Essays on the Economics of Authority and Bureaucracy

by

Jaime Ortega

Licenciado en Ciencias Económicas, Universidad Autónoma de Madrid (1993)

Submitted to the Department of Economics
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Author .............................................

Department of Economics
May 15, 1998

Certified by .............................................

Bengt Holmström

Paul A. Samuelson Professor of Economics
Thesis Supervisor

Certified by .............................................

Daron Acemoglu

Pentti J. K. Kouri Career Development Associate Professor of Economics
Thesis Supervisor

Accepted by .............................................

Peter Temin

Chairman, Department Committee on Graduate Students

JUN 09 1998

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Abstract

This thesis contains three essays on the economic role of authority in organizations.

I begin by reviewing the existing theoretical literature (chapter 1), with a focus
on two issues: the role of authority as a device to induce firm-specific human capital
acquisition; and the limits to the exercise of authority in a hierarchical organization
when subordinates have an informational advantage over their superiors. I look at
both the incomplete contracts approach and the asymmetric information approach.
The remaining chapters contribute to this literature with an analysis of two issues:
the role of authority as an instrument to motivate employees (chapter 2), and the
differences in the ways the authority to hire new employees is allocated in governments
and firms (chapter 3).

In Chapter 2, I use a model of team production with career concerns to analyze
how authority generates incentives by making employees more visible. I study the
determinants of the optimal allocation of authority when an employee's authority
can only be increased by reducing another employee's. First, I show that, with a
simple linear technology and two risk-neutral workers, distributing authority more
equally does not increase output: although the employee who receives more authority
becomes more motivated, these gains are outweighed by the reduction in the other
employee's incentives. Secondly, I find that equal authority generates insurance gains.
Thirdly, I show that there is a trade-off between maximizing the employees' incentives
and minimizing the conflicts of interest across positions. Finally, I briefly study how
the distribution of authority affects the costs and benefits of using explicit incentives
to motivate workers.

In the last chapter I provide an explanation for the high level of bureaucratization
of governments compared to private companies. Specifically, I look at the ways in
which the freedom of managers to hire their subordinates is restricted and at the
weakness of individual incentive schemes which are characteristic of the governments'
human resource practices. I provide evidence on these characteristics and present
an explanation for the differences between governments and firms. Firstly, I look at
three selected countries —France, Great Britain, and the United States—to show
that governments use various mechanisms, from formal tests to periodical audits, to
limit managerial discretion on hiring. Secondly, I study the optimal decentralization of hiring decisions using a model of hierarchies. I show that organizations subject to strong product market competition optimally choose decentralized hiring and high-powered incentives; whereas centralized hiring and low-powered incentives are optimal when competition is small.

Thesis Supervisor: Bengt Holmström
Title: Paul A. Samuelson Professor of Economics

Thesis Supervisor: Daron Acemoglu
Title: Pentti J. K. Kouri Career Development Associate Professor of Economics
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Contents

1 Authority and the Economics of Organizations ................................................. 10
  1.1 Introduction ......................................................................................... 10
  1.2 What is Authority? ............................................................................... 13
  1.3 The Role of Power in Inducing Firm-Specific Human Capital Acquisition .... 16
    1.3.1 The Role of Residual Rights of Control .......................................... 16
    1.3.2 The Role of Access to Critical Resources ....................................... 20
    1.3.3 The Role of Promotions ................................................................. 22
  1.4 The Exercise of Authority in a Hierarchy .............................................. 25
    1.4.1 Loss of Control Across Layers ...................................................... 25
    1.4.2 Cooperation, Collusion, and Competition Between Layers .............. 27
    1.4.3 Delegation ..................................................................................... 34
  1.5 Other Issues ....................................................................................... 35
    1.5.1 Leadership .................................................................................... 35
    1.5.2 Interest Groups ............................................................................ 36
  1.6 Conclusions ....................................................................................... 37

2 Authority, Visibility, and Incentives ............................................................ 39
  2.1 Introduction ....................................................................................... 39
  2.2 Authority and Learning ....................................................................... 43
    2.2.1 Set-up ......................................................................................... 43
    2.2.2 Preliminary Results ..................................................................... 46
  2.3 Optimal Allocation of Authority ......................................................... 48
    2.3.1 Commitment Case ........................................................................ 48
2.3.2 No-commitment Case ........................................ 55
2.4 Explicit Incentives and Authority ............................ 61
2.5 Conclusions ..................................................... 65

3 Governments and Firms: A Comparison of Hiring Practices 67
3.1 Introduction ...................................................... 67
3.2 Empirical Evidence .............................................. 70
  3.2.1 France ..................................................... 70
  3.2.2 Great Britain .............................................. 72
  3.2.3 United States .............................................. 74
  3.2.4 Pay Components .......................................... 76
  3.2.5 Firms ..................................................... 77
3.3 Model .......................................................... 78
  3.3.1 Hiring ...................................................... 79
  3.3.2 Production .................................................. 80
  3.3.3 Timing ..................................................... 82
3.4 Results ........................................................ 82
  3.4.1 Optimal Hiring and Production .......................... 82
  3.4.2 Discussion: Governments and Firms .................... 85
3.5 Conclusions ..................................................... 87

A Appendix to Chapter 2 ............................................. 89

B Appendix to Chapter 3 .......................................... 90
  B.1 Proof of Proposition 1 ....................................... 90
  B.2 Proof of Proposition 2 ....................................... 91
  B.3 Proof of Proposition 3 ....................................... 91
List of Figures

2-1  Updating coefficient for $i$ ($\alpha_{i1}$) as a function of agent $i$’s authority ($\phi_i$) when $\sigma_i = \sigma_{-i} = 4$ and $\sigma_e = 1$  

.................................................. 49
List of Tables

3.2 Competitive Career and Career-Conditional New Hires, US Federal
    Government, 1995-97 ............................................. 75
3.3 Pay Components as a Share of Total Remuneration in %, Selected
    OECD Countries, 1985 and 1993 ............................... 76
Chapter 1

Authority and the Economics of Organizations

1.1 Introduction

Since Coase (1937), it is widely accepted that the main economic difference between a market and a firm is that the allocation of resources within firms is organized by means of authority, whereas markets allocate resources via the price mechanism (but see Alchian and Demsetz's [1972] criticism; see also Hart's [1989] survey for a discussion). However, it is rather disappointing to see that when one thinks of the role of authority, or power,\(^1\) in a framework of symmetric information and complete contracting the conclusion is that the allocation of authority has only distributional effects, and no effect on efficiency. Hence, two important questions remain unanswered: first of all, who should have more authority? And secondly: what mechanisms should a firm design to encourage an efficient use of authority? Although for many years economists have had very little to say about these questions, it is very common for managers to think of authority, power, leadership, influence, discretion, or employee participation as important determinants of firm performance. By way of example, consider how in recent years a growing interest has developed on creating more par-

\(^1\)For a discussion on the differences between the two, see sections 1.2 and 1.5.1 below. Throughout this dissertation I use power and authority as synonyms, unless I specify it otherwise.
participative workplaces where employees are not so constrained by their superiors’ orders and instead are allowed to make more suggestions (see, for example, Appelbaum and Batt [1994]).

