less likely he is to change his mind and therefore the less likely is a possible reorientation of the organization's strategy. We assume for now that signals are exogenous. We explore endogenous signals, derived from the aggregate choice of followers, in Section 5.

Model setup The organization we consider has one leader and a continuum of followers indexed by i. The organization operates in an environment parameterized by θ, which affects payoffs. The better adapted the organization is to its environment the higher is its payoff. The difficulty for the organization is that θ is not known perfectly to any member. The leader of the organization and the other agents (the *followers*) start with different information or beliefs about the true value of θ.

The leader differs from the followers in two ways: first he can define a *mission statement* for the organization based on his initial beliefs $\theta_L \sim \mathcal{N}(\theta, 1)$. Followers make their own moves after seeing the mission statement; they have diffuse priors and also obtain their own private information about the environment, $S_i = \theta + \varepsilon_i$ (with *i.i.d.* error terms $\varepsilon_i \sim \mathcal{N}(0, \sigma_F^2)$).[4] Second, after the followers have chosen their actions a_i, the leader receives further information about θ in the form of a signal $S_L = \theta + \xi_L$, where $\xi_L \sim \mathcal{N}(0, \sigma_L^2)$. This second signal ($S_L$) can be either an exogenous signal or an endogenous signal, which reflects the information obtained by followers from their observed aggregate action choices. We consider each case in turn. Note that in the latter case not only do followers learn from their leader's mission statement, but also the leader learns from followers' action choices. This is the most general and richest case, simultaneously allowing for *top-down* and *bottom-up* information flows. In the final stage, the leader implements the strategy of the organization (chooses a_L) based on his updated beliefs about θ.

Followers value three things:

1. belonging to a well-coordinated organization,[5]

2. taking an action that is aligned with the organization's strategy; and,

3. belonging to an organization that is well-adapted to its environment θ.

Formally, we represent these preferences with the following objective function for each follower:

$$\Pi_i = -\int_j (a_j - \bar{a})^2 dj - (a_i - a_L)^2 - (a_L - \theta)^2 \text{ for } i \in [0, 1], \tag{1}$$

[4]Note that we do not depart from the common prior assumption, which allows consistent welfare statements. One can think of the initial beliefs as resulting from updating a flat (improper) prior based on an initial signal.

[5]Note that *coordination* does not have to mean taking identical actions. For example, a leader might want to assign each follower to a different task b_i. If $b_i = i + a_i$, then coordination ($a_i = a$, $\forall i$) would mean that each task is located 1 unit away from the task of the nearest follower.

where

$$\bar{a} \equiv \int a_j dj$$

is the average followers' action.

The objective function of the organization, and its leader, is then the sum (in our case the integral) over all followers' objectives.[6] That is,

$$\Pi_L = -\int_j (a_j - a_L)^2 dj - \int_j (a_j - \bar{a})^2 dj - (a_L - \theta)^2. \tag{2}$$

This objective function captures the essence of team-building: Since the social benefit to coordination exceeds the private benefit, there is a role for someone to enhance the team's welfare by encouraging coordination. When each follower is well-coordinated (a_i close to $\bar{a}$), the entire organization benefits. But because each follower has zero mass, his personal benefit from coordination is zero. Thus, there is a positive coordination externality.

Appendix A.1 outlines some foundations for this objective function. The key elements of the foundational model are *learning-by-doing* and the requirement that wage contracts be *renegotiation-proof*. Followers' actions in this strategic interaction determine their value to the firm, and therefore their wage in future periods. This, in turn, prompts them to choose actions close to the ultimate direction of the firm a_L, which have greater value. The requirement that wage contracts be renegotiation-proof precludes ex-ante contracts that induce followers to coordinate efficiently. This forms the basis for modeling the benefits to coordination as a positive externality.

Central to our analysis is the notion that the leader may have a form of overconfidence: he may overestimate the precision of his initial beliefs. More formally, although initial beliefs are truly drawn from a distribution $\theta_L \sim \mathcal{N}(\theta, 1)$ a *resolute*

[6] A separate on-line technical appendix posted on the authors' websites explores alternative payoff formulations. Assuming the leader and the firm have different objectives so that the leader has no concern for misalignment leaves our qualitative conclusions unchanged. Similarly, if we weight the three terms of the payoff function unequally, it does not reverse our conclusions. A greater concern for alignment or coordination makes the optimal level of overconfidence higher, while a greater concern for adaptation makes it smaller, but still positive. Finally, the appendix explores different forms of the coordination externality and commitment cost.

leader believes that they have a higher precision, $1/\sigma_p^2 \geq 1$. In contrast, the second signal $S_L \sim \mathcal{N}(\theta, \sigma_L^2)$ is assumed to be correctly assessed: we assume that the true and perceived precision of this signal are the same.[7]

The rationale for modeling *resoluteness* as a higher precision of the leader's initial belief, is most clear in Section 5, when the signal S_L is generated by other agents' actions. In essence, resoluteness in our model means that a leader *trusts his own judgement* more than the information acquired from others. But for now, the leader cannot observe followers' actions or signals.

4 Merits of resoluteness

We begin by analyzing the case where the leader's second signal, S_L, is exogenous, and solve for a unique linear Perfect Bayesian Nash Equilibrium of the game described above.

Definition 1 *A Perfect Bayesian Nash Equilibrium is given by*
(i) a strategy, or direction, for the organization a_L that maximizes $E\left[\Pi_L|\theta_L, S_L\right]$, given followers' actions $\{a_i\}_{i\in[0,1]}$;
(ii) followers' actions a_i that maximize $E\left[\Pi_i|\theta_L, S_i\right]$ given a_L and $\{a_j\}_{j\in[0,1]}$;
(iii) Bayesian updating: $E[\theta|\theta_L, S_i] = \phi\theta_L + (1-\phi)S_i$ where $\phi := \frac{1}{1+\sigma_F^{-2}}$,
and $E[\theta|\theta_L, S_L] = \lambda\theta_L + (1-\lambda)S_L$ where $\lambda := \frac{\sigma_p^{-2}}{\sigma_p^{-2}+\sigma_L^{-2}}$.

Optimal actions We solve the model by backwards induction. When the leader chooses the organization's strategy a_L, the actions of the followers $\{a_i\}_{i\in[0,1]}$ are already determined. We will guess and verify that the leader chooses an action that is a linear

[7] Note that if we allow for costly information acquisition by the leader at date $t = 2$ then our model allows for an alternative interpretation than leader overconfidence. If the leader under-invests in information acquisition – as he would if he privately bears all the costs – and if this is observable (or anticipated) by followers when they act, then under-investment in second period information will have the same effect as overconfidence in our model: the leader will put more weight on the first signal.

combination of his two signals:

$$a_L = \alpha\theta_L + (1-\alpha)S_L. \tag{3}$$

Knowing this action rule, each follower i chooses an action a_i. For simplicity we assume that followers start with a diffuse prior, which they update using the leader's mission statement θ_L and the signal $S_i \sim \mathcal{N}(\theta, \sigma_F^2)$ they each privately and independently receive. Any follower takes the actions of the others as given and cannot influence the average action because he is of measure zero. Therefore, his objective function (1) reduces to $E\left[-(a_i - a_L)^2|\theta_L, S_i\right]$ and his optimal action a_i is equal to his expectation of the leader's action, given his own private signal S_i:

$$a_i = E[a_L|\theta_L, S_i] = \alpha\theta_L + (1-\alpha)E[S_L|\theta_L, S_i]. \tag{4}$$

Since S_L is an independent, unbiased signal about θ, $E[S_L|\theta_L, S_i] = E[\theta|\theta_L, S_i]$.

By Bayes' law, the followers' expectation of θ is $E[\theta|\theta_L, S_i] = \phi\theta_L + (1-\phi)S_i$ where

$$\phi := \frac{1}{1+\sigma_F^{-2}}.$$

Let β denote the weight that the follower puts on the leader's announcement when forming his action. Then,

$$a_i = \beta\theta_L + (1-\beta)S_i. \tag{5}$$

$$\text{where} \quad 1-\beta = (1-\alpha)(1-\phi). \tag{6}$$

Now, we use the knowledge of followers' strategies to determine the leader's optimal action. The first-order condition of the leader's utility function with respect to a_L is

$$2E[\int_0^1 (a_j - a_L)dj] - 2E[(a_L - \theta)] = 0.$$

Rearranging,

$$a_L = \frac{1}{2}\left(E_L[\bar{a}] + E_L[\theta]\right), \tag{7}$$

where $\bar{a} \equiv \int a_j dj$ is the average followers' action and E_L denotes the expectation, conditional on the leader's information set at the time when he chooses his action. That information set includes his initial belief θ_L and his signal S_L.

The leader's expectation of the state θ is given by Bayes' law:

$$E_L[\theta] = \lambda\theta_L + (1-\lambda)S_L \tag{8}$$

where

$$\lambda := \frac{\sigma_p^{-2}}{\sigma_p^{-2} + \sigma_L^{-2}}.$$

To determine the average follower's action, integrate over (5), noting that the mean of the follower's signals is the true state θ. Thus, $\bar{a} = \beta\theta_L + (1-\beta)\theta$. The leader's expectation of this average action $\bar{a}$ is $E_L[\bar{a}] = \beta\theta_L + (1-\beta)(\lambda\theta_L + (1-\lambda)S_L)$. Substituting the leader's expectations into his optimal action rule (7) yields

$$a_L = \frac{1}{2}\left(\beta\theta_L + (2-\beta)(\lambda\theta_L + (1-\lambda)S_L)\right). \tag{9}$$

Finally, collecting coefficients on θ_L then implies that $\alpha = (\beta + \lambda(2-\beta))/2$.

