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DIVERSITY IN ORGANIZATIONS

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ABSTRACT

Diversity in Organizations*

This Paper develops a theory of diversity in work groups within organizations. Diversity is determined by the group members' dfferences in backgrounds. Diverse teams possess more information than homogeneous ones. If beliefs and preferences are expressed openly, diverse teams can reach better decisions. However, due to their members' heterogeneous backgrounds diverse teams are more prone to conflict. The Paper shows that the relative performance of heterogeneous and homogeneous groups depends on the leader's authority to make personnel decisions, especially whether the leader can replace team members. A number of implications follow regarding the shaping and composition of organizations.

JEL Classification: D23, L22
Keywords: authority, conflicts, diversity, economics of organizations

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NON-TECHNICAL SUMMARY

Firms are often organized in teams. Teams can be composed of diverse people, or people with the same background and experiences. In this paper we study why some firms place emphasis on organization diversity, while other companies do not, and why some projects and tasks are done by homogeneous teams, while others seem to work better when the teams are heterogeneous? Our focus is not primarily on how rules determine individuals' behaviour, rather how the rules that govern the relationships between the members affect the composition of an organization. We conclude that differences in membership must be considered in light of the mechanisms of authority used and that these are related to the organization's demography.

Individuals with similar personal biographies generally have more similar experiences than those with different backgrounds. On average, the information available to members of diverse teams is less correlated than that available to members of more homogeneous teams. Consequently, diverse teams can improve the decision-making process. However, the benefit of richer information often comes with conflict, due to the heterogeneity of backgrounds. When forming teams, managers need to weigh the benefits of having additional information against the higher propensity for disagreement.

Conflicts can be resolved by exercising authority. However, the threat of replacement can originate strategic behaviour on the part of members of a team. To protect their careers, individuals may choose not to reveal their information when speaking out increases the likelihood of being penalized. As a result, it is possible to have diversity and conformity simultaneously. This is problematic in high stakes situations, because these would benefit more from diverse teams.

We show that in addition to authority several other factors affect the extent of group diversity: the uncertainty of the environment and the distance the team leader has from the issues being decided. A competent and informed leader places more value in the effort to implement choices made than on having additional informational input from other group members. In some instances subordinates find it more difficult to work for an informed leader than for a more distant and less informed one. Our results imply that the formal authority that goes with hierarchy combined with strong leadership skills stifles diversity in organizations.

1 Introduction

Who are the people that constitute an organization? Two ads that recently appeared in the press highlight the importance of diversity to the successful performance of firms. The first, by Goldman Sachs in *The Economist* (February 2000), proclaimed in bold letters: "The good news is great minds don't think alike", followed by the quote: "... we believe the best ideas come from a room full of differing opinions. With our substantial global resources, we're able to bring different minds and disciplines to the table. The result is out of the box thinking instead of conventional solutions." Achieving innovative thinking in a diverse working environment is also what Bell Atlantic promoted in the *New York Times* (January 17, 2000) with the quote: "At Bell Atlantic we believe in the power of diversity and the power of the individual. It is individual thinking from a diverse group of people working together that provides fresh new ideas and gives us a competitive edge." Why do firms such as Goldman Sachs and Bell Atlantic place emphasis on organization diversity, while other companies do not?[1] At a more general level, why are some projects and tasks done by homogeneous teams while others seem to work better when the teams are heterogeneous?

In this paper we develop a framework to answer these questions. To do this we consider organizations as systems of individuals performing tasks with the aim of achieving defined objectives, who relate to each other in specific ways. We wish to make clear the distinction between focusing on the rules that govern the interactions between members of an organization and focusing on the role played by the individuals in shaping these relationships. Aghion and Tirole (1997), for example, are interested in analyzing how the allocation of authority affects the behavior of the members in a hierarchy. In contrast to other papers in the economics literature devoted to the study of organizations, our focus is not primarily on how rules determine behavior. Instead, we look at how the rules that govern the relationships between the members affect the composition of organizations. We conclude that differences in the membership suit differently the mechanisms of authority in an organization, and therefore the rules governing the members' interactions affect the demography of an organization. We believe that this offers an explanation to the composition and the design of organizations, specifically to the varying degree of similarity that characterizes the members hired and the rules

[1] For example, Eisenhardt et al. (1997) find significant differences in the degree of diversity of the management boards of twelve technology-based companies in silicon valley.

followed.

Individuals with similar personal biographies generally enjoy more similar experiences than those with different backgrounds. On average, the information available to members of diverse groups is less correlated than that available to members of more homogeneous groups. Consequently, group members with different characteristics can contribute to improve the decision-making process provided that the information is easily exchanged. However, the benefit of a richer information set can come with a cost, because more diverse teams are also more prone to conflict, due to their members' heterogeneous backgrounds. Different life experiences are usually associated with diverse perspectives, and when people engage in discussion with others who are different from themselves, they are more likely to experience conflicts (see for example Eisenhardt et al., 1997). When those in charge of carrying out the decisions do not agree with those making them, the motivation to work hard decreases, and profitability suffers. Therefore, when forming a team of people with different backgrounds it is important to weigh the benefits of having additional information to the decision-making process against the higher propensity for disagreement.

Conflicts can be resolved by exercising authority, for example, by replacing or marginalizing dissenting elements. The threat of replacement, however, can create serious obstacles to the exchange of information among members of a group. To defend their position individuals may choose to strategically withhold relevant information when by speaking out they face the risk of being penalized. As a result, it is possible to have diversity and conformity simultaneously, because those who could speak out may refrain from doing so if they fear that this may harm their careers. The advantage of a diverse team over a homogeneous one then becomes less evident. And since silence may not avoid poor decisions, which is more problematic when the stakes are high, it is possible that when diversity is more beneficial, diverse groups actually perform worse. In such situations, it is optimal to either form a homogeneous team or to forbid the leader from firing an other team member or push him aside. The latter policy restores the member's incentive to disclose information and improves decision quality.

We show that, in addition to authority, several other factors affect the extent of group diversity: for example, the uncertainty of the environment and the distance of the team leader from the issue being decided.

When replacement is impossible a better informed decision has to be traded off against

a higher likelihood of conflict. Teams of members with less correlated pieces of information are particularly suitable to deal with highly uncertain and dynamic environments. In these situations, every input provided by heterogeneous members is valuable. The leader's familiarity with the issues being resolved also matters because a very well informed leader can afford to ignore other team members' recommendations when reaching a decision. For such a leader, the subordinates' effort in implementing a project of her choice is more important than additional input offered during the decision process. And since differences between members are in general associated with a higher likelihood of conflict, we show that in some instances it is more difficult for a subordinate to work for a better-informed leader than for a more distant, less-informed one. Our results imply that the authority that goes with hierarchy combined with strong leadership stifles diversity in organizations. This seems consistent with many CEO profiles that appear in the press and explains both the composition of management boards and the high degree of conformity that exists in corporations' hierarchies. In contrast, a poorly informed leader relies heavily on the informational input of the other team members. Since in this case the problem of overlapping information between her and fellow team members is insignificant, a poorly informed leader will also tend to form a homogeneous team. The highest inclination to create a diverse team occurs for those leaders who are fairly well informed but are still open to advice in the sense that they make frequent use of inputs from other team members.

When the team leader can replace team members, the main critical aspect of a diverse team is not the possibility of an open conflict anymore, since an open conflict can be eliminated through replacement. Rather, it is to ensure the flow of information to the team leader, given that information disclosure can lead to firing. The influence of the various factors on diversity are qualitatively different since they affect the aspects of conflict and communication in differently.

The paper is organized as follows: The next section reviews the literature related to the topic of the paper. Section 3 contains the basic model and identifies the trade-off between a better informed and diverse team and a more homogeneous and harmonious team. Section 4 introduces the possibility of firing to resolve conflicts and section 5 analyzes how this possibility affects information flow and recruiting decisions. Section 6 presents empirical predictions of our theory and summarizes the paper.