With the development of models of asymmetric information on one hand and incomplete contracting on the other, economists have started to shed some light on these issues. Since its early developments, principal-agent theory has stressed the fact that asymmetries of information generate power: subordinates have private information, or can choose actions that their superiors are unable to observe. The exercise of authority is then limited by the superior’s informational disadvantage. This makes it possible to explain why authority is used through some mechanisms rather than others: for example, allowing too much discretion to one’s subordinates might generate inefficiencies, and explains why some organizations tend to be rather bureaucratic. But there are also other possibilities: for example, superiors may benefit from their subordinates’ better information if they allow them to participate in the decision-making process. All these issues refer to the second question. Most insights regarding the first question — how power should be allocated — have been developed in an incomplete contracting framework. Grossman and Hart’s (1986) basic argument, on which this literature has developed, was that the inability to perfectly describe all future contingencies would lead to contract renegotiation. Hence, a formal contract is often not as important as the allocation of power behind it, *i.e.* the underlying statement about who has a right to decide when unforeseen events occur. The allocation of power is important because power provides an occasion for a party to behave opportunistically in the states of the world that have not been predicted in the contract, and this deters the other parties from making large relationship-specific investments. As a result, depending on the importance of the parties’ investments, different allocations of power are optimal.

A common feature of the two approaches — incomplete contracting and asymmetric information — is that they consider authority as an instrument to align the incentives of employees with those of the organization: more powerful employees tend to behave in the firm’s best interest and make their subordinates behave in that way
too. The question of how incentives are aligned has no trivial answer for several reasons, that we may classify in three broad categories. The first one is adverse selection: different employees have access to different information, and tend to use their private information to their own benefit. As a consequence, the firm faces a trade-off between limiting employee discretion in order to prevent the use of private information for harmful purposes; and giving discretion to employees and allowing them to capture informational rents. Section 1.4.2 contains a discussion of this issue. The second reason why it is not easy to align objectives within the organization is that employees are unable to commit to actions that they had previously agreed on. This might be because the actions are not observable or not verifiable (sections 1.3.3, 1.4 and 1.5). Finally, the third reason is contract incompleteness (sections 1.3.1 and 1.3.2).

Although there are many benefits from aligning the employees’ objectives with the firm’s (more cooperation between colleagues, more effort, or more initiative, to name only a few), many economists have emphasized one particular benefit: the effect on the accumulation of firm-specific human capital. Hence, we devote section 1.3 to analyze how power may be used to encourage such investments. That section is primarily concerned with the question of how different allocations of authority provide incentives to invest, and draws mostly on the incomplete contracting literature. The point of view adopted there is that the firm can, in a simple way, choose how much power to give to each employee. However, it is easy to see how in many cases an employee’s power depends not only on his formal position in the company, but also on how much private information he has, or on how easily he can form coalitions with other employees to attain his goals. Hence, in sections 1.4 and 1.5 we look closely at the limitations that asymmetric information imposes on the ways authority is exercised. The discussion of the basic issues and models (sections 1.3 to 1.5), is preceded by a discussion of the definition of “authority”, or “power”, used in the economics of organizations (section 1.2).
1.2 What is Authority?

By and large, economic models have used the notion of authority to refer to the ability of a person to affect the decisions of the organization he belongs to. This definition is also commonly found in sociology, although the sociological literature makes finer distinctions between various terms which conform to the above general definition. Thus, sociologists distinguish between power and authority (see for example Abercrombie, Hill and Turner [1994]). The term power is used to refer to situations where there is a conflict of interest between members of the organization: in such a context, A exercises power when he has a right to have his objectives prevail despite B's preferences. On the other hand, A has authority over B when B voluntarily accepts A's decision. In the economics literature, most of the authors use both power and authority interchangeably to refer to what sociologists would call "power", that is to refer to a situation where B unwillingly has to do what A decides, and in this dissertation I use the two terms in the same way.\(^2\) The only two exceptions are Aghion and Tirole (1997), whose notions of formal and real authority bear some resemblance with the sociological definitions of power and authority respectively; and especially Hermalin (1997), whose model of "leadership" precisely takes into account that a leader draws voluntary support from his subordinates. This concept of leadership coincides with what many sociologists would call authority.

Although it is relatively simple to give a general definition of authority, further reflection quickly suggests that it is difficult to go beyond and be more precise. Most of the times, we think of a powerful employee as someone with many subordinates: in a hierarchical organization, higher positions provide more authority because the orders given at these positions are transmitted to more employees. However, this command function is not the only characteristic of high positions: these positions also provide a right to make more important productive decisions —for example,

\(^2\)Ideally, it would be better to be able to distinguish between power and authority, as sociologists do. However, almost none of the papers in the economics of organizations allows to make this distinction. The incomplete contracting literature uses only the term power, while the asymmetric information literature uses mostly the term authority. But in both cases what is meant is the right to impose one's decision over another person's.
investments in physical capital, or development of new products or processes. While such decisions evidently require the participation of many other employees, it would be hard to argue that this is precisely the reason why they are important: after all, some units are more labor-intensive for purely technological reasons, and this does not mean that the heads of other, less labor-intensive units have less power. Finally, after having thought more about the issue one could also argue that what makes a person powerful in a company is the fact that he may have privileged information or skills that are very scarce, since private information can be used for one’s own interest.\footnote{Incidentally, many would argue that the psychological aspects of power are very important and that, independently of an individual’s position in a company, personal charisma is a crucial determinant of power. See, for example, Dalton (1959).} To sum up, there are many potentially relevant aspects of authority, and it is not immediately clear that some should be considered more important than others.