We now know how the leader will act in equilibrium, given how the followers act. But this expression still has an unknown coefficient: β. To solve for this coefficient, we substitute out β from (6) and then solve for α. This reveals that the leader's optimal action is in fact linear, of the form in (3), where

$$\alpha = 1 - \frac{1-\lambda}{1+\lambda+\phi(1-\lambda)}. \tag{10}$$

Using the relationship between α and β in (6) and rearranging terms reveals that followers' actions are also linear in θ_L and S_i, with

$$\beta = 2\left(1 - \frac{1}{1+\lambda+\phi(1-\lambda)}\right). \tag{11}$$

Optimal resoluteness. Just like the leader's payoff, the organization's payoff Π has three components. By substituting in the optimal actions of the leader and the followers, we can evaluate the effects of leader resoluteness and determine the optimal level of resoluteness. Following substitution of the equilibrium actions a_L and $\{a_i\}_{i\in[0,1]}$, the three components of Π are as given below:

1. the variance of each follower's action around the leader's,

$$E[-(a_i - a_L)^2] = -(\beta - \alpha)^2 - (1-\beta)^2\sigma_F^2 - (1-\alpha)^2\sigma_L^2 \tag{12}$$

2. the dispersion of followers' actions around the mean,

$$\int_j -(a_j - \bar{a})^2 dj = -(1-\beta)^2\sigma_F^2 \tag{13}$$

3. the distance of the leader's action from the true state,

$$E[-(a_L - \theta)^2] = -\alpha^2 - (1-\alpha)^2\sigma_L^2. \tag{14}$$

Summing the three terms, substituting in (6) and using the definition of ϕ then yields,

$$E\Pi = -(1-\alpha)^2(\phi(2-\phi) + 2\sigma_L^2) - \alpha^2. \tag{15}$$

Note that the effect of resoluteness appears in (15) only through the weight α that the leader puts on his first signal (ϕ and σ_L are exogenous). Differentiating (10) with respect to λ, and, in turn, differentiating λ with respect to σ_p, then reveals that $\partial\alpha/\partial\sigma_p^{-2} > 0$. In other words, α is monotonically increasing in resoluteness. Therefore a simple way of determining the effect of leader resoluteness on the organization's welfare is to differentiate the ex ante objective with respect to α. The chain rule then tells us that $\partial E\Pi/\partial\sigma_p^{-2}$ has the same sign.

The partial derivative of the organization's ex-ante expected payoff with respect to α is:

$$\frac{\partial E\Pi}{\partial\alpha} = 2(1-\alpha)\left[\phi(2-\phi) + 2\sigma_L^2\right] - 2\alpha.$$

This is positive if

$$\phi(2-\phi)+2\sigma_L^2 > \frac{\alpha}{1-\alpha}.$$

With a rational leader we have $\sigma_p^{-2}=1$, and therefore $\alpha/(1-\alpha)=\phi+2\sigma_L^2$. The above inequality then reduces to

$$\phi(2-\phi)+2\sigma_L^2 > \phi+2\sigma_L^2,$$

which always holds for $\phi<1$. Thus, $\frac{\partial E\Pi}{\partial\alpha}>0$, which implies that $\frac{\partial E\Pi}{\partial\sigma_p^{-2}}>0$ at $\sigma_p^{-2}=1$, so that some degree of resoluteness is always optimal.

On the other hand, for an extremely stubborn leader who fails to update at all, $\lambda\to 1$, $\alpha\to 1$, and the right side of the inequality approaches infinity, so that $\frac{\partial E\Pi}{\partial\lambda}<0$. As $\frac{\alpha}{1-\alpha}$ is continuous for $\alpha\in(0,1)$, and since the weight α is strictly increasing in the perceived precision σ_p^{-2}, there exists an interior optimal level of resoluteness that maximizes the organization's expected payoff.

Proposition 1 *The organization's ex-ante payoff is maximized with a leader's resoluteness level of*

$$(\sigma_p^{-2})^* = 1+\frac{\phi(1-\phi)}{2\sigma_L^2}. \tag{16}$$

Proofs for this and all further propositions appear in the appendix.

Since the second term in equation (16) is always positive, it is strictly beneficial for an organization to have a *resolute* leader. There are three reasons why resoluteness increases the expected payoff of the organization: First, it reduces the distance of the followers' actions from the leader's action $(a_i-a_L)^2$. Second, it reduces the distance of followers' actions from each other $\int(a_j-\bar{a})dj$. Third, weighting the later signal less reduces the error in the leader's action that comes from the noise in S_L. Of course, there is a corresponding increase in the error in the leader's action that comes from noise in θ_L.

This result forms the basis for the testable prediction that observed leader resoluteness should increase and then decrease in leaders' information advantage. Recall that ϕ is the precision of the leader's initial signal, divided by the sum of the leader's and the followers' signal precisions. Thus, ϕ is a measure of how well-informed the leader is initially vis-a-vis the followers. Equation (16) shows that the ideal leader is rational ($\sigma_p^{-2} = 1$) when $\phi = 0$ (followers have perfectly precise information) or when $\phi = 1$ (followers know nothing). It is maximized at $\phi = 1/2$, which corresponds to the case where the leader's and the followers' signals are equally precise.

5 Learning from Followers and Corporate Culture

In this section, not only do followers learn from their leader (top-down information flow), but leaders also learn from followers (bottom-up information flow). We now replace the exogenous signal S_L with an endogenous signal, which is the average action of the followers, plus some noise. A first implication is that this moderates the benefit of resoluteness. A leader who is very stubborn dissuades his followers from acting based on their private information and suppresses information revelation. More interestingly, because the leader's action depends on what he learns from agents' actions, which in turn depend on what agents expect the leader to do, multiple equilibria arise, which can be interpreted as different outcomes arising from different *corporate cultures.*

5.1 Merits and drawbacks of resoluteness

The model is the same as before with one exception: Followers' actions aggregate into the second (endogenous) signal for the leader, which now is the publicly observable organization output A:

$$A = \int_j a_j dj + \chi,$$

where χ is the independent noise term: $\chi \sim \mathcal{N}(0, \sigma_\chi^2)$. As before, the leader uses the signal A to update his initial belief θ_L and make a final inference about θ. As we shall verify, followers' equilibrium strategies again take the form $a_i(S_i) = \beta\theta_L + (1-\beta)S_i$, so that we can rewrite the aggregate output signal as

$$\hat{S}_L := \tfrac{1}{1-\beta}\left[A - \beta\theta_L\right] = \theta + \tfrac{1}{1-\beta}\chi.$$

Note that this signal's precision is given by $(1-\beta)^2\sigma_\chi^{-2}$, so that the more followers rely on their private information (the lower is β), the more accurate this signal becomes. Of course, if followers rely more on their private signals S_i there is also less coordination among them. Thus, in this setting coordinated actions have both a positive payoff externality and a negative information externality because they suppress information revelation to the leader.

Optimal actions. The nature of the leader's problem has not changed. As in Section 4, the leader's optimal action is

$$a_L = E[\theta|\theta_L, \hat{S}_L] = \alpha\theta_L + (1-\alpha)\hat{S}_L,$$

where α is given by equation (10). That solution for α is expressed as a function of λ, the weight the leader puts on θ_L when updating her belief about θ using Bayes' law. The change to an endogenous signal, A, shows up as a different λ from before:

$$\lambda = \frac{\sigma_p^{-2}}{\sigma_p^{-2} + (1-\beta)^2\sigma_\chi^{-2}}. \tag{17}$$

The difference in this case is that λ now depends on β, which is chosen by the followers and will, in turn, depend on the leader's resoluteness σ_p^{-2}.

Similarly, each follower's optimal action is their forecast of the leader's action, which can still be expressed as $a_i = \beta\theta_L + (1-\beta)S_i$, where β is given by equation (11). However, the difference is again that now β depends on λ. Thus, in this setting with bottom-up information flows, λ depends on β and conversely β depends on λ, so that we now need to solve the fixed point problem given by equations (17) and (11) to determine the equilibrium actions of leader and followers.

Substituting for λ in equation (11) delivers a third-order polynomial in $(1-\beta)$:

$$(1-\beta)\left[(1-\beta)^2\sigma_\chi^{-2}(1+\phi) - (1-\beta)\sigma_\chi^{-2}(1-\phi) + 2\sigma_p^{-2}\right] = 0.$$

This equation potentially has three solutions. $\beta = 1$ is always a solution, for any set of parameter values. The quadratic term in brackets also has two zeros if

$$\sigma_p^{-2} \leq \frac{(1-\phi)^2}{8(1+\phi)\sigma_\chi^2}. \tag{18}$$

Since we focus on stable equilibria we neglect the unstable equilibrium with the larger quadratic root for β. The following proposition characterizes the two stable solutions.

