
LEADERSHIP AND INFORMATION*

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Abstract

An organization makes collective decisions through neither markets nor contracts. Instead, rational agents voluntarily choose to follow a leader. In many cases, incentive problems are solved: the unique nondegenerate equilibrium achieves the first best, even though every agent has incentives to free ride. The leader has no special talents but is distinguished by getting exclusive access to information. A crucial feature is that the leader reveals part but not all of her information. It is this maintenance of informational asymmetry that permits achieving the first best.

*Some of the ideas in this article appeared in a working paper (Mana Komai, 2002), which demonstrated the potential benefit to concentrating information in a leader's hands.

Researchers in management and political science believe that leadership is important, but economists rarely study it.¹ When they do, economists tend to focus on *how the leader leads*. In particular, Hermalin (1998) and subsequent researchers ask how a leader with private information about the return to effort can convince her followers that she is not *misleading* them. But there is a prior question: *why should there be a leader who has exclusive access to information?* Why not bypass the leader and simply make information available to everyone in the organization? Much of the recent management literature, indeed, argues against the leader's privileged access to information and in favor of maximizing transparency.

This article sheds light on the reasons for a leader. It takes the contrarian view that concentrating information in the hands of a leader and preventing full revelation can improve efficiency versus a regime of information dispersal. In fact, restricting information to the leader can produce first-best outcomes that would otherwise be unattainable.²

To be sure, this model provides just one piece of the puzzle of leadership. Nevertheless, our results seem consistent with commonplace observations. Moreover, they provide a rationale for leadership, especially *charismatic* leadership (*i.e.*, leadership that does *not* derive from a position of authority).³

¹This is not to say there has been no economic modeling of leadership. Benjamin E. Hermalin (1998; in press), Julio Rotemberg and Garth Saloner (1993; 2000), Hajime Kobayashi and Hideo Suehiro (2005), and Steffen Huck and Pedro Rey Biel (in press) are notable exceptions. Some of the literature on sequential provision of public goods (*e.g.*, Komai, 2002, Lise Vesterlund, 2003, and James Andreoni, 2006) can also be seen as analyzes of strategic leadership.

²Canice Prendergast (1993) presents a quite different model with a related message. He shows that if managers rely on information provided by workers, then workers' incentive to conform means that it may be best to insulate them from managers' other sources of information.

³See Hermalin (1998) for a discussion of the link between a leader's informational advantage and Max Weber's notion of charismatic leadership (Part III, Ch. 9, of Weber's

I. Model

Consider the following variant of Hermalin (1998). A team with $N \geq 2$ members exists. For reasons not modeled here, the team is restricted to equal division of the team's output among the team members. Assume output is $\theta \sum_{n=1}^N e_n$, where $e_n \in \{0, 1\}$ is the effort (*e.g.*, decision to participate) of team member n and θ is the marginal return to effort. Individual efforts are not verifiable and, thus, contracts cannot be written contingent on them. The state, θ , is stochastic, but it is common knowledge that it is drawn from the interval $[0, 1]$ according to the distribution function $F(\cdot)$. Conditional on the state space being an interval, normalizing it to the interval $[0, 1]$ is without loss of generality. Assume $F(\cdot)$ is strictly increasing and continuous on $[0, 1]$.

Let $\bar{\theta}$ denote the (unconditional) expectation of θ . Let

$$\bar{\theta}_{\theta > x} = \frac{1}{1 - F(x)} \int_x^1 \theta dF(\theta).$$

The continuity of $F(\cdot)$ implies $\bar{\theta}_{\theta > x}$ is continuous in x .

A team member's utility is assumed to be

$$u(\theta, e_n, \mathbf{e}_{-n}) = \frac{\theta}{N} \left(\sum_{j=1}^N e_j \right) - ce_n,$$

where \mathbf{e}_{-n} is the vector of actions chosen by the team members other than n , and $c > 0$ is a cost of effort (participation) parameter.

II. Analysis without a Leader

Suppose there is no leader and that the team members are symmetrically informed about θ . Let $\tilde{\theta}$ denote the expectation of θ based on information

Wirtschaft und Gesellschaft [H.H. Gerth and C. Wright Mills, 1946]).

available. Each team member n seeks to maximize

$$\frac{\tilde{\theta}}{N} \left(\sum_{j=1}^N e_j \right) - ce_n,$$

Clearly, in equilibrium, $e_n = 1$ if $\tilde{\theta} \geq Nc$ and $e_n = 0$ otherwise.⁴ Given symmetric information, each team member has a dominant strategy, so that coordination is not an issue and the order in which they choose their efforts is irrelevant.