To clarify things, it will be useful to distinguish two approaches to this issue: the incomplete contracting approach (see Grossman and Hart [1986], Hart and Moore [1990], and Hart [1995]), and the asymmetric information (principal-agent) approach. The first approach stresses the fact that it is too costly or even impossible to describe all possible future contingencies when a contract is written. For example, a new technology, which was unknown when the contract was signed, might be discovered and might alter the objectives of the parties, who in that case will want to renegotiate the initial contract. Anticipating this, when the initial contract is signed the parties consider it not only as a statement of actions to be undertaken in the future, but also as a fall-back option in case the renegotiation does not succeed. Moreover, because it is likely that renegotiation will take place, the initial contract always specifies (or it is specified in the commercial laws of the country) who has a right to decide in case of an unforeseen contingency. Notice that, viewed from the point at which the initial contract is signed, the power that a party enjoys at the renegotiation stage is precisely this: a right to decide when an unpredicted event takes place. Thus, in the incomplete contracting literature power is defined as a residual decision right. In many situations, such decision rights stem from asset ownership: thus when the
owner of an asset signs a lease contract with another person, he allows him to exercise certain rights but keeps all the rights that have not been explicitly transferred.

The second approach considers that informational asymmetries are inherent to any relationship of authority and determine the mechanisms through which authority is exercised. Retaking the example of the lease, after the initial contract is signed and the asset is transferred to the lessee, the latter is likely to have better information about the state of the asset, and this limits the lessor’s ability to know what decisions are in his best interest at the renegotiation stage. On the other hand, in the event of a renegotiation it might be costly for the lessor to verify that the lessee is putting his commands into practice. Finally, it is also conceivable that the two parties will not learn at the same time that there are new contingencies that make new actions desirable. Along these lines, the asymmetric information literature stresses that the exercise of authority is limited by the differences in information between superiors and subordinates: in this sense, there is a tension between the legal right of command of certain employees and, on the other hand, the subordinates’ power to use their private information or the lack of observability to satisfy their own objectives.

Each approach throws light on a different aspect of authority. The incomplete contracting literature answers the question of the optimal allocation of authority: with complete contracts, the division of power between the two parties affects the distribution of the surplus, but not the size. To see this, consider again the example of the lease. Suppose that in order for the lease to maximize the joint surplus of the parties each party would have to make relationship-specific investments. If it is not possible to write a complete contract, the lessee might underinvest for fear that if something unexpected happens the lessor will take a decision to his own advantage and will reduce the gains from the lessee’s investment. If complete contracts are possible, the parties will be able to write a clause making sure that the lessor will not engage in such opportunistic behavior. On the other hand, the incomplete contracting literature does not explain how authority is exercised. The assumption that a contract can specify any division of authority is stronger than it seems, because a formal right to make decisions does not always translate an effective power to have one’s objectives.
prevail.

1.3 The Role of Power in Inducing Firm-Specific Human Capital Acquisition

In a world with incomplete contracts, power\(^4\) provides protection against other parties' opportunism (and provides a possibility to exercise one's own). Hence, employees with more power have more incentives to make investments in firm-specific human capital. On the other hand, firms can use promotions to reward the employees who make such investments.\(^5\) In this section we review the main results on the effects of power on specific human capital acquisition.

1.3.1 The Role of Residual Rights of Control

The idea that power induces specific investments in human capital was first studied by Hart and Moore (1990). To understand their point, consider the following simple model from Hart (1995). A group of agents, denoted by \(S\), decide how to allocate residual rights of control over a set of nonhuman assets, \(A\). For example, imagine a company deciding how much control should be given to each employee. The allocation of control is described by a function \(A = \alpha(S)\) where \(A\) and \(S\) are subsets of \(A\) and \(S\) respectively. Thus, \(\alpha(S)\) is the set of assets over which the subset \(S\) of agents can decide if there is an unforeseen contingency. Suppose that the employees can undertake investments in firm-specific human capital. Let \(x_i\) denote the cost of \(i\)'s investment. Finally, consider the following timing, whereby at time \(t = 0\) the firm distributes rights of control (that is, chooses the function \(\alpha\)) and the employees choose noncooperatively their investment levels; and at time \(t = 1\) production takes place and the surplus is shared by the employees through cooperative bargaining.

\(^{4}\)Most of this section is devoted to the incomplete contracting models, and to follow the standard terminology in that literature I will use the term "power" throughout.

\(^{5}\)Although the characterization of high and low positions is often vague in the literature on promotions, one can still view a promotion as an increase in the employee's power, which translates into a higher wage.
The allocation of control determines the ex-post division of surplus because an employee controlling an asset can gain a larger share of the surplus in the bargaining process by threatening to exclude other employees from using the asset. Let \( v(S, \alpha(S)|x) \) denote the maximum surplus that a coalition \( S \) of employees can get under the control structure \( \alpha \), given the vector of investments \( x \). Following Hart and Moore, we assume that \( v(.) \) is superadditive in \( S \) and \( A \), that is: for all subsets \( S' \subseteq S \) and \( A' \subseteq A \), \( v(S, A|x) \geq v(S', A'|x) + v(S - S', A - A'|x) \). As a consequence, ex post surplus is maximized when the agents form the grand coalition \( S \) with assets \( A \). We also assume that agent \( i \)'s ex post reward is given by his Shapley value

\[
B_i(\alpha|x) = \sum_{S|i \in S} p(S)[v(S, \alpha(S)|x) - v(S - \{i\}, \alpha(S - \{i\})|x)]
\]

where

\[
p(S) = \frac{(s - 1)! (g - s)!}{s! g!}
\]

and \( s = |S| \), \( g = |S| \). The Shapley value of agent \( i \) in the grand coalition is the average of his marginal contributions to all the possible coalitions he could belong to.

The main point regarding the effect of the distribution of control on the ex-ante investment decisions can be illustrated with some simple examples. First of all, consider the case where \( S = \{1, 2\} \) and \( A = \{a\} \). Suppose also that only agent 1 can make an investment in (specific) human capital, denoted by \( x_1 \). There are three possible control structures, corresponding to the cases where 1, 2, or both have control over the asset. Giving control to agent 1 can be interpreted as placing him in a managerial position, while leaving agent 2 as his subordinate: agent 1 can determine the use that is given to the asset and, in particular, can exclude agent 2 from working with it. Let \( R(x_1) \) denote the surplus generated by the asset when agent 1's investment in human capital is applied to it. Under control by 1, the values of the different coalitions are \( v(\{1\}, \{a\}|x_1) = R(x_1) - x_1 \), \( v(\{1\}, \{a\}|x_1) = R(x_1) - x_1 \), and \( v(\{2\}|x_1) = 0 \). As a
consequence, when 1 controls the asset

\[ B_1(x_1) = R(x_1) - x_1. \]