Proposition 2 *When leaders learn from followers' actions (18 holds), there are two stable (linear) equilibria:*
(i) A ***dictatorial equilibrium*** *where there is perfect coordination* $a_i = a_L = \theta_L$*, but information flow from followers to leaders is totally suppressed.*
(ii) A ***"lead-by-being-led equilibrium"*** *where coordination is reduced, but the organization is better adapted to the environment, as it relies on more information to determine its strategy:*

$$a_i = \beta\theta_L + (1-\beta)S_i \qquad \textit{where} \qquad \beta = 1 - \frac{1-\phi+\sqrt{(1-\phi)^2 - 8(1+\phi)\sigma_p^{-2}\sigma_\chi^2}}{2(1+\phi)},$$

and

$$a_L = \alpha\theta_L + (1-\alpha)\hat{S}_L \qquad \textit{where} \qquad \alpha = 1 - \frac{1-\phi+\sqrt{(1-\phi)^2 - 8(1+\phi)\sigma_p^{-2}\sigma_\chi^2}}{2(1-\phi^2)}$$

The economic logic of the multiple equilibria is the following: If followers expect the leader to ignore any new information from their actions, then they must also expect the leader's action to be the same as the organization's mission statement ($a_L = \theta_L$). Since followers want to take actions close to the leader's action, they then choose the same action $a_i = \theta_L$. But when followers all take the same actions, they reveal no new information. So, their expectation is self-confirming. In contrast, when followers expect the leader to learn new information from the observed output A, they try to forecast what he will learn, using their private signals. Because their actions are based on this forecast and on their private signals, aggregate output reveals information. So, the expectation that the leader will learn is also confirmed.[8]

5.2 Matching Leaders and Corporate Cultures

One way of interpreting the multiplicity of equilibria in this setting is that the role of leadership in an organization must be adapted to the organization's *culture.* There is no point in assigning a leader that is a good listener in an organization that has a hierarchical and dictatorial culture. Vice-versa, appointing a very resolute leader in a democratic organization in an attempt to bring about greater coordination could be costly, as this may clash with followers' incentives to take initiatives. These observations have often been made and are well understood in the management literature.

A more surprising and somewhat unexpected prediction of our analysis is that the assignment of leaders with different degrees of resoluteness to organizations with different corporate cultures is not a simple matter of "positive assortative matching", with more resolute leaders being matched with more dictatorial organizations. As the following results show, the opposite may be true: dictatorial organizations, where followers are expected to just coordinate around the leader's mission statement may actually be best led by rational, well-informed, and competent leaders[9], while democratic organizations, where followers are expected to take a lot of *initiatives* and where the leader can learn from followers' actions, may paradoxically be best led by somewhat

[8]This multiplicity of equilibria is generally robust to the introduction of a second exogenous signal. To see this, let the precision of this exogenous signal be denoted ξ. Then, the total signal precision of the leader's second signal is $\sigma_\chi^{-2}(1-\beta)^2+\xi$. Equations (5) and (11) still characterize followers' optimal actions, while (3) and (10) characterize leaders' optimal actions. The only difference is in the definition of the Bayesian updating weight λ. Now, $\lambda = \sigma_p^{-2}/(\sigma_p^{-2}+\sigma_\chi^{-2}(1-\beta)^2+\xi)$. Substituting the new definition of λ in (10) yields a new expression for $(1-\alpha)$. Substituting this new expression for $(1-\alpha)$ into $(1-\beta)=(1-\alpha)(1-\phi)$ and rearranging yields,

$$(1-\beta)\left[(1-\beta)^2\sigma_\chi^{-2}(1+\phi)-(1-\beta)\sigma_\chi^{-2}(1-\phi)+2\sigma_p^{-2}+(1+\phi)\xi\right]-(1-\phi)\xi=0.$$

Even in the presence of an exogenous signal ($\xi>0$), this is still a cubic equation in $(1-\beta)$ and it remains cubic as long as the leader receives some information from an endogenous signal. Therefore, multiple equilibria do not disappear with the introduction of an exogenous signal. Instead, it is the unique, linear, equilibrium (obtained when the leader only receives an exogenous signal) that is fragile. As ξ approaches zero, there is a solution β that is close to 1. So, with a small amount of exogenous information, there is still a corporate culture that is very dictatorial, with very little listening.

[9]This is especially valuable if the more competent leader has significantly more precise initial information about the environment than the information of other members of the organization.

resolute leaders (when σ_χ is sufficiently small), who can bring about some measure of coordination among followers' actions.

Indeed, in the dictatorial equilibrium ($\beta = 1$, $\alpha = 1$), leader resoluteness has no effect on the organization's ex-ante expected payoff because, in this case, the coefficients α, β and λ do not depend on the leader's resoluteness.

In the stable lead-by-being-led equilibrium, on the other hand, the organization's expected payoff is

$$E\Pi = -(1-\alpha)^2\phi(2-\phi) - \frac{2\sigma_\chi^2}{(1-\phi)^2} - \alpha^2.$$

Leader resoluteness affects this payoff through α, the weight the leader puts on her initial signal θ_L when chosing her action. The relationship between the weight α and resoluteness σ_p^{-2} is described in the second equation of proposition 2.

Taking the derivative of the payoff with respect to α and setting it equal to zero ($\partial E\Pi/\partial\alpha = 0$), yields the optimal weight that the firm would want a leader to put on his initial signal:

$$\alpha^* = \frac{\phi(2-\phi)}{1+\phi(2-\phi)}. \tag{19}$$

This is the optimal weight as long as the lead-by-being-led equilibrium exists (18) and the second-order condition holds. The existence condition can be satisfied if the noise in output, the degree of leader resoluteness, and the true precision of the leader's initial belief are low, and the precision of agents' private information is high.

More precisely, we are able to show that:

Proposition 3 *In the lead-by-being-led equilibrium, leader resoluteness increases the organization's expected payoff if and only if*

$$\sigma_\chi^2 < \frac{\phi(1-\phi)^3}{2(1+2\phi-\phi^2)^2}. \tag{20}$$

Otherwise, the opposite of resoluteness, "flexibility" increases the expected payoff.

When is the leader's resoluteness likely to be beneficial? It is, for one, in situations where the leader is already extracting most of the relevant information about the environment θ. If the signal the leader sees from the followers' output is already very precise (low σ_χ^2), then the benefit of better coordination ($\phi(2-\phi)$) matters more than the marginal loss of signal quality. When the leader learns little from followers' actions (σ_χ^2 is large), then somewhat surprisingly, leader resoluteness worsens coordination problems in the lead-by-being-led equilibrium. The leader's action is then not very responsive to the signal A, thus resulting in more mis-coordination. In such a situation it may actually be preferable to have a *flexible* or acquiescent leader. Leader acquiescence then induces more initiatives from followers, which in turn allows the leader to observe more precise information about θ and take a better-directed final action. In sum, resoluteness is most valuable when there is little noise in output and the true variance of the leader's initial belief is high. In these situations, the risk that the leader's resoluteness will suppress followers' information and possibly lead to a maladapted final action for the organization, are minimized.

5.3 Ranking Equilibria: Can resoluteness be preferable to competence?

Given that there may be multiple equilibria and that corporate culture may therefore matter, is it possible to say which corporate cultures are better? Is a dictatorial culture always better given that it leads to better coordination? Or can a democratic culture (under the lead-by-being-led equilibrium) bring about better performance due to the organization's greater adaptability to changed circumstances? The next proposition provides a clear ranking of the dictatorial and *optimal* lead-by-being-led equilibrium (that is, the lead-by-being-led equilibrium with an optimally resolute leader). It establishes that if the endogenous second signal S_L is sufficiently informative (σ_χ^2 is low enough) then an organization with a democratic culture dominates a dictatorial organization.

Proposition 4 *The optimal lead-by-being-led equilibrium equilibrium exists if condi-*

tion (18) holds and it dominates the dictatorial equilibrium if and only if:

$$\sigma_\chi^2 \leq \frac{1}{4\left(\sigma_F^2+1\right)^2-2} \tag{21}$$

Our analysis has another surprising implication. So far, we have fixed the variance of the mission statement, $\sigma_0^2 \equiv E[(\theta_L - \theta)^2]$, to be equal to one, under the objective measure. But, allowing for different values of σ_0^2 is a simple way of introducing differences in a leader's *competence* into our model. A highly competent leader then would be one who has a highly accurate initial belief θ_L, that is someone with a low value of σ_0^2.

Intuitively, one expects greater competence of a leader to be an unreserved benefit for an organization. A leader with more accurate initial information, would make better decisions other things equal, and this can only benefit the organization. However, greater competence of a leader in our model also has a *side effect*: it may crowd out learning from the actions of followers. If the leader's initial information is too precise he may no longer be able to learn anything from the actions of the followers, as the latter decide to ignore their own information when choosing their actions. The question then arises whether it may be preferable for the organization to have a resolute leader who knows less, but who is also able to learn from followers.

We provide a set of conditions below on the parameters of the model such that the organization is better off with a resolute leader rather than a (possibly more competent) rational leader. Such a situation may arise when it is better for the organization if the leader learns from the actions of followers, and when only the resolute leader is able to do so in equilibrium.