2 Related literature

Our paper is related to the literatures in organization science and economics of organizations. Since the eighties, organization science has displayed an interest in the study of demography and the design of teams. This interest is in part due to the fact that organizations rely on work groups to prepare and implement strategic decisions. Substantial empirical research has uncovered that the composition of teams has considerable influence on a number of important outcomes. For example, the demographic composition of teams has been related to turnover (Pfeffer 1983, and Wagner et al., 1984), to the incidence of disputes (Amason, 1996), to team innovativeness (Ancona and Caldwell, 1992), to the decision-making process in top management teams (Eisenhardt et al., 1997) and to the strategic reorientation of firms (Wiersema and Bantel, 1992). All these studies seem to imply that the profitability of organizations depends on the dynamic interaction occurring between and within work groups and how this interaction is shaped by the design and diversity of work groups. These studies are, however, often exploratory in nature.

In the economics literature there are few papers which explicitly address the issue of diversity of teams in organizations. Cornell and Welch (1996) argue that employers exhibit a tendency to hire employees with their own cultural background, since it is easier to assess the quality of those applicants. Athey, Avery and Zemsky (1994) present a model in which hiring and promotion are not based solely on initial talent but also on the productivity of mentoring, and argue that this is easier when the manager and the trainee have common backgrounds. In contrast to these papers, our model explicitly considers how diverse teams improve the information required to select a project. Those papers also overlook the severity of agency problems which arise in heterogeneous work groups. Friebel and Raith (1996) study the recruiting decision in an agency context when the recruiter and the recruitee compete for the same position. If their common superior learns about the agents' abilities, the recruiter has an incentive to hire a person of low quality in order to protect her position. In contrast to this approach, our analysis considers agency problems *after* hiring occurs.

Our work is also part of a new literature on corporate culture. Carrilo and Gromb (1996), for example, study how culture takes root and disseminates in organizations. Like us, Carrilo and Gromb recognize that diversity confers an advantage when dealing with dynamic economic conditions, and that group members interact better if they

share the same culture. However, they do not consider incentive problems an issue important in our approach.

The communication part of our analysis is common to that in Prendergast (1993), who provides an in-depth analysis of communication in hierarchies when subordinates are subject to subjective performance evaluation. Prendergast shows that subordinates bias their reports towards what they think the superior wants to hear, in order to be evaluated favorably. In our paper we demonstrate that the incentives to communicate available information truthfully can be hampered even when the subordinates' abilities are known. Withholding valuable information can be optimal when differences of interest exist and communication indicates the preferences of the subordinate.

Since in our model diversity is related to authority, our work intertwines with research on the allocation of authority. As in Aghion and Tirole (1997) we do recognize the difference between formal authority and power. Despite lower rank, a subordinate can force a superior to change a decision even when the superior knows that the best course of action is being abandoned. The reason for this lies in the subordinate's ability to affect the profitability of the project. Whereas the power of the subordinate comes from the threat of low effort in our model, in Aghion and Tirole real authority is derived from being better informed. De Bijl (1994) also studies how strategic delegation of authority creates incentives to acquire information and finds, as we do here, that delegation can benefit the superior because the subordinate works hard when he is allowed to implement his preferred project. Neither Aghion and Tirole nor De Bijl consider the possibility that the superior has to replace the subordinate and how different levels of authority relate to diversity.

3 A model of recruiting in organizations

Setup

An organization composed of two risk neutral agents, one superior, B, and one subordinate, A, must choose between two mutually exclusive projects, $j = 1, 2$. One project is a high-return project and has a gross return to B of $\kappa + \eta$, and the other is a low return project and has a return $\kappa - \eta$, $\kappa, \eta > 0$. Ex ante none of the agents knows which project has a good potential. The unconditional probability is 0.5 for each project. Once one project is selected, implementation follows.

Before deciding on the project, the superior collects information costlessly, which leads to the following: with probability αq, $0 < \alpha q < 1$, $q \in (0,1)$, $\alpha > 0$, B learns perfectly which project has returns $\kappa + \eta$, and with probability $1 - \alpha q$, B does not obtain an informative signal. The subordinate is hired to gather information which might be used in choosing the project, as well as to work on implementing the selected project. The implementation phase requires effort, e, on the part of the subordinate, with $e \in [0,1]$ representing the probability of a successful implementation. If the project is not successfully implemented, it returns zero. The reservation utility of the subordinate is normalized to 0. While working on the selected project, A incurs a nonmonetary cost given by an increasing and convex function $C(e)$. A can obtain nonmonetary benefits, b, from the implementation of a project and zero otherwise. One of the projects yields a benefit of $b_+ > 0$ and the other a benefit, $b_- \in (0, b_+)$. Ex ante, none of the agents knows which of the projects may yield a benefit b_+. The prior is 0.5 for each project. A collects information costlessly which leads to the following: with probability $q \in (0,1)$, he obtains a signal which perfectly reveals to him the project that produces the higher nonmonetary benefit to him. With probability $1 - q$, the subordinate does not obtain an informative signal. One possible interpretation for q is that it measures the degree of uncertainty in the environment. Firms and industries operating in stable environments are associated with a large q, while those in uncertain and dynamic environments are associated with a small q. Parameter α, affecting B's signal quality but not A's, characterizes a difference in ability of the superior over the subordinate to generate information. There are various factors that could explain an advantage or disadvantage of B. For example, B could be more or less knowledgeable about the decision. α is also related to the tasks the superior is assigned. If B's other tasks are very detached from the decision being made, α should be smaller than when the superior's other tasks are closely related to the present decision.

The signal observed by one agent is also informative to the other agent, because when an informative signal is transmitted the receiving agent can infer which of the projects the sender prefers. If one agent gets an informative signal on his own, he learns about his preference directly from that, otherwise he can learn it from communicating with the other agent. Consider, for example, that A obtains an informative signal and communicates it to B. This allows B to identify both the high-return project and also the project that A prefers. In addition, when one of the agents obtains a signal from the other agent he can report that he has received on his own a similar signal. This means that one agent can conveniently hide his private signal without the other agent

knowing it.

In the communication game, subordinate A is asked to communicate his signal to B. This could happen before or after B talks. The order of the steps in the communication sequence matters because it can change the incentives to report the signals received. If B talks first, A may decide to not report the signal observed and avoid revealing a different preferred project, when in some cases he would report it had he been required to talk first. However, B may see an advantage in talking, when A does not get a private signal and has no incentive to hide his preferred project. Concretely, we assume that there are sufficiently many rounds of communication to ensure that all information can be exchanged.

We assume that both the superior's and the subordinate's benefits are noncontractible. The subordinate's wage is then a constant, which is assumed to be zero. The subordinate's expected utility is given by $u(e) = E[b] \cdot e - C(e)$. The function $C(e)$ has a form that leads to an interior solution, $e^* \in (0,1)$. A necessary and sufficient condition for an interior solution is $E[b] = C'(e)$. Although this does not qualitatively affect the results, we assume for simplicity that the function of optimal effort is convex in the expected level of benefits between b_- and b_+.[2] When B selects the project that A prefers, A's optimal effort choice satisfies $b_+ = C'(e)$. In what follows, this effort level is denoted by e_+ and A's corresponding utility level by u_+. If B's selected project does not coincide with A's, A exerts a low effort, $b_- = C'(e)$, which is denoted by e_-, and his corresponding utility level by $u_- < u_+$. If A does not know which project he prefers, his effort level equals e_0 determined from $\frac{b_+ + b_-}{2} = C'(e)$. His utility level in this situation is denoted by $u_0 \in (u_-, u_+)$.

B can recruit a subordinate of type A_d or a subordinate of type A_i. If a subordinate of type A_d is hired, his preferred project coincides with that of B with probability one. Also, subordinate A_d privately obtains an informative signal only if B obtains one and the realizations of the signals are identical. The interests of an A_i-type subordinate and B, however, coincide only with probability $r \in [0.5, 1)$. A $r = 0.5$ means that the preferred projects to A_i and B are independent. The larger the r, the more aligned the interests of B and A_i are. Subordinate A_i privately obtains an informative signal

[2]This implies that $C(e)$ is not "too" convex. As will become clear later, this assumption has the intuitive implication that the expected effort chosen by a subordinate is not lowered as he becomes more informed about the benefits associated with a project.