On the contrary, under agent 2 control the values of the coalitions are \( v(1, 2, \{a\})x_1 = R(x_1) - x_1, v(\{1\})x_1 = -x_1, \) and \( v(\{2\})x_1 = 0 \) and therefore

\[ B_1(x_1) = \frac{1}{2} R(x_1) - x_1. \]

Several things have to be pointed out here. First of all, agent 1 has higher incentives to invest in firm-specific human capital when he controls the asset than when he does not. Hence, if the firm is only concerned about 1's investment decision, all the power (that is the control over the asset) should be given to 1. Intuitively, if the firm gave control to 2, his ability to exclude agent 1 from using the asset would be wasted: if the firm wants 1 to invest, there is no reason why it should make it difficult for him to use it. More generally, Hart and Moore prove that if only one agent invests, then he should control all the assets. Secondly, agent 1 would still invest in the case where 2 controls the asset. This is so because \( x_1 \) is an investment in human capital, and therefore 1 can always walk away with his investment and leave agent 2 with a lower surplus. If the investment was in physical capital, there would be no reason for 1 to invest when 2 controls the asset. Thirdly, suppose that both agents could make initial investments in specific human capital. Then the optimal division of power would depend on how the control of the asset affects the marginal return of each agent’s investment.

A more interesting insight brought by the incomplete contracting model is that the control of nonhuman assets provides control over human assets. Thus, even though managerial positions are characterized by the right of both telling other employees what to do and making decisions concerning the use of the firm’s nonhuman assets, both rights should not be considered at the same level. To see this, suppose the firm had no nonhuman assets. In the absence of slavery, it would not mean anything to say that 1 (or 2) has all the power. On the contrary, when the firm has nonhuman
assets, the fact that 1 can control them gives him a legal way to threaten 2 who, as a consequence, will tend to act in 1’s interest. To illustrate this, let us retake our previous example and assume now that $S = \{1, 2, 3\}$ and $A = \{a\}$. In this case, suppose that only 1 or 2 can control the asset (they are the only possible “managers”), and only 3 can invest. Denote his investment by $x_3$ and suppose that, as before, it is an investment in firm-specific human capital. However, unlike in our previous example, suppose that the investment is considered valuable only by agent 1 (that is only one of the managers considers the investment to be profitable). If this agent controls the asset, the values of the different coalitions (net of the investment cost) are $v(\{1, 2, 3\}, \{a\}|x_3) = R(x_3)$, $v(\{1, 3\}, \{a\}|x_3) = R(x_3)$ and $v(S|x_3) = 0$ for any other coalition $S \subset S$. Therefore agent 3’s Shapley value is

$$B_3(1\text{controls}|x_3) = \frac{2}{6}R(x_3) + \frac{1}{6}R(x_3) - x_3 = \frac{1}{2}R(x_3) - x_3.$$ 

On the other hand, when agent 2 controls the asset the corresponding values of the coalitions (again, net of the investment cost) are $v(\{1, 2, 3\}, \{a\}|x_3) = R(x_3)$ and $v(S|x_3) = 0$ for all other coalitions $S \subset S$. Hence

$$B_3(2\text{controls}|x_3) = \frac{1}{3}R(x_3) - x_3,$$

and agent 3 will have less incentives to invest. In other words, an employee will invest more when the manager who values that investment more controls the asset: having control over a firm’s nonhuman assets allows to affect other employees decisions in one’s own interest. Another interesting conclusion from this example is that it is not always optimal to give control to the employees who are supposed to make the investments, because it might be that these employees do not value their investments enough. In such cases, it might be better to give control to the employees that value the investments more, even if they are not the ones to invest.
1.3.2 The Role of Access to Critical Resources

Rajan and Zingales (1996) have pointed out that Hart and Moore’s (1990) result that asset control has always a positive effect on the incentives to invest might be misleading. For this, let us retake the first example we used in the previous section. In that example, when agent 1 controlled the asset we had \( v(\{1\}, \{a\}|x_1) = R(x_1) - x_1 \).

This means that if agent 2 was to break the relationship, agent 1 would still be able to get the whole surplus. But if 1 can get the same payoff from his investment independently of whether 2 is in (that is, \( v(\{1\}, \{a\}|x_1) = v(\{1, 2\}, \{a\}|x_1) \)), then his investment in human capital is not really relationship-specific (even though it is asset specific). Suppose instead that \( v(\{i\}, \{a\}|x_1) = R_i(x_1) \) when agent \( i \) controls the asset. Then

\[
B_1(1\text{controls}|x_1) = \frac{1}{2}R_1(x_1) + \frac{1}{2}R(x_1) - x_1
\]

\[
B_1(2\text{controls}|x_1) = \frac{1}{2}[R(x_1) - R_2(x_1)] - x_1.
\]

If \( x_1 \) is a relationship-specific investment, it may be reasonable to assume that \( R'(x_1) > 0 \) and \( R'_1(x_1) < 0 \): the investment increases the value of the asset inside the relationship, but reduces its outside value. In this case, controlling the asset does not protect agent 1 against opportunistic behavior but, on the contrary, makes him more vulnerable. As a consequence, Rajan and Zingales have argued that the residual rights of control are not always a good measure of power.

Instead, Rajan and Zingales argue that the access to critical resources is a more accurate measure of power in the firm. They point out that employees cannot undertake investments in firm-specific human capital unless they are allowed to operate the company’s equipment, or to be exposed to the ideas of more senior colleagues or higher-ranked employees. Thus, by regulating access to such critical resources (for example by allowing an employee to become familiar with a physical asset), the firm can regulate her employees’ ability to invest in human capital. Formally, suppose
that $S = \{1, 2, 3\}$ and $A = \{a\}$ in our previous example, and allow for two changes: on one hand, suppose that we take a certain distribution of control as given. Specifically, suppose that agent 1 actually owns the asset $a$. On the other hand, instead of making assumptions about who can invest let us consider a case where both agent 2 and agent 3 could invest if they were allowed to by agent 1. This would be a way to model the fact that the owner of the asset can regulate access to it and in this way determine what employees invest and (as long as he can regulate competition or cooperation among employees) how much.