Observe first that when σ_0^2 varies, the resolute leader's Bayesian updating weight λ is unaffected, as the leader believes the variance to be σ_p^2. The followers' beliefs are affected because when the true precision of the leader's announcement σ_0^{-2} changes, the weight followers put on that announcement when forming expectations of the state becomes $\phi = \sigma_0^{-2}/(\sigma_F^{-2} + \sigma_0^{-2})$. Given this new expression of ϕ, the leaders' and followers' actions take the same form as before. Thus, the solution is again that given by proposition 2, and the lead-by-being-lead equilibrium exists whenever (18) holds.

In sum, changing competence only affects the solution through its effect on the value of ϕ. We are then able to establish the following proposition.

Proposition 5 *Suppose there are two leaders, one resolute and one rational. Both have initial beliefs with the same perceived precision* $\sigma_p^{-2} = \sigma_0^{-2}$ *, but the resolute leader's initial information has lower true precision* $\underline{\sigma_0^{-2}} < \sigma_0^{-2}$*. There then exists a non-empty set of parameters such that the rational, more competent leader always ends up in the dictatorial equilibrium, while the resolute, but less competent leader can end up in a lead-by-being-led equilibrium. Moreover, for a subset of these parameter values the dictatorial equilibrium is worse for the organization.*

In light of the proposition it is possible for the organization to prefer a less competent but resolute leader to a more competent but rational leader as long as the difference in competence is not too large and the leader's resoluteness is large enough. The basic logic behind the proposition is that a more precise initial belief (a higher σ_0^{-2}) induces both the rational leader and the followers to weigh the mission statement more when forming their forecasts. When followers weigh the mission statement more, they weigh their idiosyncratic information less. This makes their aggregate output less informative about the environment, which encourages the leader to put even less weight on the information in output. This feedback, in turn, can result in a breakdown of the lead-by-being-led equilibrium. As a result a less competent but more resolute leader can welfare-dominate a more competent, rational leader who gets stuck in a dictatorial equilibrium.[10]

6 Renegotiation-proof Contracts Cannot Substitute for Resoluteness

As the preceding analysis highlights, resoluteness of a leader provides a form of commitment to *staying the course*. It ensures that the leader's strategy choice after learning

[10]It is worth mentioning that for a less competent leader, it might be optimal to act resolute, in order to appear as competent, as in Prendergast and Stole (1996).

new information does not deviate too much from the mission he set for the organization, which is centered on his initial belief. If the leader's beliefs do not change much, his strategy choice will be similar to his mission statement. This commitment in turn facilitates coordination. However, to the extent that leader resoluteness also introduces a bias in the organization's adaptation to the environment, it would seem that a more direct solution to the leader's time-consistency problem – allowing a rational leader to commit to staying the course, or writing a contract that penalized the leader for a lack of commitment – would be preferable.

The question is: Why can't the organization simply write an optimal contract with a rational leader, instead of choosing an irrational one? To answer this question, we introduce a new agent in the model, the *board of directors* (hereafter "the board"), who can choose the form of the compensation contract for the leader. The board can write a contract with the leader that may penalize him for taking a final action a_L that is far away from the announced direction θ_L. With a rational leader, such a contract could provide a commitment to stay the course and could help to achieve more coordination among followers. The problem however, as we show, is that any contract that is designed to provide a commitment to stay the course is not renegotiation-proof. After setting a penalty for leader deviations and ensuring that followers are well-coordinated, the board would want to reduce the penalty and allow the leader to take an action that is better adapted to the state θ, thus unravelling the commitment.

More precisely, assume that the board can write a contract with the leader that pays some fraction of the firm's value Π, minus a penalty that is c times the squared deviation of a_L from θ_L, where $c \geq 0$. In other words, the leader's compensation is designed so that the leader's problem is to choose a_L to maximize his expected value of

$$\Pi_L = -\int_j (a_j - a_L)^2 dj - \int_j (a_j - \bar{a})^2 dj - (a_L - \theta)^2 - c(a_L - \theta_L)^2. \qquad (22)$$

The penalty for deviating is paid to the board, and for the sake of generality we also allow for a fraction $\gamma \,\epsilon\, [0, 1]$ of this payment to be lost in the transfer.

In sum, the contracting problem is such that the board essentially chooses a_L and the penalty parameter c to maximize firm value as in equation (2) net of deadweight costs from the transfer to the leader:

$$\max_{a_L, c} \Pi_B = -\int_j (a_j - a_L)^2 dj - \int_j (a_j - \bar{a})^2 dj - (a_L - \theta)^2 + (1-\gamma)\, c(a_L - \theta_L)^2 \quad (23)$$

subject to satisfying the incentive compatibility constraint of the leader:

$$a_L \in \arg\max_a \left[-\int_j (a_j - a)^2 dj - \int_j (a_j - \bar{a})^2 dj - (a - \theta)^2 - c(a - \theta_L)^2 \right]. \quad (24)$$

To show that the solution to this ex-ante contracting problem is not renegotiation-proof, we begin by conjecturing that leaders' and followers' actions are linear functions of their signals, where the linear weights α and β depend on the ex-post and ex-ante contracted penalty payment c. Substituting in $a_L = \alpha\theta_L + (1-\alpha)S_L$ and $a_j = \beta\theta_L + (1-\beta)S_i$ into (22) and using the results in (12)-(14) then yields:

$$E[\Pi_L] = -(\beta - \alpha)^2 - 2(1-\beta)^2\sigma_F^2 - (1-\alpha)^2[2\sigma_L^2 + c(1+\sigma_L^2)] - \alpha^2. \quad (25)$$

The followers' optimization problem is the same here as it was in the previous versions of the model. Namely, followers choose

$$a_i = E_i[a_L] = E_i[\alpha\theta_L + (1-\alpha)S_L].$$

Since $E_i[S_L] = E_i[\theta]$ and ϕ is constructed to be the weight such that $E_i[\theta] = \phi\theta_L + (1-\phi)S_i$, (6) still holds. In other words, we still obtain that

$$\beta = 1 - (1-\phi)(1-\alpha).$$

Substituting for these expression for a_i, a_L and β into Π_B, we obtain the first-order condition for the optimal incentive intensity c by setting the partial derivative of Π_B with respect to c equal to zero. It is straightforward to verify that the optimal incentive intensity c is generally different from zero, as one might expect. However, while such a contractual commitment to stay the course for a rational leader could be superior to appointing a resolute leader, the problem is that such a commitment contract is generally not renegotiation-proof. In fact, as the following result shows, there is no positive penalty that can be sustained when renegotiation is possible.

Proposition 6 *Any positive penalty $c > 0$ is not renegotiation-proof.*

The intuition for this result is that the board has a time-inconsistency problem for the same reason the leader does. The board wants to commit to a positive penalty so that followers can expect that a_L will be close to θ_L, and therefore will coordinate by choosing actions a_i close to θ_L. Such coordinated actions benefit the organization as they reduce the loss due to miscoordination $\int (a_i - \bar{a})^2 di$. However, after followers have chosen their actions and coordination is achieved, the organization would like to reduce c to allow the leader to choose an action closer to the true state so that the cost of maladaptation $(a_L - \theta)^2$ is also reduced. Moreover, the reduction in c also reduces the size of the deadweight loss from the transfer. Thus, by renegotiating the contract, the leader and the board can reduce the maladaptation cost and the deadweight loss and make themselves both better off. If such renegotiation is anticipated, of course, followers will not pay attention to the leader's compensation contract, with the consequence that the organization will suffer from too much mis-coordination under a rational leader. Note also that any contractual commitment over and above the commitment through the leader's resoluteness would be ineffective for the same reason. Followers would anticipate renegotiation of a positive incentive intensity c down to 0, and would therefore simply ignore the leader's incentive compensation.

7 Conclusion

We have proposed a model of leadership and corporate culture in large organizations to analyze a problem that is well known in the management literature, namely the challenge that leaders face in coordinating followers actions over time, and steering the organization's course in a changing environment. We have stripped down the model to four main phases. In a first phase, the leader assesses the environment and defines a mission for the organization. In a second phase, the other members attempt to coordinate around the leader's stated mission. Since followers know that new information may prompt the leader to change the organization's strategy, they use their own private information to forecast the change. Since private information is heterogeneous, forecasts and resulting actions are heterogeneous. This is the coordination problem that the leader is trying to minimize. In a third phase, the leader gets new information, updates his assessment of the state and chooses a direction for the organization. Fourth and last, the state is revealed and leader's and followers' payoffs are realized.

Facilitating coordination among followers is a challenging strategic task for the leader. By its nature, coordination is an activity that creates positive externalities. Thus, followers' private value of coordination is typically lower than the organization's value. The ability of a leader to facilitate coordination is further hindered by his own time-consistency problem. To make matters worse, while the organization would like to offer the leader a contract that allows him to commit to a course of action and thereby achieve coordination, such a contract is generally not renegotiation-proof.

The main message of the paper is that this conundrum can be partially resolved by appointing leaders with the right personality traits, in particular by appointing leaders known for their resoluteness. In our model, resoluteness allows the leader to credibly stick to a course of action because it implies that he won't update the organization's course as much as he rationally should. A more general theme of this paper is one which has been studied extensively in management but is novel in the economics literature: Not only do the organization's structure, objectives, information, communication technology, and environment determine its success, but a leader's behavioral traits and his interaction with followers are also crucial determinants of the organization's ultimate performance.