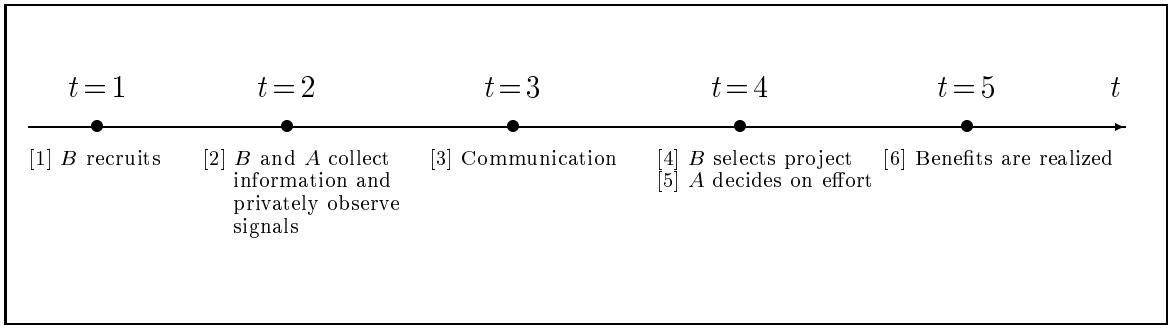

Figure 1: Timing of decisions

which is independent of B's signal. These differences between A_d and A_i characterize B's choice between a subordinate similar to her or different from her. Differences and similarities can be manifested in several dimensions: for example, A_d is someone recruited from within the organization and A_i from the external labor market, or A_d is an agent with a long tenure in the organization while A_i is a recent hire, or A_d has personal, educational or professional experiences similar to those of the superior and A_i has a different background. If A_d is hired, A_d and B form what we call a homogeneous team. If, on the other hand, A_i is recruited, A_i and B form a heterogeneous team.

The timing of the decisions is illustrated in Figure 1.

All parameters of the model are assumed to be common knowledge. In our analysis we proceed backwards. When the superior is indifferent between the two types of subordinates, A_i is hired. When one agent is indifferent between communicating and not communicating he or she is assumed to communicate.

Analysis

A first result of the described setup states that when the superior has information about her preferred project, she communicates her signal to the subordinate. By doing so, the superior expects to have a positive impact on the subordinate's effort decision, which may lead to a larger utility for both agents.[3] The subordinate also communicates his signal to the superior. By doing so, he influences the probability that his favored project is selected by the superior.[4]

[3]The result requires the convexity of the effort function. If the effort function is strictly concave, there exist admissible values for r such that B prefers to not disclose her information to an A_i subordinate.

[4]In contrast to Milgrom (1988), the subordinate's influence is welcomed by the superior, since it

Lemma 1 *At the time the project is selected, all information has been exchanged.*

Proof. Since no conflicts of interest can occur between B and A_d , both parties do not have an incentive to not disclose any information.

Consider now when an A_i type is employed. Without loss of generality we will prove the claim for the case in which B selects the high-return project, if she obtained an informative signal. She may only find it superior to decide otherwise if doing so increases both her and A_i's utility.

Suppose that B received an informative signal. If A_i communicates his information, he will not reduce his utility because this does not change B's decision. Suppose instead that B does not have information. If A_i does not communicate his expected utility is $\frac{1}{2}(u_+ + u_-)$, and if A_i communicates his expected utility is $ru_+ + (1-r)u_- \geq \frac{1}{2}(u_+ + u_-)$. Thus, A_i reveals his information. Let us now turn to B. B's communication only matters if it alters A_i's effort level. This is the case only if A_i did not obtain information previously. So we can restrict the analysis to this situation. A_i's expected effort when B reveals her information is $re_+ + (1-r)e_-$, since interests are aligned with probability r and A_i obtains a signal with the message received. If B does not communicate, the expected effort level depends on the probability that A_i assigns to the case that B is informed. Denote this probability by $p \in [0,1]$. Then A_i's effort is determined by $[rp + 0.5(1-p)]b_+ + [(1-r)p + 0.5(1-p)]b_- = C'(e)$ which by the convexity of the effort function does not exceed $re_+ + (1-r)e_-$ for any $p \in [0,1]$. Thus, B can always achieve at least the same utility when she communicates as when she does not communicate.

Q.E.D.

We proceed in the analysis by considering separately the situations when subordinates of different types are employed. We begin with the case when A_d is hired. Using lemma 1, we can write B's expected utility when A_d is employed, Π_d, as:

$$\Pi_d = \max\{\alpha, 1\}q(\kappa + \eta)e_+ + (1 - \max\{\alpha, 1\}q)\kappa e_0 \ . \tag{1}$$

The probability that both agents end up informed about the same preferred project depends on whether α is larger or smaller than 1 and is given by αq or q, respectively. In this case, the expected profit takes on its highest level $(\kappa + \eta)e_+$. With the remain-

may provide relevant information to her.

ing probability both agents are uninformed about their favored projects. Then, B's expected profit is κe_0.

When instead B hires A_i, conflicts of interest can occur. Because of this, when the superior selects the project, she has to take into account how much effort she can expect from the subordinate. If A_i obtains an informative signal, his expected utility depends on whether B decides in favor of the project he prefers or against it. When the signals received by B and A_i differ, B may decide to overrule the subordinate's choice if the benefits from doing so compensate A_i's low resulting effort. Lemma 2 shows in which circumstances B selects the project regardless of A_i's preferences. The proof of this result is omitted since it is obvious.

Lemma 2 *If the informative signals reveal that A_i and B prefer the same project, B selects the high-return project. If the informative signals reveal that A_i and B prefer different projects, B selects the high-return project if $\eta > \frac{e_+-e_-}{e_++e_-}\kappa$ and the low-return project in the remaining cases. If A_i and B do not receive signals, B selects each project with probability* 0.5.

For $\eta < \frac{e_+-e_-}{e_++e_-}\kappa$ the superior *de facto* delegates the decision to the subordinate. The cost of choosing the inferior project is relatively low and counting on high effort is better than selecting the superior's preferred choice. Although B has the formal authority to choose the project, she accepts any proposal from the subordinate. The subordinate's power stems from the implicit threat to exert little effort when his less preferred project is chosen. The opposite holds for $\eta > \frac{e_+-e_-}{e_++e_-}\kappa$, and the superior always overrules any recommendation made by the subordinate.

Using lemma 1, the superior's expected utility when A_i is hired, Π_i, can be written

$$\Pi_i = q[1+\alpha(1-q)][r(\kappa+\eta)e_+ + (1-r)\max\{(\kappa-\eta)e_+, (\kappa+\eta)e_-\}] + [1-q[1+\alpha(1-q)]]\kappa e_0 \ , \quad (2)$$

where $q[1+\alpha(1-q)]$ is the probability that at least one agent obtained an informative signal. It is clear that the highest return is obtained when the project chosen is preferred by both B and A_i. With probability $(1-r)$, however, the agents prefer different projects and the expected return is lower. When none of the agents obtains an informative signal, the expected return is κe_0, a situation which occurs with probability $1-q[1+\alpha(1-q)]$.

Comparing Π_i with the expected profit when A_d is hired, Π_d, allows the superior to decide who gets the job. A simple statement on the organization's recruiting policy is:

Proposition 1 *B employs A_i if $\Pi_i - \Pi_d \geq 0$, implying that r is above or equal to $\hat{r}$, with $\hat{r}$ being defined as*

$$\frac{\max\{\alpha,1\}(\kappa+\eta)e_+ + [\alpha+(1-\alpha q)-\max\{\alpha,1\}]\kappa e_0 - [1+\alpha(1-q)]\max\{(\kappa-\eta)e_+,(\kappa+\eta)e_-\}}{[1+\alpha(1-q)][(\kappa+\eta)e_+ - \max\{(\kappa-\eta)e_+,(\kappa+\eta)e_-\}]} \; . \tag{3}$$

Otherwise A_d is employed.

