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Economics of leadership and hierarchy ☆

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ABSTRACT

This paper explores leadership within hierarchical organizations. For each hierarchy, I consider a dynamic signaling game in which each player observes only the actions of his direct superiors before choosing his action. At the top of the hierarchy are the leaders, who learn the state from nature. The hierarchy controls the flow of information and the timing of the game, and determines the equilibrium output and welfare. I show that the welfare-optimal hierarchy is the chain, because it maximizes the incentive of players to "lead by example" for their subordinates. The chain remains optimal even in the presence of verifiable or unverifiable costly information acquisition by the leaders.

1. Introduction

This paper studies the role of leadership and information flow in the design of organizations. I develop a model of public good provision in teams with asymmetric information. Team members can engage in costly signaling of their information through their choice of effort to invest in the joint project. Leadership positions within the organization are distinguished by differential access to information: a team member's effort is observed only by her direct subordinates. The flow of information is thus endogenous to the design of the organization, and becomes the crucial channel through with the organizational design affects team output. I characterize the optimal organizational design in this model, and show that the optimal hierarchy provides important welfare gains over the standard team output and other methods of addressing the classic problem of moral hazard in teams (Holmstrom, 1982).

A central building block for my work is the idea of leading by example, introduced in the seminal work of Hermalin (1998). Hermalin (1998) also starts from the issue of free-riding in team production problems, and assumes that one team member knows the true marginal return to effort. In the standard team model, the informed member cannot credibly signal her information, thus it is useless. Hermalin's fundamental insight is that if the informed member can move first, however,

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then she can "lead by example": if she chooses her effort first and this is observable to all other team members, then her investment in the project provides a credible costly signal. Hermalin (1998) shows that such leading by example, by exploiting this information channel, yields higher welfare in equilibrium than the standard team production (even in the symmetric information case). Thus Hermalin (1998) identifies an important aspect of leadership in information transmission and incentive provision that can mitigate free-riding in teams. This insight has been at the heart of a sizable and growing literature on the economics of leadership.

An important limitation to the analysis in Hermalin (1998) is that the information channels and organizational structure are essentially taken to be exogenous. One team member is exogenously assumed to be informed about the true state, thus have "leadership potential." The leader's only choice is whether to move first, thereby signaling to all of the other members simultaneously. Thus the organizational structure is exogenously given: a two-tier hierarchy with the leader at the top and all other members on the second tier. If the signaling role of a leader is important, however, then information flows should be an important component in the endogenous design of organizations. For example, consider a three-person team in which one member learns the true state. Hermalin (1998) results show that team output increases if the informed member invests first and reveals her investment to the other members, who then choose their investments simultaneously. Is this the optimal organizational design, however? Hermalin (1998) and the substantial work that followed do not address this important question. For example, is it better to have information flow through a "middle manager," that is, to have a three-tier hierarchy in which a single member observes the leader's investment, chooses his investment and then in turn reveals only his investment to the third member? Or is it better to have two leaders, each of whom signals to the third member?

To answer these questions, I develop a general model with any number of workers and general sharing rule and disutility function in section 2. For simplicity, I focus on simple hierarchies, in which every player who is not the leader has a unique direct predecessor. In a simple hierarchy, the dynamic signaling game I define always has a unique separating equilibrium. Given the equilibrium characterization, I can show that the chain is optimal in an arbitrarily large team. The optimality of the chain follows from the observation that by transforming any hierarchy into a chain, I obtain the maximal number of stages of signaling, as the set of followers for each member is larger in the chain than in the original hierarchy. For fixed shares, the chain gives every member the largest possible signaling incentive, hence motivates the highest efforts. Combing these observations shows the optimality of the chain among simple hierarchies.

I then extend the model to allow for endogenous information acquisition by the leaders. If research effort is verifiable, then the optimal hierarchy is still the chain because the chain generates the highest social return to information. Even if research effort is not verifiable, the chain remains optimal because the leader's incentive for information acquisition now depends monotonically on her equilibrium effort, which is higher in the chain than in any other hierarchy. Thus the leader acquires more accurate information in equilibrium, even when research effort is not verifiable.

While I use the language of leaders and followers throughout the paper, following Hermalin (1998) and subsequent work, the results developed here can be applied to a wide variety of team production problems with asymmetric information. In many applications, the informed players who move first in the optimal team hierarchy need not literally be team "leaders" or CEOs; in many settings it might be natural for more informed members to be lower-level workers more familiar with the production technology or better able to collect information. In such problems, these results show that the optimal arrangement of the team is a chain originating with the informed member, with each member signaling via his effort to a subsequent member.

The assumption that the designer can tightly control the paths through which information flows within an organization may sound too strong at first glance. How can the designer stop the agent from communicating with remote links in the hierarchy? Here we need to clarify the contrast between formal and informal communication in organizations.[1] The information obtained from a direct link in the hierarchy is typically formal and is based on reports and documentation, whereas the one based on more remote links is prone to be less reliable (the more so the further away the agent is in the network). Arguably, rumors would play much greater role for the case of informal communication. But there are many reasons why people focus on the more reliable information while making decisions in organizations, either because they need hard grounds to justify their behavior to themselves and to others, or because they have limited attention thus are not able to process too much information. Moreover bypassing the immediate leadership is often not encouraged, if not fully prohibited in many organizations. Last, in Radner (1993)'s classical papers on hierarchy design, he also makes a similar assumption on the rigidity of the flow of information in organizations, although the difference is that the direct of the flow of information is bottom-up in Radner (1993) (an agent reports his information to his direct supervisor) whereas here it's top-down (a member reveals his information to his direct subordinator).

1.1. Related literature

This paper is related to two strands of literature, one focusing on the economics of leadership, and the other focusing on determinants of organizational design.

[1] I thank the advisory editor and a referee for suggesting this line of reasoning.