While leader resoluteness facilitates greater coordination, our model also highlights the dangers of resoluteness in situations where followers have valuable information. The expectation that resolute leaders will not listen to followers suppress valuable follower initiatives. This is what we call a dictatorial corporate culture. Such a culture can persist even after a leader has been replaced, and makes it less likely that leaders can learn what followers know. However, even in situations where it is important for a leader to listen to followers, some degree of leader resoluteness can still play a positive role.

An important implication of our analysis, which we leave for future research, is the question of whether a board of directors might appoint a resolute leader in the early life-cycle of the organization so as to foster greater coordination, to then replace him in later stages of the firm's life-cycle with a rational leader, so as to achieve better adaptation to a changed environment. The same time-consistency problems that undermine leader commitment and that make compensation contracts prone to renegotiation may also lead the board to desire leaders with different characteristics at different points in the firm's life-cycle. If the board has too much discretion it could then undermine the commitment benefits of resolute leaders. Thus, our framework suggests a novel, potentially important benefit of *arms-length corporate governance* and anti hostile-takeover protections: They give sufficient legroom for resolute CEOs to carry out the corporation's strategy.

A Technical Appendix

A.1 Foundations for Preferences

This appendix provides a set of foundations that explain why leaders and followers might have objective functions posited in the main text. Specifically, it attempts to explain why followers would want to choose actions that are well-aligned with the leader's action as a way to maximize the value of their human capital and why firms cannot write contracts with followers that induce them to coordinate optimally. The contracting friction is that firms can commit to current, but not future pay schedules. In other words, contracts must be renegotiation-proof. This is the same friction that the main paper considers in the relationship between a leader and a board in section 3.

A model of product development and production with learning-by-doing. There are two stages in the process of bringing a new good (or service) to market: a development stage and a production stage. It is during the development stage that leaders and followers are uncertain about the nature of the product that will ultimately be sold. Two things are important to the firm's success in this first stage: strategy and execution. The strategic challenge is to develop the right good, the one that will attract the highest consumer demand at the time it is sold. This is challenging because the market and consumer tastes are constantly changing, so new information about the optimal product is arriving during product development. The leader's choice of action a_L represents this choice of what good to develop. The ideal good is not likely to be an extreme good in any dimension, but typically balances some trade-offs. In other words, the leader is searching for an interior optimum, or bliss point. Payoffs with such a bliss point are typically represented as quadratic loss functions where the loss depends on the squared distance between the good chosen and the optimal good. (See e.g. Wilson (1975).) In our model, θ represents this optimal good. Thus, the strategic component of the firm's payoff is $-(a_L - \theta)^2$.

The second challenge in the development stage is to execute the design well. The firm may choose to make exactly the product that the market now demands, but if the product is poorly designed, it may still fail. A good product design must seamlessly integrate many product features. Since no one worker can develop and refine every feature, workers must cooperate in teams to achieve a coherent design. (A large management literature on operation systems considers such problems. Seminal papers include Marschak and Radner (1972) and Radner and Van Zandt (2001).) A typical way to represent such coordination problems is with a quadratic loss for deviating from the average action: $-\int(a_i - \bar{a})^2 di$ (see e.g., Morris and Shin (2002)).

In production (stage 2), workers' efficiency depends on the skill that they have acquired in the product development stage. If the worker spent his time developing exactly the product that was eventually produced, his skill set is ideal. He knows exactly the ins and outs of the product and can produce it with maximum efficiency. If he instead worked on a related technology that is similar to, but not identical to the one actually implemented, then his skills are moderately relevant and he can produce with medium efficiency. In other words, worker's marginal product diminishes as the distance between the action they took a_i and the leader's eventual choice of strategic direction for the firm a_L

grows. An example of such a marginal product is

$$MP_i = m - (a_i - a_L)^2$$

This is an example of workers who are learning-by-doing in the first stage. The convention of using quadratic loss production functions appears in well-known papers on learning-by-doing such as Jovanovic and Nyarko (1996). While the worker's payoff depends on his own marginal product, firm efficiency depends on the average marginal product, $m - \int (a_i - a_L)^2 \, di$.

Putting these three payoffs together yields an objective function for the firm that is $-(a_L - \theta)^2 - \int (a_i - \bar{a})^2 di - \int (a_i - a_L)^2 di$, plus a constant. Maximizing this function is equivalent to maximizing the firm's objective function in the paper's main text.

Wage bargaining. Followers are paid at the beginning of the first stage. Then, after product development takes place, the firm can observe the actions of each follower and pay them again at the start of the second stage. One might wonder why firms cannot simply write contracts that induce followers to coordinate optimally. Since coordination yields firm-specific benefits, it is like acquiring firm-specific capital. Felli and Harris (1996) show that wage bargaining in such a situation can achieve efficient outcomes. The difference is that our firm suffers from a commitment problem. It can promise high future wages and then fire workers who have coordinated well but are unproductive. In such a setting, the efficient contract is not renegotiation-proof.

At the start of the first stage, the firm does not observe the workers' private signals. Since all workers appear identical, they are paid a fixed amount. At the start of stage 2, the firm does observe each worker's marginal productivity. The lack of commitment means that each period, the firm writes a contract that maximizes future expected profit. Profit is maximized by hiring all workers that have a marginal product greater than or equal to their wage. The wage is determined by Nash Bargaining. The outside option for the firm is not hiring the worker and getting 0 marginal product. The outside option for the worker is not working and getting 0 payoff as well. Thus the match with worker i produces surplus MP_i. The Nash bargaining solution is that if all workers have the same, non-zero bargaining weight vis-a-vis the firm, then each worker gets paid a fixed positive fraction of their marginal product: $w_i = \alpha MP_i$.

If each worker chooses actions in stage one to maximize their total wage, they will want to maximize the expected value of a constant minus $\alpha(a_i - a_L)^2$, for $\alpha > 0$. Maximizing this expected wage is equivalent to maximizing the first stage objective function in the model of the main text because the only term in the objective that workers have any influence over is the $(a_i - a_L)^2$ term.

The friction undermining optimal contracting does not have to be a lack of commitment. Another way one might justify the inability of firms to punish non-cooperative workers is to write down a competitive market with multiple firms who produce similar products in the second stage. If other firms can hire away productive workers, then workers will still have an incentive to align a_i with a_L in order to maximize their productivity and obtain a high outside wage offer from a competing firm. Even if their own firm threatens to diminish their future wage for lack of cooperation, they cannot implement that punishment if the follower leaves to work for another employer.

Timing assumptions The assumption that followers have to choose their actions a_i before the leader sees his signal and chooses the final direction for the firm a_L can be relaxed. For example, the second-stage marginal product of the follower might depend on all the actions he has taken between time 0 and time 1: $\int_0^2 -(a_i(t) - a_L)^2 dt$. Even if the follower can adjust his action at every moment in time, he will still want to anticipate what the optimal action will turn out to be so that he can spend as much time as possible developing that optimal skill.

The first order condition of this objective will be $a_i(t)^* = E_i[a_L]$ where $E_i[a_L]$ depends in part on private information. Thus, even when followers can continuously adjust their actions, heterogeneous private information still undermines coordination.

A.2 Payoff Function for Generalized Model

We begin by examining a general model with commitment costs c. The proof also generalizes the leader's initial belief distribution to $N\left(0, \sigma_0^2\right)$ instead of $N(0,1)$. The organization's ex-ante expected payoff has four components:

1. The variance of each follower's action around the leader's,

$$E[-(a_i - a_L)^2] = E[-(\beta\theta_L + (1-\beta)\theta_i - \alpha\theta_L - (1-\alpha)S_L)^2]$$

   Recall that $(1-\beta) = (1-\phi)(1-\alpha)$. Thus,

$$E[-(a_i - a_L)^2] = E[-(\phi(1-\alpha)\theta_L + (1-\phi)(1-\alpha)\theta_i - (1-\alpha)S_L)^2]$$

   Since θ_L, S_i, S_L each have independent signal noise, and the coefficients in the previous expression add up to zero, we can subtract the true θ from each one and then have independent, mean-zero variables that we can take expectations of separately.

$$E[-(a_i - a_L)^2] = E[-(\phi(1-\alpha)(\theta_L - \theta) + (1-\phi)(1-\alpha)(\theta_i - \theta) - (1-\alpha)(S_L - \theta))^2]$$
$$= -\phi^2(1-\alpha)^2 E[(\theta_L - \theta)^2] - (1-\phi)^2(1-\alpha)^2 E[(\theta_i - \theta)^2] - (1-\alpha)^2 E[(S_L - \theta)^2]$$
$$= -(1-\alpha)^2(\phi^2/\sigma_0^{-2} + (1-\phi)^2\sigma_F^2 + \sigma_L^2)$$

   Note that $1 - \phi = \sigma_F^{-2}/(\sigma_0^{-2} + \sigma_F^{-2})$. Therefore,

$$\begin{aligned}(1-\phi)^2\sigma_F^2 &= (1-\phi)\cdot 1/(\sigma_0^{-2} + \sigma_F^{-2}) \\ &= (1-\phi)\phi/\sigma_0^{-2} \\ &= \left(\phi - \phi^2\right)/\sigma_0^{-2}\end{aligned}$$

   Thus,

$$E[-(a_i - a_L)^2] = -(1-\alpha)^2(\phi + \sigma_L^2)\sigma_0^2 - (1-\alpha)^2\left(1 - \sigma_0^2\right)\sigma_L^2$$

2. the dispersion of followers' actions around the mean. Each follower chooses $a_i = \beta\theta_L + (1-\beta)\theta_i$. Since each follower's signal has mean θ and independent noise, the average follower chooses

$\bar{a} = \beta\theta_L + (1-\beta)\theta$.

$$\begin{aligned} \int_j -(a_j - \bar{a})^2 dj &= -(1-\beta)^2 \int (\theta_j - \theta)^2 dj \\ &= -(1-\beta)^2 \sigma_F^2 \end{aligned}$$

Recalling that $(1-\beta) = (1-\phi)(1-\alpha)$, this is equal to $(1-\phi)^2(1-\alpha)^2\sigma_F^2$. Using the definition of ϕ, this is $(1-\alpha)^2\phi(1-\phi)$.