First of all, notice that in general access will be positively correlated with the incentives to invest, whereas control, as we have seen, need not be. Moreover, while the right of controlling an asset can be a good definition of power for high positions, where managers have really a lot of freedom to dispose of the company's assets (even though they do not technically own them), access seems on the other hand a more realistic definition of power for employees at lower positions. Secondly, Rajan and Zingales show that the regulation of access can be a more useful instrument to generate incentives than the allocation of control. Specifically, there are cases in which granting access to several employees generates strong competition and might allow the firm to induce first-best levels of investment by all the employees. One such case is the one where the agents' investments enter the production function in an additive way, that is

$$y = R(x_2, x_3) = R(x_2 + x_3)$$

where $R' > 0$ and $R'' < 0$. With this kind of technology, it is optimal for agent 1 to grant access to both employees (agents 2 and 3). Intuitively, when only agent 2 has access, granting access to another employee (agent 3) generates a rat race which reduces agent 2's equilibrium payoff but increases the marginal return of his investment. The reason for this lies in the assumption that the outcome of the bargaining process can be characterized by the Shapley value. The Shapley value assigns to each agent the average of his marginal contributions to all possible coalitions. Hence, the
size of an agent's investment depends not only on his marginal contribution to the grand coalition, but also on his marginal contributions to all the smaller coalitions. However, when there are decreasing returns to the investments \( R'' < 0 \) and the investments are additive, these marginal contributions are larger than the contributions to the grand coalition. Therefore, when more agents are allowed to invest the firm "artificially" increases the marginal return of each individual agent. In fact, with \( n \) agents and more restrictive assumptions about the production function there are cases in which the sum of investments is monotonically increasing in \( n \) (however, there are also cases in which it is not). In general, the effectiveness with which access provides incentives depends both on the definition of the bargaining process and on the technology \( R(.) \). Take for example the case in which the investments are complements:

\[
y = R(x_2, x_3)
\]

with

\[
\frac{\partial^2 R}{\partial x_2 \partial x_3} > 0.
\]

In this case the marginal contributions to the small coalitions are smaller than the marginal contributions to the grand coalition, and it is optimal to grant access to one agent only.

1.3.3 The Role of Promotions

The main point of the incomplete contracting literature is that organizations use the allocation of power as an imperfect substitute for an ideal contract where the employees' rewards could be made contingent on every possible state of the world. However, another reason why the allocation of power is a useful instrument in organizational design is that even in cases in which it would be possible to describe ex ante all the states of the world, enforcing such a contract could be difficult. In the incomplete
contracting literature, all difficulties related to the enforcement of the contracts (other than the difficulty to verify the state of the world) are put aside by assuming that all the surplus is divided through cooperative bargaining. However, when a firm is trying to design mechanisms to motivate employees to invest, enforcement is a real issue: by its nature, firm-specific human capital is hard to assess by third parties. Hence, when workers have already invested, the firm could have an incentive to claim that the level of investment has not been adequate and refuse to reward the workers. On the other hand, even if the firm decided to be honest, workers could decide not to invest (or to invest too little) and then claim that they did.

Prendergast (1993) has shown that promotions can sometimes be used to attenuate this double moral hazard problem. Suppose a risk-neutral firm employs a risk-neutral worker who, before being assigned to a job, can decide to invest in firm-specific human capital. Denote this investment by $x \in \{0, 1\}$. Suppose also that the firm can assign the worker to one of two jobs, denoted by $i \in \{E, D\}$. Job $E$ is an “easy” job, for which the worker’s firm-specific human capital matters relatively little, whereas job $D$ is a “difficult” job for which the fact that the worker has invested or not makes a big difference. Assignment to job $D$ may be interpreted as a promotion. Specifically, consider the following example:

$$R_D(0) < R_E(0) < R_E(1) < R_D(1),$$

where $R_i(x)$ is the worker’s output in job $i$ when he has invested $x$ (hence, it is efficient to assign a worker that has not invested to the easy job and a trained worker to the difficult one). Because of the double moral hazard problem, an employment contract where the worker is given incentives to invest has to satisfy the following two incentive compatibility constraints:

$$R_D(1) - w_D \geq R_E(1) - w_E$$

---

6It is more appropriate, in my view, to interpret this model as a model about how job reallocation, or task assignment, can be used to induce specific investments. The job reallocation could be a promotion or a lateral move within the firm’s hierarchy.
and

$$w_D - w_E \geq c,$$

where $w_i$ is the wage corresponding to job $i$ and $c$ is the cost incurred by the worker when making the investment. The first inequality ensures that when the worker has invested it is profitable for the firm to promote him; and the second inequality is the worker's incentive compatibility constraint.

First of all, notice that in order to induce the workers to invest the firm has to set a high enough wage differential ($w_D - w_E$). However, the differential cannot be too high because then the firm would not be willing to promote the worker even if he had invested. Thus, there exists a contract that induces the workers to invest (and the firm to promote) only as long as the inequality

$$R_D(1) - R_E(1) \geq c$$

is satisfied. This means that a promotion can successfully induce specific human capital acquisition only if it consists in moving the worker to a position where his newly acquired human capital makes him considerably more productive. In fact, suppose that $w_D > w_E$ but $R_D(1) = R_E(1)$, i.e. suppose that the firm offered simply a monetary reward for the investment or a promotion to a better paid position in which the worker's investment would not be particularly useful. Such mechanisms would not be successful at creating incentives to invest because the firm would have an incentive to refuse to promote the worker after his investment has been made. Secondly, suppose that instead of one worker there was a continuum of workers with ability $\eta \in (0, 1)$, and redefine the production function as $R_i(\eta, x)$, with

$$R_D(\eta, 1) - R_D(\eta, 0) > R_E(\eta, 1) - R_E(\eta, 0)$$
for every $\eta \in (0, 1)$, and

$$\frac{\partial R_D}{\partial \eta} > \frac{\partial R_E}{\partial \eta} \geq 0.$$ 

Suppose also that ability is unknown when the workers decide whether to invest but becomes known after that. Then the firm will choose to underpromote with respect to the first best (in order to get a promotion, a worker will need a higher ability than he would need under no moral hazard).

### 1.4 The Exercise of Authority in a Hierarchy

The assumption made in the incomplete contracting literature that a simple contract can be written to distribute authority within the organization overlooks the fact that the employees to whom more authority has been granted can encounter resistance from their subordinates if appropriate mechanisms are not put in place. In fact, the decisions of how to facilitate the exercise of authority within a company are often more problematic than the decision of how to divide authority.

#### 1.4.1 Loss of Control Across Layers

Williamson (1967) first noted that moral hazard by subordinates imposed limits on the optimal size of the firm. This idea was further explored by Calvo and Wellisz (1978), and more recently by Qian (1994). In these models the firm is a “tree-shaped” hierarchy where each employee monitors a number of direct subordinates, who in turn monitor their own direct subordinates. Monitoring is assumed to be imperfect, and therefore there is always some control lost across hierarchical layers. Nonetheless, the firm can (to a certain extent) determine the size of the loss of control by designing a few organizational characteristics: the total number of layers, the span of control (i.e., the number of direct subordinates controlled by each person in the firm), and

---

7See also Keren and Levhari (1979), whose focus is on the limits to firm size that are imposed by the fact that hierarchical levels create delays in decision making.
the wage scales. In Williamson’s (1967) model, the firm chooses only the number of hierarchical levels, while in Calvo and Wellisz (1978) and Qian (1994) the firm is also allowed to choose the span of control and the wage scales.