Whether it is optimal to hire A_i or not depends critically on how much value B assigns to A_i's input during the decision process. A_i and B together are more likely to be informed than A_d and B together. However, the richer information set must be weighted against the likelihood and the consequences of a conflict when A_i and B disagree on the choice of project. Conflicts come with costs either in the form of low effort when the subordinate's less preferred project is implemented, or in B's selection of the inferior project to avoid the subordinate's low effort. Consequently, there are circumstances in which B prefers to employ A_d instead of A_i.

To better understand the effects that determine the hiring decision, the following propositions present comparative static results.

Proposition 2 *The parameter set in which A_i is hired is weakly smaller, the larger the q. For $\hat{r} > 0.5$ the parameter set strictly decreases with q.*

Proof.

$$\frac{\partial \hat{r}}{\partial q} = \frac{\alpha \max\{\alpha,1\}[(\kappa+\eta)e_+ - \kappa e_0)]}{[1+\alpha(1-q)]^2[(\kappa+\eta)e_+ - \max\{(\kappa-\eta)e_+,(\kappa+\eta)e_-\}]} > 0 \; .$$

Q.E.D.

The higher the uncertainty of the environment in which the decision is taken (the lower q), the more valuable it is for the superior to form a heterogeneous team. In highly uncertain situations, the information collected by an A_i subordinate is very important to complement that of the superior. An implication from this result is that firms in more uncertain environments fill management positions with a greater proportion of people from outside the organization. In contrast, firms in fairly stable environments frequently select their project/division managers from within the organization.[5]

[5] Later, in section 4, we show that the implications derived in this section are restricted to situations where firing is relatively expensive.

Proposition 3 *For $\alpha < 1$, the parameter set in which A_i is hired is weakly larger, the larger α. For $\hat{r} > 0.5$ it increases strictly with α.*

For $\alpha > 1$, the parameter set in which A_i is hired is weakly smaller, the larger α. For $\hat{r} > 0.5$ it decreases strictly with α.

Proof.

$$\frac{\partial \hat{r}}{\partial \alpha} = \begin{cases} \frac{-(1-q)[(\kappa+\eta)e_+ - (1+\alpha(1-q))\kappa e_0]}{[1+\alpha(1-q)]^2[(\kappa+\eta)e_+ - \max\{(\kappa-\eta)e_+, (\kappa+\eta)e_-\}]} < 0 & \alpha < 1 \\ \frac{(\kappa+\eta)e_+ - \kappa e_0}{[1+\alpha(1-q)]^2[(\kappa+\eta)e_+ - \max\{(\kappa-\eta)e_+, (\kappa+\eta)e_-\}]} > 0 & \alpha > 1 \end{cases} .$$

Q.E.D.

α is a measure of the superior's ability to collect an informative signal. Whether an increase favors the formation of a homogeneous or a heterogeneous team depends on in which team the additional information can be better brought to use. The additional capacity to collect information is useful when the subordinate is uninformed. Thus, an additional piece of information can be used in a heterogeneous team in a fraction of $1-q$ of all cases while in a homogeneous team the additional information can be used either with probability 1 ($\alpha > 1$) or with probability zero ($\alpha < 1$). This significant difference when A_d is recruited drives the result. Casual observation confirms that managers who almost always know themselves which project is the better one – which implies an α close to $(1/q) > 1$) – tend to choose subordinates for their effort and not for their input in the decision-making process. Perhaps surprisingly, superiors who rely heavily on the subordinate's informational input are also only infrequently recruiting A_i. When α is small, for example caused by the superior's job design, A_d is likely to provide useful information, since the probability of informational overlap is small. Most likely to form a heterogeneous team are superiors whose ability to collect information is similar to that of the subordinate.

Proposition 4 *For $(\kappa-\eta)e_+ \geq (\kappa+\eta)e_-$ the parameter set in which A_i is hired is weakly smaller the larger the η. For $(\kappa-\eta)e_+ < (\kappa+\eta)e_-$ the parameter set in which A_i is hired is weakly larger the larger the η. For $\hat{r} > 0.5$ the changes in parameter sets are strict.*

Proof.

$$\frac{\partial \hat{r}}{\partial \eta} = \begin{cases} \frac{\kappa(e_+ - e_0)}{\eta^2(e_+ - e_-)} > 0 & \eta < \frac{e_+ - e_-}{e_+ + e_-}\kappa \\ -\frac{(\alpha+(1-\alpha q) - \max\{\alpha,1\}\kappa e_0}{[1+\alpha(1-q)](\kappa+\eta)^2(e_+ - e_-)} < 0 & \eta \geq \frac{e_+ - e_-}{e_+ + e_-}\kappa \end{cases} .$$

Q.E.D.

When the project return has a small variability, η, it is more important for B to focus on the subordinate's choice of effort, and delegation is the appropriate course of action for the superior. On average, A_i exerts a higher level of effort than A_d, because the probability of at least one agent obtaining an informative signal is larger when A_i is hired, $q[1+\alpha(1-q)]r > \alpha q$. Thus, for very low values of η, A_i is employed regardless of the value of r. When it is optimal for B to not impose her choice of project on A_i, the larger the η the more often A_d is hired. This guarantees that only small losses arise from a conflict of interest when the benefits to B come mostly from the effort exerted by the subordinate to implement the project. However, when the stakes are high (large η), selecting the high return project becomes more important and delegation is not B's preferred option anymore. The superior decides according to her own preferences and always ignores the subordinate's recommendations. Moreover, the larger the η, the more likely A_i is hired, since he may have information that helps B identify the best project.

Although it appears that with a high η it is better to hire an A_i-type subordinate, high-stake situations do not always require diverse teams.

Corollary 1 *Even for very high-stake situations, there are cases that recommend hiring a A_d type subordinate.*

$$\lim_{\eta\to\infty} \hat{r} = \frac{\alpha e_+ - [(1+\alpha(1-q)]e_-}{[(1+\alpha(1-q)](e_+ - e_-)} \ .$$

For α or e_+/e_- sufficiently large $\lim_{\eta\to\infty} \hat{r} > 0.5$.

For α or e_+/e_- sufficiently large, heterogeneous teams do not always dominate homogeneous ones even if it is essential to have as much information as possible to make the right decision. Corollary 1 shows that although the richer information set of heterogeneous teams is expected to improve the information available during the selection of the project, such teams suffer from a lower effort in case of a conflict. In high-stake situations it is very important to make the right decisions but it is also important to avoid any conflicts. This is because the magnitude of the losses arising from conflicts tends to be greater when the relevance of the project increases.

4 Resolving conflict through firing

So far we have focused on differences between the members to understand the composition of teams. Here we analyze how team diversity is affected when the superior has the power to replace the subordinate. This authority has implications to the actions as well as to the communication between the parties. We show that the threat of being replaced induces strategic behavior by a subordinate who wishes to protect his career. Essentially, communication becomes more sparse. Discretion is the way that subordinates choose in order to avoid open conflicts when the risk of being fired rises. Less communication, however, comes with an increase in the overall level of effort. We also look at the relationship between group diversity and turnover. Experts in organization theory often conjecture a link between turnover and the occurrence of conflicts. Pfeffer (1983), for example, notes that when diversity increases in an organization, internal communication becomes more difficult, resulting in potentially greater conflict, which in turn leads to higher turnover. In this section we explain how this happens. We defer the analysis of recruiting when replacement is possible to the next section.

Consider the model in the previous section with the additional assumption that the superior can replace the subordinate prior to the implementation of the project. We also assume that if the subordinate initially employed is fired there is some loss and B's maximum benefits are $\gamma(\kappa+\eta)$, with $\gamma \in (\frac{e_-}{e_+}, 1)$. This deadweight cost represents, for example, losses from delaying the project. The lower bound for γ ensures that B always finds it optimal to replace the subordinate in at least some set of circumstances. If γ is below this threshold level, replacement would never be optimal. Finally, we assume that a subordinate who is hired to replace a fired one does not collect information. If the superior is indifferent between replacing the subordinate and not, she retains the initial subordinate.[6] To simplify the exposition of our analysis, we impose two additional parameter restrictions. First, η is assumed to be sufficiently large so that $(\kappa+\eta)e_- > (\kappa-\eta)e_+$. From the last section this corresponds to B deciding always which project is selected. As a result we leave aside in this section issues of informal authority which allow the subordinate to choose his preferred project. Second, we assume α to be larger or equal to one, which implies that the superior's ability to generate an informative signal is at least as high as the subordinate's.