3. the distance of the leader's action from the true state,

$$\begin{aligned} E[-(a_L - \theta)^2] &= -E[(\alpha\theta_L + (1-\alpha)S_L - \theta)^2] \\ &= -\alpha^2 E[(\theta_L - \theta)^2] + (1-\alpha)^2 E[(S_L - \theta)^2] \\ &= -\alpha^2\sigma_0^2 - (1-\alpha)^2\sigma_L^2. \end{aligned}$$

Summing up the three terms, and then the total ex-ante pay-off for the organization is thus

$$E\Pi = -(1-\alpha)^2 \left[\phi(1-\phi) + \phi\sigma_0^2 + 2\sigma_L^2\right] - \alpha^2\sigma_0^2$$

4. the commitment cost

$$\begin{aligned} E[c(1-\gamma)(a_L - \theta_L)^2] &= -c(1-\gamma)E[(\alpha\theta_L + (1-\alpha)S_L - \theta_L)^2] \\ &= c(1-\gamma)(1-\alpha)^2 E[(S_L - \theta - (\theta_L - \theta))^2] \\ &= c(1-\gamma)(1-\alpha)^2(\sigma_L^2 + \sigma_0^2). \end{aligned}$$

Summing the terms and rearranging yields,

$$E\Pi = -(1-\alpha)^2 \left[\phi(2-\phi) + 2\sigma_L^2 - c(1-\gamma)(\sigma_L^2 + \sigma_0^2)\right] - \alpha^2 \tag{26}$$

The leader has an identical objective, except that he has $\gamma = 2$ and he evaluates it under a different probability measure. The leader believes that $E[(\theta_L - \theta)^2] = \sigma_p^2$. Under this measure, expected payoff is

$$E_L[\Pi] = -(1-\alpha)^2 \left[\phi^2\sigma_p^2 + 2\phi(1-\phi) + 2\sigma_L^2 + c(\sigma_L^2 + \sigma_p^2)\right] - \alpha^2\sigma_p^2 \tag{27}$$

A.3 Proof of Proposition 1

For our initial results we set $\sigma_0^2 = 1$. The next step is to determine partial derivative of the organization ex-ante expected payoff with respect to the leader's resoluteness σ_p^{-2}. Note that resoluteness matters because it causes the leader to put a greater weight on his initial information θ_L when forming beliefs and therefore the weight α that the leader puts on θ_L when choosing his optimal action. Note that λ is increasing in σ_p^{-2} and that α is increasing in λ. Therefore, by the chain rule, $\partial\Pi/\partial\sigma_p^{-2}$ has the same sign as $\partial\Pi/\partial\alpha$. Thus, we take a partial derivative of the organization's objective with respect to α:

$$\frac{\partial E\Pi}{\partial\alpha} = 2(1-\alpha)\left[\phi(2-\phi) + 2\sigma_L^2 + c(1-\gamma)(\sigma_L^2 + 1)\right] - 2\alpha$$

This is positive if

$$\phi(2-\phi) + 2\sigma_L^2 + c(1-\gamma)(\sigma_L^2 + \sigma_0^2) > \frac{\alpha}{1-\alpha}$$

With $c = 0$ and a rational leader we have $\sigma_p^2 = 1$, and therefore $\lambda = 1/(1+\sigma_L^{-2})$, $1-\alpha = \sigma_L^{-2}/(2+(1-\phi)\sigma_L^{-2})$, and $\alpha/(1-\alpha) = \phi+2\sigma_L^2$. The above inequality becomes $\phi(2-\phi)+2\sigma_L^2 > \phi+2\sigma_L^2$, which always holds for $\phi < 1$. Thus, if a leader is rational, there is a positive marginal value to the organization of having the leader be more resolute. So, some degree of resoluteness is always optimal.

On the other hand, for an extremely resolute leader who fails to update at all, $\lambda \longrightarrow 1$ and $\alpha \longrightarrow 1$, and the right side of the inequality approaches infinity, so that $\frac{\partial E\Pi}{\partial \alpha} < 0$. As $\frac{\alpha}{1-\alpha}$ is continuous for $\alpha \in (0,1)$, and since the weight α is strictly increasing in the perceived precision σ_p^{-2}, there exists an interior optimal level of resoluteness that maximizes the organization's expected payoff. The first order condition for optimal resoluteness is $\phi(2-\phi) + 2\sigma_L^2 = \frac{\alpha}{1-\alpha}$. Substituting in for α and then for λ, we can rewrite this as

$$\sigma_p^{-1} = \frac{\phi(1-\phi)}{2\sigma_L^2} + 1$$

This proves proposition 1.

A.4 Results: Learning from Followers

This model does not change the payoffs to leaders or followers. Therefore, the first-order conditions are the same. Equations (5) and (11) characterize followers' optimal actions, while (3) and (10) characterize leaders' optimal actions. The only difference is in the definition of the Bayesian updating weight λ. Now, $\lambda = \sigma_p^{-2}/(\sigma_p^{-2} + \sigma_\chi^{-2}(1-\beta)^2)$.

Recall that $(1-\beta) = (1-\alpha)(1-\phi)$. Using this relationship and substituting in the new definition of λ in (10) yields

$$1-\beta = (1-\phi)\frac{\sigma_\chi^{-2}(1-\beta)^2}{2\sigma_p^{-2} + \sigma_\chi^{-2}(1-\beta)^2 + \phi\sigma_\chi^{-2}(1-\beta)^2} \tag{28}$$

Multiplying both sides by the denominator of the fraction and rearranging yields,

$$(1-\beta)\left[(1-\beta)^2\sigma_\chi^{-2}(1+\phi) - (1-\beta)\sigma_\chi^{-2}(1-\phi) + 2\sigma_p^{-2}\right] = 0 \tag{29}$$

This is a cubic equation in $(1-\beta)$. Since when $\beta = 1$, the left side is pre-multiplied by 0, that is one solution to the equation. The other solution comes from setting the term inside the square brackets to zero. Applying the quadratic equation to the term inside the square brackets yields the solution for β in proposition 2. Using the equality $(1-\alpha) = (1-\beta)/(1-\phi)$ yields the solution for α.

Proof of Proposition 2 As before, the endogenous nature of signal precision does not change the payoffs to the organization (15). It just changes the variance of the leader's signal, which is now $\sigma_L = \sigma_\chi^2(1-\beta)^{-2}$. Substituting in for σ_L in (15) and combining terms yields

$$E\Pi = -(1-\alpha)^2(2\phi - \phi^2) - 2\alpha \tag{30}$$

The organization's utility $E\Pi$ is maximized when the weight α satisfies the first order condition

$$\alpha^* = \frac{\phi(2-\phi)}{1+\phi(2-\phi)}. \tag{31}$$

The leader will choose this weight when it corresponds to the solution to his problem as given in proposition 2. Equating the above equation for α with the equation for α in proposition 2 yields

$$\frac{\phi(2-\phi)}{1+\phi(2-\phi)} = 1 - \frac{1-\phi+\sqrt{(1-\phi)^2 - 8(1+\phi)\sigma_p^{-2}\sigma_\chi^2}}{2(1-\phi^2)} \tag{32}$$