In a firm with a hierarchical structure, the intensity with which a manager monitors his direct subordinates has an effect on the effort of his indirect subordinates: if his direct subordinates are watched over very closely, they try to work hard at their job, which includes monitoring their own direct subordinates. As a consequence, the efficiency of the firm as a whole depends both on the number of direct subordinates that each employee has to monitor; and on the total number of hierarchical layers. In a very flat hierarchy, very little control is lost across layers, because there are very few of them. However, such a hierarchy requires a higher span of control at each level, which makes monitoring more costly. On the other hand, in a “tall” hierarchy (one with many layers) it is easier for each employee to control his direct subordinates, but there are many layers across which control of the indirect subordinates will be lost.

Qian (1994) shows that the optimal design of the hierarchy is not degenerate: the optimal hierarchy is neither reduced to two layers, nor expanded to the point where every employee has only one subordinate. More interestingly, he shows that even though employees are identical ex ante (i.e. before they have been assigned to a position), it is optimal to give higher powered incentives to employees at higher positions.\(^8\) This is so because an increase in an employee’s effort increases the marginal return of all his subordinates (the direct and the indirect ones). Since it is cheaper for the firm to increase the incentives of a high-rank employee (and count on the effect of his increased effort on all his subordinates) than to increase the incentives of all of the latter’s subordinates, hierarchical power and incentives are positively correlated at the optimum. Finally, as the size of the firm, measured by the total number of employees, increases, the optimal number of layers increases; the incentives given to top employees increase; and the incentives given to bottom employees diminish.

\(^8\)Qian restricts incentive schemes to payments of the type \(w_i = 0\) if i’s direct superior learns that i has exerted insufficient effort and \(w_i = w_i^* > 0\) otherwise. Hence, in his model higher incentives always mean higher wages, even though all employees are assumed to be risk-neutral.
1.4.2 Cooperation, Collusion, and Competition Between Layers

Loss of control in a hierarchy may also occur because employees at different levels of the firm find it profitable to agree between them on actions that are not beneficial to the firm as a whole. For example, a worker might do personal favors to his supervisor or even offer him money in order to have the supervisor give a favorable opinion of him when a promotion has to be decided. As the number of layers grows, so do these opportunities for collusion. On the other hand, side agreements between employees sometimes benefit the organization: for example, employees at different levels of the firm usually have access to different kinds of information which, put together, can greatly improve decision making. In these situations, the firm is better off letting employees make agreements, and it is more appropriate to speak of “cooperation” rather than collusion (see Holmström and Milgrom [1990]). Finally, there are cases in which a certain way of exercising authority might generate competition between different subordinates and harm the superior.

Cooperation

Although the issue of cooperation has received relatively little attention in the literature, it is, at a more practical level, a crucial element of organizational design: thus in recent years there has been an increasing interest in the advantages of organizations with a less hierarchical structure, partly because it has been understood that by limiting communication between layers too much important information is lost. Another important advantage of cooperation is that when employees are allowed to reach side agreements they become better insured. This has been shown by Holmström and Milgrom (1990), who have analyzed the costs and benefits of allowing side trade between two agents working for the same principal. Assuming that agents can observe each other’s efforts, they can provide better insurance to themselves than the principal, given his information, would be able to. Specifically, Holmström and Milgrom show that when side trade is allowed the two agents behave like a single agent,
i.e. like a syndicate. As a consequence, only aggregate incentives (the incentives for the two agents) matter. Because of the better insurance, the principal can offer higher incentives to the syndicate than he would be willing to offer to the two agents separately. On the other hand, there are two important costs to allowing side trade. First of all, when the agents choose their efforts cooperatively, relative performance evaluation becomes useless. Since the advantage of relative performance evaluation is to protect agents from risk (and in this way reduce the cost of incentives), the issue is whether a side contract insures agents better than does relative performance evaluation. This depends on the degree of correlation between the two agents' outputs: if the correlation is low, relative performance evaluation does not insure well, and the principal should allow side trade. However, if the agents' outputs are very correlated it is better to prohibit side trade and use relative performance evaluation instead. Secondly, suppose that the principal would like the agents to exert effort in different tasks but cannot observe what has been done on each task separately (as in Holmström and Milgrom [1991]). Then, when side contracting is allowed it is more costly to direct the agents' efforts to the appropriate tasks than when no side contracting is allowed: in the former case, each agent can not only choose how to distribute his effort among the various tasks assigned to him, but can also agree to participate on tasks that had (intentionally) been assigned to the other agent. Thus, the possibilities to engage in arbitrage across tasks are increased, and it is more costly to make sure that the agents divide their time between the various tasks in the way that is optimal for the firm.

Collusion and Influence Activities

When the agents' agreements harm the principal (i.e. in case of collusion), the principal would in principle benefit from exercising all his authority and forbidding side contracts. However, this is usually costly. Consider for example the promotion example mentioned at the beginning of this section. Even if the firm fears that the candidates for the promotion will bribe their supervisors in order to increase their chances, a mere prohibition will not always be effective: it is very difficult to con-
trol all personal favors or gifts and almost impossible to prove the intention with which they have been made. Being realistic, the firm has two solutions at hand. The first one is simply not to take into account the supervisors' opinions about the promotion. This is costly because supervisors, although potentially corrupt, have good information about their subordinates, and promotions would be more efficient if that information could be used. The second possible solution is to take the supervisors' opinions into account but give them incentives not to accept bribes. The cost here is that the firm has to pay the supervisor more when he gives an unfavorable opinion about his subordinate to compensate for the bribes that he could earn if he lied and recommended his (underqualified) subordinate for the promotion.