[6] One could also assume that there is a small fixed cost associated with a replacement.

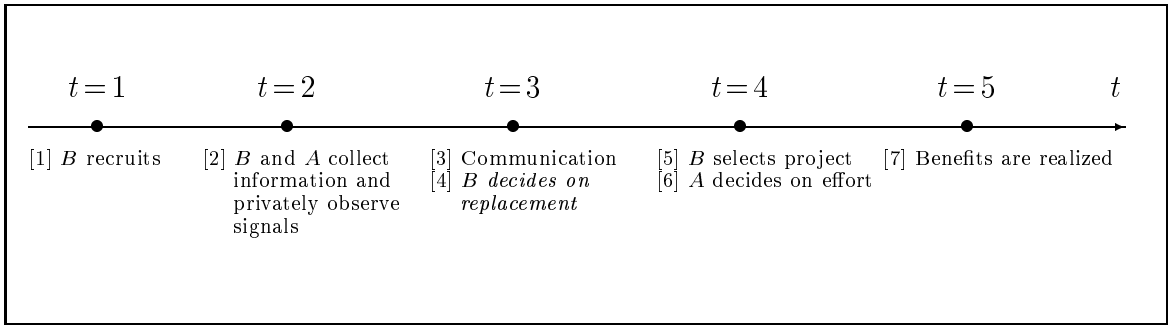

Figure 2: Timing of decisions

Type of new hire	A_d-type	A_i-type
No information	$\kappa e_0 - (1-\gamma)(\kappa+\eta)e_0$	$\kappa e_0 - (1-\gamma)(\kappa+\eta)e_0$
Information	$\gamma(\kappa+\eta)e_+$	$\gamma(\kappa+\eta)(re_+ + (1-r)e_-)$

Table 1: B's payoffs (replacement)

The possibility of firing a subordinate and starting the hiring process again to find a new candidate for the job of implementing the project adds an additional step to the sequence (see Figure 2).

After replacing the initial subordinate, the superior's payoff depends both on whether she is informed and on the type of subordinate newly hired. B's payoffs are given in table 1. Since a new hire does not collect information, there is no information in the system when B is uninformed. B's payoff in this case is in the first line of the table. When B is informed, she communicates her signal to the new subordinate to induce a certain effort from him. B's payoff is in the second line of the table. Since the payoffs are after replacement, all entries in the table take the loss from replacement into account. From the table it is clear that the superior never strictly prefers to replace the initial subordinate by an A_i type subordinate. An A_d type will exert at least as much effort as an A_i type who does not collect information. Without loss of generality then we can assume that the second hire will be of an A_d type.

B decides to replace the subordinate first hired when the benefits of keeping him are smaller than the benefits of firing and then recruiting at a cost an A_d type. This happens when differences in the preferences of B and A_i reduce B's payoff due to A_i's poor effort in the implementation stage of a project.

Consider first the case when an A_d type is initially employed. Since there are no conflicts of interest between B and A_d, an A_d is never replaced. Therefore, the option of replacement does not change B's expected payoff from hiring an A_d type, given in equation (1).

If instead an A_i type is originally employed, his replacement depends on what he says to B. A_i chooses to communicate his informative signal if his expected utility is not lower than that from not communicating. Communication has obvious trade-offs. The benefits occur when B did not get a signal on her own and A_i's information triggers a signal of identical realization to B. A_i's communication then convinces B to select the project A_i prefers. However, revealing one's information can also have a cost since it potentially increases the likelihood of being sacked. If this likelihood is sufficiently large, the subordinate may decide to keep his signal to himself. B's reaction to A_i's communication is summarized in the following lemma:

Lemma 3 *When a subordinate of type A_i communicates his signal, he will be fired if his revealed preference differs from the superior's.*

When a subordinate of type A_i does not communicate a signal, he will not be fired if B did not obtain an informative signal. He will be fired if B obtains an informative signal on her own and $\gamma > \frac{re_+ + (1-r)e_-}{e_+}$.

Proof. Consider that an initially employed subordinate A_i communicates his signal to B. Then B becomes also informed if she has not yet received a signal. When B agrees with A_i, the maximum payoff is obtained. When B does not agree, the payoff of retaining the A_i who does not agree with B is $(\kappa + \eta)e_-$, which is less than the payoff when A_i is replaced, $\gamma(\kappa + \eta)e_+$, since $\gamma > \frac{e_-}{e_+}$.

Consider now that A_i does not communicate. If he is retained, B chooses the project using her information only. In the following we discriminate between (1) B being informed and (2) B being uninformed. (1) When B is informed, the initial subordinate is informed too, because B has an incentive to communicate to A_i. Then, B can expect a payoff of $(\kappa+\eta)[re_+ + (1-r)e_-]$, which compares with the payoff when the subordinate is replaced, $\gamma(\kappa + \eta)e_+$. When $\gamma > \frac{re_+ + (1-r)e_-}{e_+}$ the expected payoff from replacing the subordinate is higher. (2) When B is uninformed, her expected benefit when retaining the subordinate depends on the probability that A_i assigns to the case of B being informed. Denote this probability by $p \in [0, 1]$. Then B's expected payoff

Probabilities	αqr	$\alpha q(1-r)$	$(1-\alpha q)r$	$(1-\alpha q)(1-r)$
No communication, low γ	u_+	u_-	$0.5(u_+ + u_-)$	$0.5(u_+ + u_-)$
No communication, high γ	0	0	$0.5(u_+ + u_-)$	$0.5(u_+ + u_-)$
Communication	u_+	0	u_+	0

Table 2: A_i's payoffs

is $\kappa[p(0.5e_+ + 0.5e_-) + (1-p)e_0]$ which, by the convexity of the effort function, is never smaller than κe_0 for any $p \in [0,1]$.

Q.E.D.

Since replacement is optimal in the case of an open conflict, communicating an informative signal has a cost to A_i. The reason is that A_i's utility is lower if he is replaced than if he keeps his job. The expected benefits of an informed A_i are summarized in table 2 for the following cases:

When there is communication and the superior obtains an informative signal identical to that of the subordinate, A_i has utility u_+. This is also the case when an uninformed superior obtains information from communicating with A_i and both agents prefer the same project. Zero utility occurs when an explicit conflict ends in replacement for A_i. When there is no communication from A_i to B, a utility of u_+ is obtained when the informed superior chooses the project preferred by the subordinate and he is retained. When the informed superior chooses the project not liked by the subordinate and this is retained u_- results. Note, however, that no firing happens only when the costs of replacement are relatively high. Otherwise, from lemma 3 a silent A_i will be replaced, yielding a utility of zero. When the superior is not informed and randomly chooses a project, the subordinate is not replaced (see lemma 3)and his utility is $0.5(u_+ + u_-)$.

Subordinate A_i will compare the expected benefits of communicating with B with the expected benefits from staying silent. The following proposition states A_i communication strategy:

Proposition 5 *When the replacement costs are relatively high, A_i communicates if $ru_+ - \alpha q(ru_+ + (1-r)u_-) - (1-\alpha q)0.5(u_+ + u_-) \geq 0$. When the replacement costs are low, A_i communicates if $ru_+ - (1-\alpha q)0.5(u_+ + u_-) \geq 0$.*

In the previous section we concluded that with no firing A_i always communicates with

B. Here, when A_i gets a signal he communicates it to B only if the expected gain from convincing B to adopt his preferred project is greater than the expected loss from being fired. The ability to convince B depends on B being not informed. The risk of A_i being fired depends on the cost of replacement, $(1-\gamma)(\kappa+\eta)$. The greater authority given to B to deal with incidents then leads to a reduction in the information exchanged in the hierarchy.