The degree of resoluteness σ_p^{-2} that solves this equation is the degree of resoluteness that maximizes the organization's expected utility. We call this the optimal degree of resoluteness in a manager. Rearranging yields

$$2(1-\phi^2)\left(1-\frac{\phi(2-\phi)}{1+\phi(2-\phi)}\right) = 1-\phi+\sqrt{(1-\phi)^2 - 8(1+\phi)\sigma_p^{-2}\sigma_\chi^2}$$

$$\left[2(1-\phi^2)\left(\frac{1}{1+\phi(2-\phi)}\right) - 1 + \phi\right]^2 = (1-\phi)^2 - 8(1+\phi)\sigma_p^{-2}\sigma_\chi^2$$

$$\sigma_p^{-2} = \frac{1}{8(1+\phi)\sigma_\chi^2}\left[(1-\phi)^2 - \left(\frac{2(1-\phi^2)}{1+\phi(2-\phi)} - (1-\phi)\right)^2\right]$$

$$\sigma_p^{-2} = \frac{1}{8(1+\phi)\sigma_\chi^2}\left[(1-\phi)^2 - \left(\frac{2(1-\phi^2)-(1-\phi)(1+\phi(2-\phi))}{1+\phi(2-\phi)}\right)^2\right]$$

$$\sigma_p^{-2} = \frac{1}{8(1+\phi)\sigma_\chi^2}\left[(1-\phi)^2 - \left(\frac{\phi^3-\phi^2+\phi-1}{1+\phi(2-\phi)}\right)^2\right]$$

$$\sigma_p^{-2} = \frac{(1-\phi)^2}{8(1+\phi)\sigma_\chi^2}\left[1 - \left(\frac{1+\phi^2}{1+\phi(2-\phi)}\right)^2\right]$$

$$\sigma_p^{-2} = \frac{(1-\phi)^2}{8(1+\phi)\sigma_\chi^2}\frac{4(1+\phi)\phi(1-\phi)}{(1+\phi(2-\phi))^2}$$

$$\sigma_p^{-2} = \frac{\phi(1-\phi)^3}{2\sigma_\chi^2(1+\phi(2-\phi))^2} \tag{33}$$

Resoluteness is optimal when this optimal degree of resoluteness is above the rational level. In other words, $\sigma_p^{-2} > 1$. This is true when

$$\phi(1-\phi)^3 > 2\sigma_\chi^2(1+\phi(2-\phi))^2$$

$$\sigma_\chi^2 < \frac{1}{2}\frac{\phi(1-\phi)^3}{(1+\phi(2-\phi))^2} \tag{34}$$

In other words, when followers' signals are sufficiently precise, resoluteness is optimal.

Proof of Proposition 4: Ranking Equilibria We return to the more general payoff function specified in Equation (27), with general σ_0^{-2} as this will turn out to be useful for the proof of Proposition 5. However, we switch off the commitment costs by setting $c = 0$.

1. Note that, the dictatorial equilibrium gives expected payoff

$$E\Pi = -(1-\alpha)^2 \left[\phi(1-\phi) + \phi\sigma_0^2 + 2\sigma_L^2\right] - \alpha^2\sigma_0^2$$

Note that for dictatorial equilibrium $\beta = 1$. Hence, $\alpha = 1$ by ,

$$1 - \beta = (1-\alpha)(1-\phi) \tag{35}$$

where $\phi = \phi = \frac{\sigma_0^{-2}}{\sigma_0^{-2} + \sigma_F^{-2}}$, the weight followers put on θ_L. In short, the dictatorial equilibrium gives an expected payoff of $-\sigma_0^2$.

2. Payoff for the lead-by-being-led equilibrium after optimizing over σ_p^2.
Note that in the lead-by-being-led equilibrium, $\sigma_L^2 = \sigma_\chi^2 / (1-\beta)^2$

$$\begin{aligned} E\Pi &= -(1-\alpha)^2 \left[\phi(1-\phi) + \phi\sigma_0^2 + 2\sigma_L^2\right] - \alpha^2\sigma_0^2 \\ &= -(1-\alpha)^2 \left[\phi(1-\phi) + \phi\sigma_0^2 + 2\frac{\sigma_\chi^2}{(1-\beta)^2}\right] - \alpha^2\sigma_0^2 \\ &= -(1-\alpha)^2 \left[\phi(1-\phi) + \phi\sigma_0^2\right] - \frac{2\sigma_\chi^2}{(1-\phi)^2} - \alpha^2\sigma_0^2 \end{aligned}$$

using $(1-\beta) = (1-\alpha)(1-\phi)$. The optimal α is given by the first order condition

$$2(1-\alpha)\left[\phi(1-\phi) + \phi\sigma_0^2\right] - 2\alpha\sigma_0^2 = 0$$

or

$$\alpha^* = \frac{\phi(1-\phi) + \phi\sigma_0^2}{\sigma_0^2 + \phi(2-\phi)}$$

The corresponding optimal σ_p^2 is inside the regions where the lead-by-being-led equilibrium exists. To see this, after plugging in α^* in equation (19), the optimal resoluteness has to satisfy:

$$\sigma_p^{-2} \leq \frac{(1-\phi)^2}{8(1+\phi)\sigma_\chi^2} \tag{36}$$

note that the corresponding $\left(\sigma_p^{-2}\right)^*$ to α^* is

$$\left(\sigma_p^{-2}\right)^* = \frac{\phi(1-\phi)^3}{2\sigma_\chi^2\left(1+2\phi-\phi^2\right)^2}$$

Therefore we need $\left(\sigma_p^{-2}\right)^* \leq \frac{(1-\phi)^2}{8(1+\phi)\sigma_\chi^2}$

$$\frac{\phi(1-\phi)^3}{2\left(1+2\phi-\phi^2\right)^2} \leq \frac{(1-\phi)^2}{8(1+\phi)}$$

or

$$\phi^2(2-\phi) + 1 \geq 0$$

which is automatically satisfied and $\left(\sigma_p^{-2}\right)^*$ is indeed the stable lead-by-being-led equilibrium. Note that, by equation (36), the lead-by-being-led equilibrium exist if and only if

$$\sigma_p^{-2} \leq \frac{\sigma_F^{-2}}{8\sigma_\chi^2\left(2\sigma_0^{-2}+\sigma_F^{-2}\right)\left(\sigma_0^{-2}+\sigma_F^{-2}\right)}$$

To proceed, the optimal expected payoff

$$\begin{aligned}
E\Pi\left(\alpha^*\right) &= -\left[\frac{\sigma_0^2+\phi\left(1-\sigma_0^2\right)}{\sigma_0^2+\phi\left(2-\phi\right)}\right]^2\left[\phi\left(1-\phi\right)+\phi\sigma_0^2\right] \\
&\quad -\frac{2\sigma_\chi^2}{\left(1-\phi\right)^2}-\left[\frac{\phi\left(1-\phi\right)+\phi\sigma_0^2}{\sigma_0^2+\phi\left(2-\phi\right)}\right]^2\sigma_0^2 \\
&= -\left[\frac{1}{\sigma_0^2+\phi\left(2-\phi\right)}\right]^2\left[\phi\left(1-\phi\right)+\phi\sigma_0^2\right] \\
&\quad \left[\sigma_0^2+\phi\left(1-\sigma_0^2\right)+\phi\left(1-\phi\right)+\phi\sigma_0^2\right]-\frac{2\sigma_\chi^2}{\left(1-\phi\right)^2} \\
&= -\frac{\phi\left(1-\phi\right)+\phi\sigma_0^2}{\sigma_0^2+\phi\left(2-\phi\right)}-\frac{2\sigma_\chi^2}{\left(1-\phi\right)^2}
\end{aligned}$$

Provided the lead-by-being-led equilibrium exists, it dominates the dictatorial equilibrium if and only if

$$\frac{\phi\left(1-\phi\right)+\phi\sigma_0^2}{\sigma_0^2+\phi\left(2-\phi\right)}+\frac{2\sigma_\chi^2}{\left(1-\phi\right)^2}\leq\sigma_0^2$$

or

$$\begin{aligned}
\sigma_\chi^2 &\leq \frac{\left[\sigma_0^4+\phi\left(1-\phi\right)\left(\sigma_0^2-1\right)\right]\left(1-\phi\right)^2/2}{\sigma_0^2+\phi\left(2-\phi\right)} \\
&= \frac{\left[\sigma_0^4+\frac{\sigma_F^{-2}\sigma_0^{-2}}{\sigma_0^{-2}+\sigma_F^{-2}}\left(\sigma_0^2-1\right)\right]\left(\frac{\sigma_F^{-2}}{\sigma_0^{-2}+\sigma_F^{-2}}\right)^2/2}{1+\frac{\sigma_0^{-2}}{\sigma_0^{-2}+\sigma_F^{-2}}\frac{\sigma_0^{-2}+2\sigma_F^{-2}}{\sigma_0^{-2}+\sigma_F^{-2}}} \\
&= \frac{\sigma_F^{-2}\left(1-\sigma_0^{-2}\right)+\sigma_0^2\left(1+\sigma_0^2\sigma_F^{-2}\right)}{\sigma_0^{-2}+\sigma_F^{-2}}\frac{\sigma_F^{-4}/2}{\left(\sigma_0^{-2}+\sigma_F^{-2}\right)^2+\sigma_0^{-2}\left(\sigma_0^{-2}+2\sigma_F^{-2}\right)}
\end{aligned}$$

$$\begin{aligned}
&= \frac{\sigma_F^{-2}\left(1-\sigma_0^{-2}\right)+\sigma_0^2\left(1+\sigma_0^2\sigma_F^{-2}\right)}{\sigma_0^{-2}+\sigma_F^{-2}}\frac{\sigma_F^{-4}/2}{\sigma_0^{-4}+2\sigma_0^{-2}\sigma_F^{-2}+\sigma_F^{-4}+\sigma_0^{-4}+2\sigma_0^{-2}\sigma_F^{-2}} \\
&= \frac{\sigma_F^{-2}\left(1-\sigma_0^{-2}\right)+\sigma_0^2\left(1+\sigma_0^2\sigma_F^{-2}\right)}{\sigma_0^{-2}+\sigma_F^{-2}}\frac{\sigma_F^{-4}/2}{\sigma_F^{-4}+4\sigma_0^{-2}\sigma_F^{-2}+2\sigma_0^{-2}} \\
&= \frac{\sigma_F^{-2}\left(1-\sigma_0^{-2}\right)+\sigma_0^2\left(1+\sigma_0^2\sigma_F^{-2}\right)}{\sigma_0^{-2}+\sigma_F^{-2}}\frac{1/2}{1+4\sigma_0^{-2}\sigma_F^2+2\sigma_0^{-2}\sigma_F^4} \\
&= \frac{\sigma_F^{-2}\left(1-\sigma_0^{-2}\right)+\sigma_0^2\left(1+\sigma_0^2\sigma_F^{-2}\right)}{\sigma_0^{-2}+\sigma_F^{-2}}\frac{1/2}{2\left(\sigma_0^{-1}\sigma_F^2+1\right)^2-1}
\end{aligned}$$