Observe (as noted, *e.g.*, by Bengt Holmström, 1982) that this equilibrium fails to maximize surplus in either a full-information world (*i.e.*, $\tilde{\theta} = \theta$) or a world of no information (*i.e.*, $\tilde{\theta} = \bar{\theta}$). Maximizing surplus requires that $e_n = 1$ for all n if and only if $\theta \geq c$, but the equilibrium fails to satisfy that for $\tilde{\theta} = \theta$ and for $\tilde{\theta} = \bar{\theta}$. The *expected* welfare loss in a full-information world is readily shown to be

$$N \int_c^{Nc} (\theta - c) dF(\theta);$$

while in the no-information world the *expected* welfare loss is

$$\begin{aligned} & N \int_0^c (c - \theta) dF(\theta) \text{ if } \bar{\theta} \geq Nc \quad \text{or} \\ & N \int_c^1 (\theta - c) dF(\theta) \text{ if } \bar{\theta} < Nc. \end{aligned}$$

III. Analysis with a Leader

Now, suppose one team member, L , is made the leader. Suppose, further that the leader can learn what θ will be, while the other team members remain ignorant of its value. Finally, suppose that the leader can “lead by example”; that is, she can choose her effort, e_L , prior to the rest of the team and that

⁴For convenience, the exposition ignores some ambiguities which appear at nongeneric thresholds (*e.g.*, player n is indifferent between $e_n = 0$ and $e_n = 1$ if $\tilde{\theta} = Nc$).

the rest of the team can observe her choice of effort before committing their effort. Let $\bar{\theta}_{e_L}$ denote the followers' expectation of θ based on the leader's effort, $e_L \in \{0, 1\}$.

Because the leader's action conveys information, it cannot be an equilibrium for the leader to play the strategy $e_L = 1$ if and only if $\theta \geq Nc$. To understand why, observe that if she played such a rule in equilibrium, then $\bar{\theta}_1 > Nc > \bar{\theta}_0$ and the followers would mimic the leader. Consider the state $\theta = Nc - \varepsilon$, where $\varepsilon > 0$ but small. If the leader deviated and chose $e_L = 1$ for such a θ , then her payoff would be

$$Nc - \varepsilon - c > 0,$$

where the right-hand side is her payoff were she to play $e_L = 0$ and the inequality follows if ε is small enough. Consequently, it cannot be an equilibrium strategy for the leader to play the strategy $e_L = 1$ if and only if $\theta \geq Nc$.

In what follows we consider two scenarios.

A. First Scenario: $\bar{\theta}_{\theta > c} \geq Nc$

In this section, we assume that

$$\bar{\theta}_{\theta > c} = \frac{1}{1 - F(c)} \int_c^1 \theta dF(\theta) \geq Nc. \quad (1)$$

This inequality would be satisfied if, for example, $F(\cdot)$ were the uniform distribution and $c \leq \frac{1}{2N-1}$.

Under this assumption, there exists an equilibrium that achieves full efficiency given (1); that is, one in which $e_n = 1$ if and only if $\theta \geq c$. The equilibrium strategies are that the leader plays $e_L = 1$ if $\theta \geq c$ and $e_L = 0$ if $\theta < c$ and the followers mimic the leader. To see that this an equilibrium,

observe that if the followers will mimic her, the leader plays $e_L = 1$ if and only if

$$\frac{\theta}{N} \sum_{n=1}^N 1 - c = \theta - c \geq 0.$$

Given this rule, $\bar{\theta}_0 < c$ and $\bar{\theta}_1 = \bar{\theta}_{\theta > c} \geq Nc$. Hence, mimicry is a best response for the followers. To summarize:

Proposition 1 *If the expected value of the productivity parameter θ conditional on $\theta \geq c$ is great enough (specifically, if (1) holds), then leading by example leads to a fully efficient equilibrium.*

B. Second Scenario: $\bar{\theta}_{\theta > c} < Nc$

If (1) does not hold, then a mixed-strategy equilibrium exists provided $Nc < 1$, a condition we henceforth impose.⁵ To derive this equilibrium, begin by defining $\hat{\theta}$ as the value of θ that solves

$$\frac{1}{1 - F(\hat{\theta})} \int_{\hat{\theta}}^1 x dF(x) = Nc.$$

Because the conditional expectation is continuous, (1) doesn't hold, and $Nc < 1$, this equation has a solution satisfying $c < \hat{\theta} < Nc$. Define p such that

$$\frac{\hat{\theta}}{N} \sum_{j=0}^{N-1} \binom{N-1}{j} p^j (1-p)^{N-1-j} (j+1) = \hat{\theta} \frac{1 + (N-1)p}{N} = c. \quad (2)$$

Observe

$$p = \frac{Nc - \hat{\theta}}{(N-1)\hat{\theta}} \in (0, 1).$$

⁵If $Nc > 1$, then the only equilibrium is one in which all team members (leader included) choose $e = 0$. If $Nc = 1$, then the only equilibria are those in which the followers choose $e = 0$ regardless of the leader's action, the leader plays $e_L = 0$ if $\theta < 1$, and she plays $e = 1$ with probability σ , $\sigma \in [0, 1]$ if $\theta = 1$.