Note that communication changes A_i's likelihood of being fired. When the replacement cost is high, communication increases the risks of being fired, because if A_i does not communicate he is never fired. On the other hand, when the replacement cost is low, not communicating increases the risk of being fired when B is informed. However, not communicating increases the risk of being fired when B is not informed. Not surprisingly, proposition 5 states that A_i's motivation to communicate is ceteris paribus greater when the cost of replacement is low relative to when this cost is high.

When A_i does not get a signal but finds out about his preferred alternative through a message from B, A_i does not disclose his opinion if this differs from B's, since showing disagreement leads to replacement.

The superior's ability to generate an informative signal also affects the communication between B and A_i, since α changes the likelihood of A_i being fired and his incentives to communicate:

Proposition 6 *When the cost to replace the subordinate is relatively high but not too high, an increase in the superior's ability to generate information leads A_i to communicate less.*

When the cost to replace the subordinate is low, an increase in the superior's ability to generate information increases A_i's incentive to communicate.

Proof. Taking the derivatives of the conditions in proposition 5 with respect to α yields $0.5q(u_+ + u_-) > 0$ when $\gamma > \frac{re_+ + (1-r)e_-}{e_+}$ and $-q(r-0.5)(u_+ - u_-) \leq 0$ when $\frac{e_-}{e_+} < \gamma < \frac{re_+ + (1-r)e_-}{e_+}$.

Q.E.D.

With low replacement costs, the better informed the superior is, the more often she requires the subordinate to speak. This is because the risk of A_i being fired increases in α, when A_i does not speak. On the other hand, when the replacement costs are

high but not prohibitively high, a superior will not replace the subordinate if he stays silent. Anticipating this, the subordinate chooses to keep his information more often to himself the better informed the superior is, because doing so protects him from being fired. Despite these opposite comparative statics results, an A_i's incentive to communicate remains always higher when the cost of replacement is low than when it is high.

The result in proposition 6 also has implications for the design of the superior's job. When the replacement cost is relatively high (low γ), it may be better to keep B not too close to the operations, and lower α deliberately. Some distance or a certain degree of ignorance can be better than intimate knowledge. A lower α increases the subordinate's willingness to communicate and can lead to higher expected payoffs (see figure 3). The argument herein provides an additional reason for the existence of strategic ignorance on the part of the principal. In Cremér (1995), reducing the amount of information available enhances the principal's possibilities to commit to a certain course of action. In Aghion and Tirole (1997) ignorance can enhance an agent's incentive to acquire information.

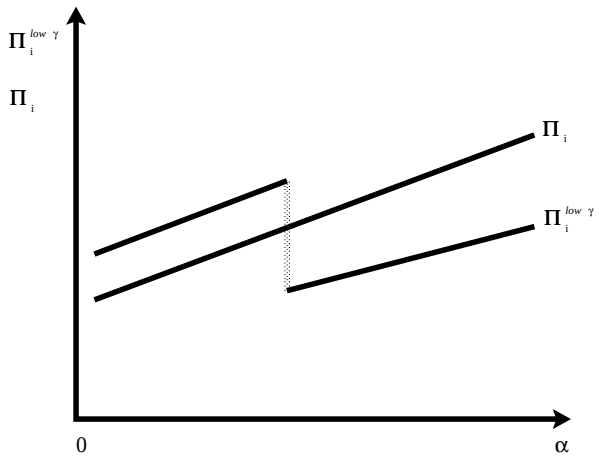

Figure 3: Payoffs of diverse teams with and without replacement for varying α

With respect to turnover, the following result holds. The proof of the proposition is skipped since it follows directly from the previous analysis.

Proposition 7 *If an A_d subordinate is hired he is never replaced. However, there exist parameter constellations in which an A_i subordinate is hired and replaced with positive probability.*

According to this proposition, diverse teams have a higher turnover rate than homogeneous ones. This is consistent with the findings of several studies in the organization literature for different countries as well as different organizational environments (see e.g. McCain, O'Reilly and Pfeffer (1983), Wagner, Pfeffer and O'Reilly (1984) and Wiersema and Bird (1993)).[7]

Interestingly, a small increase (decrease) in the costs of replacement can lead to a significant decrease (increase) in turnover. There are two factors that influence the change in the rate of turnover. The first is the cost of replacement, and the second is the flow of communication in the hierarchy. As expected, an increase in the cost of replacement makes the superior less inclined to replace the subordinate. But in addition to this there are incentive considerations that need to be considered. Higher replacement costs allow the subordinate to conceal his signal more often without risking being replaced. These two effects together matter to the rate of turnover.

The authority to fire the subordinate negatively affects the flow of information between B and A_i. Replacement, however, pushes up the level of effort in the organization. With replacement, the superior gets rid of conflicting elements, who predictably exert low levels of effort. Therefore, the average effort among those A_i who remain in the organization is higher than that of the entire population of A_i types. On the other hand, A_i is replaced when the effort expected from him is less than that for an A_d type. The result of the action also pushes up the overall level of effort in the organization.

5 Team diversity and hierarchical authority

Section 4 deals with the authority to replace a subordinate and at how it affects the communication between the members of the hierarchy. Being candid poses risks and sometimes subordinates decide strategically to conceal their private signals. They

[7] These studies are often of explorative rather than exhaustive character. For example, Wagner et al. (1984) study the turnover in top management teams of 31 manufacturing firms in the US. Demographic similarity is approximated by the coefficient of variation of an individual distance measure to the other team members based on entry dates. Controlling for absolute and relative profitability, team size and firm age, they find that teams that were characterized by a higher degree of demographic similarity in 1976 displayed a significantly lower turnover during the four subsequent years.

speak only when they can be reasonably sure that they will not lose their jobs and are able to influence the superior's decision. In this section we compare hiring decisions with and without the replacement option.

Since it is said that the degree of diversity in organizations is not independent of the level of involvement of the superior in the problems being solved, we provide here a discussion of the issue. In particular, we analyze whether the superior's distance to the problem is a strategic substitute or a strategic complement of more authority.

We start by writing B's expected benefits. There are four different situations: communication between A_i and B, no communication between A_i and B, high and low costs to replace A_i. Denoting these by $\Pi_i^{c,low\,\gamma}$, $\Pi_i^{c,high\,\gamma}$, $\Pi_i^{nc,low\,\gamma}$and $\Pi_i^{nc,high\,\gamma}$ we have:

$$\begin{aligned}\Pi_i^{c,low\,\gamma} &= q[1+\alpha(1-q)](\kappa+\eta)[re_+ +(1-r)e_-]+[1-q[1+\alpha(1-q)]]\kappa e_0 \\ &\quad +q(\kappa+\eta)(1-r)(\gamma e_+ +e_-]\end{aligned}$$

and

$$\Pi_i^{c,high\,\gamma} = \Pi_i^{c,low\,\gamma} + \alpha q(1-q)(\kappa+\eta)\left[\gamma e_+ - (re_+ + (1-r)\,e_-)\right] \quad ,$$

where the last term is the gain from replacing an uninformed A_i. $\alpha q(1-q)$ is the probability of B being informed and A_i being uninformed, whereas the remainder of the term is the gain obtained by replacing A_i with A_d. In the no communication case, B's benefits are given by

$$\begin{aligned}\Pi_i^{nc,low\,\gamma} &= [\alpha q+0.5(1-\alpha q)q](\kappa+\eta)[re_+ +(1-r)e_-] \\ &\quad +0.5(1-\alpha q)q(\kappa-\eta)[re_- +(1-r)e_+]+(1-\alpha q)(1-q)\kappa e_0\end{aligned}$$

and

$$\Pi_i^{nc,high\,\gamma} = \Pi_i^{nc,low\,\gamma} + \alpha q(1-q)(\kappa+\eta)\left[\gamma e_+ - (re_+ + (1-r)\,e_-)\right] \quad .$$

With these payoffs, we can analyze the recruiting decision when the superior has the authority to fire the subordinate. In the following we focus on the range of parameter values for which hiring A_d is the best option if A_i does not communicate.[8] This

[8]Formally this can be expressed as

$$r < \frac{\alpha q(\kappa+\eta)(e_+-e_-)-0.5(1-\alpha q)[(\kappa+\eta)e_+-(\kappa-\eta)e_-]+q(1-\alpha q)\kappa e_0}{\alpha q(\kappa+\eta)(e_+-e_-)-(1-\alpha q)\eta(e_+-e_-)}.$$

excludes the less interesting situations where an A_i type subordinate would be chosen solely because of his higher expected effort.[9]

In the sequel, we first analyze the impact of changes in the values of the parameters on the recruiting decision. After this, we study a company's choice of replacement cost and how it affects B's exercise of authority.