Thus, as long as the optimal lead-by-being-led equilibrium exists, which is the case when

$$\sigma_p^{-2} \leq \frac{\sigma_F^{-2}}{8\sigma_\chi^2 \left(2\sigma_0^{-2} + \sigma_F^{-2}\right)\left(\sigma_0^{-2} + \sigma_F^{-2}\right)}$$

it dominates the dictatorial equilibrium if and only if

$$\sigma_\chi^2 \leq \frac{\sigma_0^2 + \left(1 - \sigma_0^{-2} + \sigma_0^4\right)\sigma_F^{-2}}{\sigma_0^{-2} + \sigma_F^{-2}} \frac{1}{4\left(\sigma_0^{-1}\sigma_F^2 + 1\right)^2 - 2} \tag{37}$$

Finally, setting $\sigma_0^2 = 1$ in the above two conditions we obtain the desired result.

Proof of Proposition 5: Confidence versus Competence

Welfare comparison between competent rational and less competent and resolute leader Both leaders have the same belief on the precision of the signal $\sigma_p^{-2} = h$. However, while the competent leader's precision is truly $\sigma_0^{-2} = h$, the less competent (and resolute) leader's precision is only $\sigma_0^{-2} = l < h$. We choose the parameters such that the competent leader ends up in the dictatorial equilibrium, while the less competent (resolute) leader ends up in the lead-by-being-led equilibrium:

$$\frac{\sigma_F^{-2}}{8\sigma_\chi^2 \left(2h + \sigma_F^{-2}\right)\left(h + \sigma_F^{-2}\right)} \leq h \leq \frac{\sigma_F^{-2}}{8\sigma_\chi^2 \left(2l + \sigma_F^{-2}\right)\left(l + \sigma_F^{-2}\right)} \tag{38}$$

The less competent but resolute leader is preferred if and only if conditions (38) and (37) are satisfied. We now establish that there always exists a pair (h, l) such that these two conditions hold simultaneously. Denote two functions

$$f(h, l) = 8\sigma_\chi^2 h \left(2h + \sigma_F^{-2}\right)\left(h + \sigma_F^{-2}\right) - \sigma_F^{-2},$$

and

$$g(h, l) = 8\sigma_\chi^2 h \left(2l + \sigma_F^{-2}\right)\left(l + \sigma_F^{-2}\right) - \sigma_F^{-2},$$

where,

$$\sigma_\chi^2 = \frac{l^{-1} + \left(1 - l + l^{-2}\right)\sigma_F^{-2}}{l + \sigma_F^{-2}} \frac{1}{4\left(\sqrt{l}\sigma_F^2 + 1\right)^2 - 2}.$$

Possible pairs of (h, l) should satisfy $f(h, l) \geq 0$ and $g(h, l) \leq 0$. Note that there always exist a pair (h, l) such that $f(h, l) = g(h, l) = 0$, so that we have a crossing property of line solved from $f(h, l) = 0$ (denoted as $h_f(l)$) and $g(h, l) = 0$(denoted as $h_g(l)$). Since f and h are in C^1, $h_f(l)$ and $h_g(l)$ are in C^1. After the crossing point (h, l), there always exist a open ball that is to the right of $h_f(l)$ and to the left of $h_g(l)$, or equivalently $f(h, l) \geq 0$ and $g(h, l) \leq 0$. This means that we always have an open ball of pairs (h, l) such that (38) and (37) are satisfied.

A.5 Results: Renegotiation-proof contracts

To determine whether a contract is renegotiation-proof, we need to ask whether it maximizes the joint payoffs of the parties involved. In this case, that joint payoff is

$$E[\Pi_L + \Pi_B|\theta_L, S_L] = -2E\{\int_j (a_j - a_L)^2 dj + \int_j (a_j - \bar{a})^2 dj + (a_L - \theta)^2|\theta_L, S_L\} - \gamma c(a_L - \theta_L)^2.$$

Note that this joint payoff is equal to $E[2\Pi_L + (2-\gamma)c(a_L - \theta_L)^2]$. The contract cost c affects payoffs both indirectly, through the leader's choice of a_L and directly through the last term, the deadweight loss in the payoff function. Thus, the first-order condition for the optimal cost c is $dE[\Pi_L + \Pi_B|\theta_L, S_L]/dc = 0$, which is

$$2\frac{\partial E[\Pi_L|\theta_L, S_L]}{\partial a_L}\frac{\partial a_L}{\partial c} + 2\frac{\partial E[\Pi_L|\theta_L, S_L]}{\partial c} + 2(2-\gamma)c(a_L - \theta_L)\frac{\partial a_L}{\partial c} + (2-\gamma)(a_L - \theta_L)^2 = 0$$

The leader chooses his action a_L to maximize $E[\Pi_L|\theta_L, S_L]$. Thus, the leader's first order condition sets $\partial E[\Pi_L|\theta_L, S_L]/\partial a_L = 0$. That ensures the first term is always zero. Furthermore, $2\partial E[\Pi_L|\theta_L, S_L]/\partial c = -2(a_L - \theta_L)^2$. So, any renegotiation-proof contract must satisfy

$$2(2-\gamma)c(a_L - \theta_L)\frac{\partial a_L}{\partial c} - \gamma(a_L - \theta_L)^2 = 0.$$

Since $\alpha < 1$ (see equation 10), $a_L \neq \theta_L$. Next, cancel out the $(a_L - \theta_L)$ term and replace the remaining a_L with $\alpha\theta_L + (1-\alpha)S_L$. Finally, realize that $\partial a_L/\partial c = (\partial\alpha/\partial c)(\theta_L - S_L)$. Making these replacements yields

$$2(2-\gamma)c\frac{\partial\alpha}{\partial c}(\theta_L - S_L) - \gamma(1-\alpha)(S_L - \theta_L) = 0.$$

Canceling out the $(\theta_L - S_L)$ term leaves

$$2(2-\gamma)c\frac{\partial\alpha}{\partial c} + \gamma(1-\alpha) = 0.$$

Since $\alpha < 1$ and $\gamma < 1$, if $\partial\alpha/\partial c \geq 0$, this condition cannot be satisfied with a cost $c > 0$.

To show that $\partial\alpha/\partial c \geq 0$, substitute in $a_L = \alpha\theta_L + (1-\alpha)S_L$ and $a_j = \beta\theta_L + (1-\beta)S_i$ into (22) and using the results in (12)-(14) yields

$$E[\Pi_L] = -(\beta-\alpha)^2 - 2(1-\beta)^2\sigma_F^2 - (1-\alpha)^2[2\sigma_L^2 + c(1+\sigma_L^2)] - \alpha^2. \tag{39}$$

Then, take the first-order condition for the leader's optimal action weight α is:

$$2(\beta-\alpha) + 2(1-\alpha)[2\sigma_L^2 + c(1+\sigma_L^2)] - 2\alpha = 0$$

This tells us that the leader puts weight α on his original signal θ_L where

$$\alpha = \frac{\beta + 2\sigma_L^2 + c(1+\sigma_L^2)}{(2+c)(1+\sigma_L^2)}$$

Finally, differentiating α with respect to c yields

$$\frac{\partial\alpha}{\partial c} = \frac{(2+c)(1+\sigma_L^2)(1+\sigma_L^2) - (\beta + 2\sigma_L^2 + c(1+\sigma_L^2))(1+\sigma_L^2)}{[(2+c)(1+\sigma_L^2)]^2}$$

$$= \frac{(2-\beta)(1-\sigma_L^2)}{[(2+c)(1+\sigma_L^2)]^2}.$$

Since $\beta = (1-\alpha)(1-\phi)$, where $0 \leq \alpha \leq 1$ and $0 \leq \phi \leq 1$, this implies that $\beta \leq 1$. Therefore the partial derivative is positive.

Thus, for all $\gamma > 0$, no non-negative cost is renegotiation-proof. If $\gamma = 0$, meaning that there are no deadweight losses from contracts, then the condition for renegotiation-proofness becomes $(2-\gamma)c(\partial\alpha/\partial c) = 0$. Since $\gamma < 1$ and $\partial\alpha/\partial c \geq 0$, this means that the unique renegotiation-proof cost is $c = 0$.

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