The equilibrium is that the leader chooses $e_L = 1$ if and only if $\theta \geq \hat{\theta}$. Given their equilibrium inference if $e_L = 1$, the followers are indifferent between $e = 0$ and $e = 1$. They are, therefore, willing to mix between the two. In this case, let each follower's strategy be to play $e = 1$ with probability p . The followers rationally mimic $e_L = 0$ because $\bar{\theta}_0 < Nc$. Given this follower behavior, expression (2) implies that it is a best response for the leader to choose $e_L = 1$ if and only if $\theta \geq \hat{\theta}$.

To assess the expected welfare properties of this equilibrium, observe expected total effort when $\theta \geq \hat{\theta}$ is

$$1 + (N - 1)p = 1 + \frac{Nc}{\hat{\theta}} - 1 = N\frac{c}{\hat{\theta}}.$$

Observe it is *as if* each team member expends $c/\hat{\theta} < 1$ unit of effort.

It follows, therefore, that expected surplus is

$$N\frac{c}{\hat{\theta}} \int_{\hat{\theta}}^1 (\theta - c) dF(\theta). \quad (3)$$

Compared to surplus under full information,

$$N \int_{Nc}^1 (\theta - c) dF(\theta), \quad (4)$$

there are two differences. There is productive effort for a wider range of productivity parameters (*i.e.*, for $\theta \in [\hat{\theta}, Nc)$), but there is less than the optimal level of effort at some levels of productivity (*i.e.*, effort per team member is $c/\hat{\theta}$ rather than one for $\theta \geq Nc$). *A priori* it cannot be known which factor dominates.

As an example, let $F(\cdot)$ be the uniform distribution. Given N , the mixed-strategy equilibrium exists for $c \in (\frac{1}{2N-1}, \frac{1}{N})$ (from $Nc < 1$ and the violation of (1)). Given N , the subset of this interval for which leadership is superior to full information (*i.e.*, for which (3) exceeds (4)) is given by

$$c \in \left(\frac{1}{2N-1}, \frac{\sqrt{20 - 28N + 9N^2} - N - 2}{2(4 - 8N + 2N^2)} \right).^6$$

For $N \geq 3$, the upper limit of this interval lies in the interior of $(\frac{1}{2N-1}, \frac{1}{N})$; that is, for $N \geq 3$, there are parameter values (low values of c) such that leadership is more efficient and parameters values (high values of c) such that full information is more efficient when the equilibrium under leadership is the mixed-strategy equilibrium.

IV. Discussion

The contribution of this article relative to Hermalin (1998) is as follows: In Hermalin (1998), the initial asymmetry of information has no effect ultimately on the followers' effort.⁷ In contrast, here, by preventing full revelation of the state, the followers are induced to work harder—at least in some states—than they would were the leader's action to reveal the state fully. In turn, this creates a potential motive for centralizing information in the hands of a single leader; a motive that is not present in Hermalin (1998). Except when she would lead by example, and hence signaling creates additional work incentives for the leader, there is no reason in Hermalin (1998) to restrict information to a single person; welfare would be essentially the same whether just the leader learned the information or everyone in the team learned it.⁸ Because, here, there can be a *benefit* to keeping information from the followers, a group could have a motive to create a leadership position and to limit how much information the leader can credibly communicate to the

⁶The uniform distribution implies that $\hat{\theta} = 2Nc - 1$. Then, for $c \in (\frac{1}{2N-1}, \frac{1}{N})$, (3) exceeds (4) if $1 - (N + 2)c - (4 - 8N + 2N^2)c^2 > 0$. The upper bound of the interval is a root of this polynomial.

⁷This assumes the shares are not optimally adjusted; but even adjusting the shares still exploits the leader's signaling incentives and creates no changes in the incentives of the followers *given* their shares.

⁸To be precise, welfare would be the same if there were a signaling mechanism for the leader (*e.g.*, leading by sacrifice) that neither caused her to work harder nor resulted in the destruction of resources (*e.g.*, her sacrifice is a transfer to her followers).

rest of the group.⁹

Of course, as section III.B reveals, it is not always the case that centralizing information is superior to dissemination. A potential research agenda is to understand better when centralized information is superior to decentralized information within organizations. Jordi Blanes i Vidal and Marc Möller (2005) also consider this question. Employing a far different model than do we, they find an alternative motive for dissemination, namely that a self-confident leader is more productive when information is widely disseminated than when it is centralized. But like us, they also derive conditions under which centralization of information is superior.

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⁹Given a broader class of payoff functions, which has the present payoff function $u(\cdot)$ on its boundary, Komai and Mark Stegeman (2004) show that assigning information to a single leader can simultaneously solve problems of coordination and free riding. They also show that if the original population of players has heterogeneous costs of participation, then the best leader is someone who has average or higher-than-average costs.

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