To see this, consider the following model from Tirole (1992). A firm is composed of a principal (the owner), a supervisor, and an agent. The agent produces a unit of output for the principal and has private information about the cost of producing the unit, that we denote by \( c \in \{c, \bar{c}\} \), where \( 0 \leq c < \bar{c} \). We denote by \( \alpha \) the probability that the marginal cost is low, that is: \( P\{c = c\} = \alpha \), and \( P\{c = \bar{c}\} = 1 - \alpha \). The supervisor has more information about the marginal cost than the principal, but less than the agent: before production takes place, he learns a signal \( s \in \{c, \phi\} \), where \( s = c \) means that he learns that the cost is low and \( s = \phi \) means that he learns nothing. We assume that if \( c = c \) then \( s = c \) with probability \( \zeta \); and if \( c = \bar{c} \) then \( s = \phi \) with probability 1. Thus, when \( s = c \) the supervisor can report the truth or lie and pretend that he has not learnt anything. The supervisor's report is denoted by \( r \in \{s, \phi\} \). Finally, everyone is supposed to be risk neutral, with utilities \( U_A = w_A - cx \) for the agent, \( U_S = w_S \) for the supervisor, and \( U_P = R_x - w_A - w_S \) for the principal, where \( x \in \{0, 1\} \) is the probability that the agent produces the good and \( w_A \) and \( w_S \) are the agent's and the supervisor's respective wages.

The timing is assumed to be as follows: at stage 1, the agent learns \( c \) and the supervisor learns \( s \) (the agent learns \( s \) too); at stage 2, the principal offers a grand contract to the supervisor and the agent, which specifies \( w_A, w_S \) and \( x \) as functions of the supervisor's report \( (r) \); at stage 3, the supervisor and the agent can collude, i.e. sign a side contract which specifies a side transfer as a function of the report made to
the principal; and finally, at stage 4 the contracts are implemented. At the collusion stage (stage 3), we denote the transfer made by the agent to the supervisor by \( t \). In this model, the principal would prohibit collusion if he could. Therefore, it is realistic to assume that the technology of transfers is imperfect in order to reflect the fact that the supervisor and the agent cannot rely on direct, visible monetary transfers (or, equivalently, that there is an added private cost to making illegal transactions). Specifically, we assume that if the agent transfers \( t \), the supervisor only receives \( kt \), with \( 0 \leq k \leq 1 \).

For a full discussion of the solution the reader can consult Tirole (1992) or Laffont and Tirole (1991). Here we discuss the main implications for the role of authority in organizations. The most important insight is that the exercise of authority by the principal is limited by his informational disadvantage: even though he can make a take-it-or-leave-it offer to the supervisor and the agent, the possibilities of collusion limit his choice. Specifically, he has two options. The first one is to offer the same contract to his subordinates no matter what the supervisor reports. He can then pay the supervisor his reservation wage \( w_s = 0 \) and pay the agent \( w_A = \bar{c} \) or \( w_A = c \) depending on whether

\[
R - \bar{c} > \alpha(R - c)
\]  

(1.1)

is satisfied or not (respectively). If \( w_A = \bar{c} \), then both types of agent \( (c = c \) and \( c = \bar{c} \) produce, and the principal’s utility is given by the left-hand-side expression. In that case, the low-cost agent earns a rent \( \Delta c = \bar{c} - c \). On the other hand, if \( w_A = c \), then only the low-cost agent produces, and the principal’s utility is measured by the right-hand-side expression. In any of these cases, the grand contract is not contingent on the supervisor’s report, and as a consequence there is no scope for collusion. This has been called a bureaucratic contract, because under this contract the firm operates in a way that does not allow the supervisor’s discretion to play a role (see also Tirole [1986]). The principal’s second option is to offer an incentive contract, i.e. a contract which depends on the supervisor’s report and which has been designed to induce him
to report truthfully. For truthful revelation, the principal has to give some rents to the supervisor to compensate him for the bribes he could get from the agent if he lied. In fact, if \( w_A(r = c) = \xi \) and \( w_A(r = \phi) = \bar{c} \) (which is optimal if the above inequality is satisfied), and \( w_S(r = c) = w_S(r = \phi) \), then the agent would be willing to pay \( t = \Delta c \) to the supervisor to convince him to lie when \( s = c \). Hence an incentive-compatible wage scheme for the supervisor should satisfy

\[
 w_S(r = \phi) + k\Delta c \leq w_S(r = c),
\]

and the principal would choose \( w_S(r = \phi) = 0 \) and \( w_S(r = c) = k\Delta c \). To use Aghion and Tirole's (1997) terminology, this tells us that formal power and real authority do not necessarily coincide: even though the principal has formal authority (he can offer the contract he wishes), the supervisor has some real power. Specifically, when \( s = c \) he has information that the principal is willing to pay for, and this enables him to capture an informational rent equal to \( k\Delta c \).

The idea that private information provides agents with rents is a standard result of information economics, but it is interesting to note some implications for the incomplete contracting literature. Incomplete contracting models do not take into account that the specific ways in which power is distributed give rise to different kinds of informational asymmetries which affect the parties' shares of the surplus and therefore the size of ex-ante investments. Consider for example a lease contract: from an incomplete contracting point of view, the owner of the asset has more incentives to make specific investments, because if any unforeseen contingency arises he is able to decide to his own advantage. However, by the nature of the contract, the owner enters a relationship in which he is likely to become less informed than the lessee about the condition of the asset. This might force him to give up some informational rents, which reduce his ex-ante incentives to invest.

It is also worth noting that the idea that the opportunities for collusion give rise to bureaucratic behavior is not specific to the model we have shown here. Thus, Holmström and Milgrom (1990) show that it is optimal for a firm to constrain the
amount of wages that a supervisor can pay to his subordinate when these two employees (supervisor and supervised) can collude. Such a constraint limits their gains from collusion, but also makes it more costly to induced effort from the supervised worker. Prendergast and Topel (1996) also find that collusion leads to a more bureaucratic organizational design.

In some cases, the reason why collusion between employees causes harm to the firm is not that it leads to a distortion of information. Milgrom (1988) has pointed out that there are cases in which the employees’ attempts to influence their superiors cause inefficiencies simply because such influence activities prevent them from spending enough time on their jobs. On the other hand, lobbying would benefit the firm if the lobbyists’ suggestions enabled the superiors to improve decision making. Hence Milgrom’s main point: influence activities should be restricted when the lobbyists’ aim is to induce changes that would cause little improvement in the performance of the firm but are of great importance to them. In order to restrict influence activities, the firm should reduce the discretion of the supervisors.

An interesting case in which employees have an incentive to spend time influencing their superiors with no advantage to the organization is the case of general human capital acquisition. When some jobs provide better opportunities to acquire general human capital than others, employees try to influence their superiors in order to be assigned to these jobs. However, the firm does not care about how these positions are allocated, because the returns from general human capital investments are completely captured by the employees.