Comparative Static Analysis

First, we state a result which shows how the cost of replacement affects recruiting:

Proposition 8 *A relatively high cost of replacement leads ceteris paribus to a lower incentive to hire an A_i type subordinate than when the cost of replacement is low.*

Proof. Π_d is independent of γ. Also, $\Pi_i^{c,high\,\gamma} > \Pi_i^{c,low\,\gamma}$ and $\Pi_i^{nc,high\,\gamma} > \Pi_i^{nc,low\,\gamma}$. Thus, given a certain communication strategy of A_i, $\Pi_i - \Pi_d$ is larger for a high γ. However, the incentives to communicate differ for different values of γ. These incentives are higher when γ is large. It can be easily verified that $\Pi_i^{c,high\,\gamma} > \Pi_i^{nc,high\,\gamma}$ and $\Pi_i^{c,low\,\gamma} > \Pi_i^{c,low\,\gamma}$ which implies that the higher tendency that A_i has to communicate when γ is large leads to a stronger incentive to hire an A_i when the cost of replacement is low.

Q.E.D.

The following result characterizes the changes in the recruiting policy from changes in the degree of environmental uncertainty q, considering both replacement and the incentives to communicate:

[9] If we include the parameter constellations in which it is optimal to hire an A_i type even if he does not communicate, the results are not qualitatively affected.

Proposition 9 *Suppose an A_i is not recruited if he does not communicate. Then, an A_i will be hired if and only if the condition in proposition 5 is met and also the following is satisfied:*

$$-\alpha(1-r)(e_+-e_-)+(1-\alpha q)[re_++(1-r)e_--\frac{\kappa}{\kappa+\eta}e_0]+(1-r)(\gamma e_+-e_-)\geq 0 \qquad (4)$$

for $\gamma \in (\frac{e_-}{e_+}, \frac{re_++(1-r)e_-}{e_+})$ *and*

$$-\alpha(1-r)(e_+-e_-)+(1-\alpha q)[re_++(1-r)e_--\frac{\kappa}{\kappa+\eta}e_0]+(1-r)(\gamma e_+-e_-) \\ +\alpha(1-q)[\gamma e_+-(re_++(1-r)e_-)] \quad \geq \quad 0 \quad (5)$$

for $\gamma \in (\frac{re_++(1-r)e_-}{e_+}, 1)$.

Proof. Hiring A_i requires that he communicates and that the payoff to B from hiring an A_i who communicates exceeds that of hiring an A_d.

The first condition is given in proposition 5. The second depends on the cost of replacement and evaluates $\Pi_i^{c,low\,\gamma} - \Pi_d$ and $\Pi_i^{c,high\,\gamma} - \Pi_d$.

Q.E.D.

Proposition 9 states that a heterogeneous team is formed when A_i communicates despite the risk of being fired, and B's expected payoffs given communication exceed those from hiring an A_d type instead. The next set of results show how recruiting depends on several other parameters.

Proposition 10 *For relatively high costs of replacement, the parameter set in which A_i is hired is weakly smaller the larger the uncertainty in the environment.*

For low costs of replacement, the relationship between the value of q and the size of the parameter set in which A_i is hired is ambiguous: in the most general order of actions A_d is hired for small values of q, A_i is hired for intermediate values of q and A_d is hired for large values of q.

Proof. For a relatively high cost of replacement, it suffices to show that the partial derivatives of the relevant terms with respect to q are negative. They are $-\alpha(r-0.5)(u_+-u_-)<0$ and $-\alpha[re_++(1-r)e_--\frac{\kappa}{\kappa+\eta}e_0]<0$.

For a low cost of replacement, the derivatives are of opposite signs. They are $\frac{\alpha}{2}(u_++u_-)>0$ and $-\alpha[\gamma e_+-\frac{\kappa}{\kappa+\eta}e_0]<0$. For a sufficiently large u_- there is no communication

by A_i when q is low. Then Π_i^{nc} is the relevant part of Π_i and $\Pi_i - \Pi_d$ is negative. After q reaches a certain value, communication occurs and Π_i becomes Π_i^c. This corresponds to a positive jump in $\Pi_i - \Pi_d$ which can make B hire an A_i. After that, $\Pi_i - \Pi_d$ decreases continuously. Beyond a certain value of q, this difference becomes negative again and an A_d type is recruited.

Q.E.D.

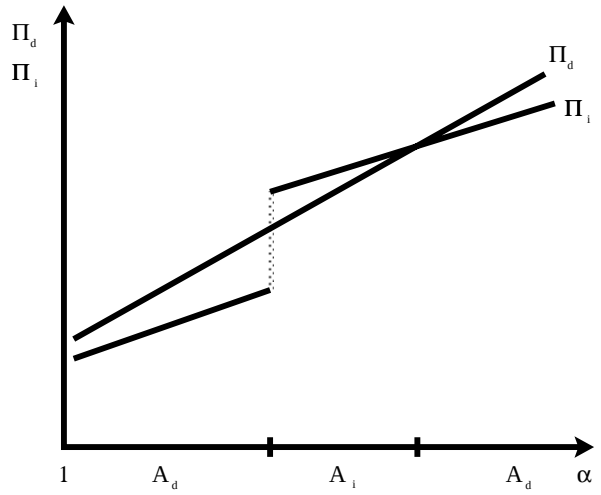

Figure 4: Payoffs and team formation for different values of α

Figure 4 provides an illustration of proposition 10 when the cost to replace is low. Starting with a level of q close to zero, i.e., high uncertainty in the environment, a subordinate A_i is never hired, because he declines to communicate his signal to B if he has received one. By hiding his information, A_i reduces the likelihood of being fired if B learns from A_i that she prefers a different project. Anticipating this behavior by A_i, B prefers to hire an A_d. At high values of q, i.e., low levels of uncertainty, the advantage of hiring an A_i decreases because the value of his input to the decision process declines and there is always the possibility of a conflict between him and B. For intermediate levels of uncertainty, an A_i decides to communicate which makes him more valuable than an A_d. If A_i had refused to talk B would see in the silence the possibility of a conflict and the likelihood of being recruited would decrease. Note that replacing the subordinate is not very expensive, and therefore the certainty equivalent of a risky outcome (keeping a silent A_i subordinate) is lower than the sure outcome (replacement by an A_d subordinate).

Things differ when the cost of replacing the subordinate is high but not prohibitively high (not shown in Figure 4). A high cost of replacing means that B has less flexibility to correct past hiring decisions, and therefore the likelihood of hiring a risky A_i over an uncontroversial A_d increases monotonically with the uncertainty in the environment. A_i's inclination to communicate is also higher the higher the uncertainty. So one effect reinforces the other.

The model thus predicts that when job characteristics and labor market regulations make firing relatively expensive, firms tend to be more heterogeneous in their human resources if they operate in less stable environments. Not surprising, organizations in highly uncertain environments facing low firing costs should be even more heterogeneous in their membership. The risks of recruiting A_i types are reduced if it is easier to fire dissenting individuals. Perhaps more surprising is that heterogeneous teams are best if environmental uncertainty is present but not excessive, and the cost of replacement is low. The reason is that the flow of communication from A_i to B improves with a less uncertain environment. Thus, for a certain range of values, the relationship between the uncertainty of the environment and the degree of heterogeneity in the firm varies in exactly opposite directions for high and low costs of replacement.

Turning to turnover, our model predicts that the highest degree of turnover should be observed in firms operating in industries with relatively unstable environments and low firing costs. Turnover should then be lower for firms operating in highly unstable environments and with low firing costs, followed by firms operating in highly unstable environments and high firing costs. Turnover should be lowest in firms operating in industries in relatively unstable environments and high firing costs.

These results are similar to those obtained for α given that $\alpha \geq 1$. Since the proof of the following result is analogous to that of proposition 10, it is omitted.

Proposition 11 *Suppose* $\alpha \geq 1$.

For relatively high costs of replacement, the parameter set in which A_i *is hired is weakly smaller the larger the* α.

For low costs of replacement, the relationship between the value of α *and the size of the parameter set in which* A_i *is hired is ambiguous. In the most general order of actions* A_d *is hired for small values of* α, A_i *is hired for intermediate values of* α *and* A_d *is hired for large values of* α.

As mentioned before, α characterizes the quality of the superior, or, alternatively, the superior's distance (familiarity) to the issues being resolved. In discussing the implications of proposition 11, we focus on the second interpretation. Consider first the case of a low cost of replacement. The proposition implies that neither a superior who is very close to the problem nor one who is distant finds attractive forming a heterogeneous team. Superiors very close to the problem do not benefit as much from independent sources of information. At the opposite end, little-informed superiors cannot provide sufficient incentives to a subordinate to communicate his private information. Only when the superior's distance to the decisions lies in between is there a basis to the formation of heterogeneous work groups.

For relatively high and high costs of replacement, the attractiveness of a heterogeneous team is monotonic in the proximity of the superior to the issue being decided. Superiors close to the situations are reluctant to form heterogeneous teams, not only because the expected contribution of a different source of information is small, but also because the subordinate will frequently decide not to disclose his information and is hard to replace. This result complements the findings of Friebel and Raith (1996), who claim that a subordinate finds it hard to work with an unproductive superior, because he constantly challenges the boss's position. In our paper we argue that working with an knowledgeable is difficult for the subordinate, because the subordinate's position is in danger frequently.

The importance of η in the composition of the team is given in the next proposition.

Proposition 12 *Given that A_i communicates his information, the set of parameter values in which A_i is hired increases strictly with η.*

Proof. The result follows from the conditions outlined in proposition 9 and taking into account that η does not affect A_i's communication decision.

Q.E.D.

Given that the information flow remains the same for different values of η, the more important it is for the superior to choose the high-return project, the more attractive it is to form a heterogeneous team.[10] Since A_i's communication decision is not affected

[10]Please note that this result hinges on the assumption that κ is strictly positive. If it were zero, the magnitude of η would not affect the recruiting decision at all.

by the superior's utility, even a situation with a very large η does not lead to hiring an A_i when the relevant condition in proposition 5 is not met. This may explain the observation that conflict in top management teams is less frequent than expected, given the relevance of the decisions at stake (Eisenhardt et al. 1997).

Endogenous Determination of Cost of Replacement

So far we have assumed an exogenous cost of replacement. In practice, however, companies' policies often set this cost internally. The most obvious way for this is when there is a set of rules regarding firing decisions. In the following, we analyze the optimal choice of γ. We assume that the interests of the superior and the shareholders coincide and that when indifferent, the superior chooses a low cost of replacement.

Proposition 13 *A high cost of replacement, such that an A_i is never replaced, is chosen when α, q and u_+ are sufficiently small.*

A relatively high cost of replacement, such that an A_i is replaced only on an open conflict, is never chosen.

A low cost of replacement, such that an A_i will sometimes be replaced if he does not talk, is chosen otherwise.

Proof. From propositions 5 and 9 it follows that the superior always prefers a low cost of replacement (high γ), if replacement is to be optimal at all. Given that the subordinate communicates, the superior's expected payoffs are higher when γ is high than when γ is low. For α, q and u_+ sufficiently small, however, A_i does not communicate and is not hired in the first place, implying that the superior's benefits are given by Π_d. Finally, from the results in section 3, for small α and q, A_i is hired when the possibility of replacement does not exist.

Q.E.D.

Proposition 13 implies that it can be optimal for an organization to grant the head of a unit the right to hire a subordinate but not to fire him. However, when she also has the authority to fire a subordinate, the action should be carried out in a way that minimizes the cost of replacement. Not only does this reduce the loss in case of a replacement, it also contributes to improving communication in the work unit.

6 Summary and final remarks

In this paper we analyze factors that determine diversity in organizations. This is achieved by answering several related questions. What is the optimal recruiting policy when the candidates differ in their background and information? How does the nature of the organization's business feed back into the design of the organization? How do agency considerations affect the sharing of information and the behavior of team members? How is diversity affected unintentionally in work environments dominated by the leaders' degree of information? What is the role of formal authority in the composition of teams?

The main findings can be summarized as follows: (a) By improving the information available in a decision, diverse teams are especially helpful in situations when the degree of uncertainty and the stakes involved are relatively high. (b) However, diversity may not be effective when the difference between good and bad choices is large, and agency problems affect the outcome. (c) Group leaders affect the degree of team diversity. Well-informed leaders depend less often on the information content that comes with diversity. (d) Authority is also an important factor in determining the extent of organizational diversity. (e) However, conformity may be only apparent, as disagreements get translated into resisting actions that reduce the payoff. (f) Authority can be especially counterproductive at times when, in order to reach the right decision, it would be important to have an open exchange of information. In these situations it is optimal to have organizations with less hierarchical authority.

This work is an exploratory step towards a more general theory of diversity. It can be applied to a variety of situations, for example, the consequences of mixing people with different cultures, the composition of boards in corporations, task assignment in organizations, career development in corporations, and even cross cultural/background marriage decisions.

References

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

Amason, A.C. (1996): Distinguishing the Effects of Functional and Dysfunctional Conflict on Strategic Decision Making: Resolving a Paradox for Top Management Teams. *Academy of Management Journal*, Vol. 39, 123-148.

Ancona, D.G.; D.F. Caldwell (1992): Demography and Design: Predictors of New Product Team Performance. *Organization Science*, Vol. 3, 321-341.

Athey, S.; C. Avery; P.B. Zemsky (1994): Mentoring, Discrimination and Diversity in Organizations. Stanford University, Research Paper No. 1317.

Carillo, J.D.; D. Gromb (1996): Culture in Organizations: Inertia and Uniformity. Mimeographed.

Cornell, B.; I. Welch (1996): Culture, Information, and Screening Discrimination. *Journal of Political Economy*, Vol. 104, 542-571.

Cremér, J. (1995): Arm's-Length Relationships. *Quarterly Journal of Economics*, Vol. 110, 275-295.

De Bijl, P.W.J. (1994): Delegation of Responsibility in Organizations. Tilburg University, CentER Discussion Paper No. 9469.

Eisenhardt, K.M.; J.L. Kahwajy; L.J. Bourgeois (1997): Conflict and Strategic Choice: How Top Management Teams Disagree. *California Management Review*, Vol 39, Winter, 42-62.

Friebel, G.; M.A. Raith (1996): Strategic Recruiting and the Chain of Command – On the Abuse of Authority in Internal Labor Markets. Université Libre de Bruxelles, ECARE Working Paper.

Lawrence, B.S. (1997): The Black Box of Organizational Demography. *Organization Science*, Vol. 8, 1-22.

Milgrom, P.R. (1988): Employment Contracts, Influence Activities, and Efficient Organization Design. *Journal of Political Economy*, Vol. 96, 42-60.

Pfeffer, J. (1983): Organizational Demography. In Cummings, L.L.; B.M. Staw (eds.): *Research in Organizational Behavior*. Vol. 5, Greenwich, CT: JAI Press, 299-357.

Prendergast, C. (1993): A Theory of "Yes Men". *American Economic Review*, Vol. 83, 757-770.

Wagner, W.G.; J. Pfeffer; C.A. O'Reilly (1984): Organizational Demography and Turnover in Top-Management Groups. *Administrative Science Quarterly*, Vol. 29, 74-92.

Wiersema, M.F.; K.A. Bantel (1992): Top Management Team Demography and Corporate Strategic Change. *Academy of Management Journal*, Vol. 35, 91-121.