Another perverse effect of influence activities is that they limit the ability to agree on Pareto-improving actions within the organization. Rajan and Zingales (1997) have constructed an incomplete contracting model in which two parties, A and B, can agree to undertake an action that would increase their joint surplus. The action would actually reduce A’s utility, but the increase in B’s utility would be large enough to compensate A with a transfer. Their model is different from the standard incomplete contracting model of section 1.3.1 in that power is not contractible ex ante, but depends on the resources that each party devotes to influence activities (which are
themselves not contractible). Thus, after the parties have agreed to undertake the Pareto-improving action and $B$ has compensated $A$ with an appropriate transfer, both $A$ and $B$ can spend their resources in two different activities: a productive activity, which increases the size of the joint surplus, and an influence activity, which does not add anything to the surplus but increases the agent's share. In this context, the Pareto-improving decision is not always undertaken because $B$ is reluctant to transfer resources which $A$ could use to increase her power.

**Competition**

In some cases, different hierarchical levels compete. Promotions can generate this kind of competition when the skills of some employees are similar to their superior's: for example, a manager might try to assign inefficient people to lower positions than his if he is afraid of being replaced by one of them and lose his position. Carmichael (1988) has argued that the main role of tenure in academic departments is precisely to induce efficient hiring of junior professors. If the size of a department is fixed and in one particular year there is an especially good pool of candidates, then it would be optimal to replace senior professors with new junior professors. However, the university must rely on senior professors to screen the candidates appropriately, and the former cannot be expected to choose the best candidates if they are afraid that they will take their jobs. A way to be sure that the incumbent professors hire the right candidates is to grant them lifetime employment, i.e. tenure.

Friebel and Raith (1996) have argued that the practice of restricting communication between non-adjacent levels of the hierarchy (“skip-level” communication) plays a similar role: it protects employees from being replaced by their subordinates. Consider for example a three-level hierarchy with a principal, a supervisor, and an agent. Suppose the principal could replace the supervisor by the agent if he knew that the latter is more efficient, but has no way to find out. If skip-level communication is not allowed (i.e. the agent cannot communicate with the principal), the principal has no way to learn that the agent is more efficient than the supervisor when this is true, because the supervisor obviously has no incentive to tell him. Thus, the common
practice of restricting skip-level communication could be a device to ensure proper hiring.

1.4.3 Delegation

The idea that subordinates often have valuable private information could explain why authority is often delegated, *i.e.* why it usually happens that the employees who are formally in charge of making certain decisions do not exercise their right and end up by rubber-stamping their subordinates’ suggestions.

Consider again Tirole’s (1992) model of section 1.4.2. We argued that the principal could offer one of two contracts: a bureaucratic contract, where his subordinates’ private information was not used; and an incentive contract, where the principal used that information and provided incentives to prevent lies. We did not mention a third possibility, which is to let his subordinates decide, *i.e.* to delegate. Principal-agent models usually ignore this third option because in many real situations wealth constraints make it unfeasible. However, when both the principal and the supervisor are managers of the same firm (the only difference being that one has more power than the other), there is no reason why the option of delegation should not be feasible.

Aghion and Tirole (1997) have argued that an important benefit of delegation is that subordinates, knowing that their opinions are going to be heard, put more effort into finding profitable projects to propose to their superiors. Thus, on one hand, managers would like to exercise their formal authority in order to make the decisions they personally prefer. But on the other hand, they would like to be able to count on their subordinates in those cases where they think the latter might be better informed. In order to motivate their subordinates, managers have to assure them that their opinions are going to be taken into account. Aghion and Tirole analyze several ways in which managers can commit to listen to their subordinates and hence encourage their initiative. In particular, they show that it is always optimal for the firm to overload managers with tasks. For similar reasons, there is a tendency for more decentralized decision making when decisions are urgent.
1.5 Other Issues

1.5.1 Leadership

As we mentioned in section 1.2, there is an old distinction between power—the right to impose one’s will on another person—and the ability to draw voluntary support from other persons, which is usually called authority in the sociology literature. The use of these terms in the economics of organizations has not been very precise, and in most cases the two have been used interchangeably to refer to (the sociological notion of) authority. The only exception is Hermelin (1997): his definition of leadership as the ability to induce others to voluntarily follow is almost exactly what in sociology would be called authority.⁹

In Hermelin’s (1997) model, the leader’s ability to convince comes from the fact that he has better information than anyone else about the marginal return of effort. He defines the firm as a team of workers with production function \( V = \theta \sum_{i=1}^{N} e_i \), where \( e_i \) is agent \( i \)'s effort. Contracts can be made contingent on the team output, \( V \), but not on the individual effort choices. Moreover, the marginal return of effort, \( \theta \), is observed only by one of the team members, say agent \( N \) (the leader). Hence, the optimal contract has to solve two problems at the same time: a moral hazard in teams problem (as in Holmström [1982]), and an adverse selection problem.

Hermelin compares two kinds of contracts. The first one is a mechanism in which the informed agent sends a message \( \hat{\theta} \) to his teammates which truthfully reveals \( \theta \), and then everyone chooses an effort level. The optimal contract of this kind induces truthful revelation by making the informed agent’s reward a decreasing function of his message, \( \hat{\theta} \). This is needed for incentive compatibility because otherwise agent \( N \) would have an incentive to claim that \( \theta \) is very high so that everyone else exerts a lot of effort. Hermelin calls this property “leader sacrifice”. The second class of contracts

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⁹It is clear that in any standard agency model of the type discussed in section 1.4 subordinates reveal their information (or choose their effort) voluntarily once their superior has designed the appropriate incentive mechanism: hence, in equilibrium all actions are voluntary. However, this is an unsatisfactory description of leadership, because the superior “buys” his subordinates’ actions. Instead, the intuitive idea of a leader is that of someone who has the ability to convince others to carry out certain actions or, in other words, the ability to change their objectives.
are mechanisms in which the informed agent chooses his effort before anyone else, and his teammates observe this choice and then choose their own efforts. In this case, the informed agent "leads by example": to make his teammates believe that θ is high, he chooses a high level of effort.

With the "leader sacrifice" contract, the team can attain the same level of output that it would be able to produce if there was symmetric information about the marginal return of effort (i.e. all teammates knew θ). To see this, consider the case in which θ is known by everyone. The (second-best) optimal contract is a shares contract where every agent gets a share 1/N of every additional unit of team output and where the levels of the agents' rewards can be determined through lump-sum transfers, which redistribute the surplus without affecting its size. With asymmetric information about θ, these transfers can be made contingent on the message ˆθ in order to induce truthful revelation without reducing the size of the surplus. On the other hand, consider the "leading by example" type of contract. In this case, truthful revelation requires the leader to exert "too much" effort (compared with the symmetric information case) when θ is high in order to convince his teammates. Hence, the need to reveal θ truthfully increases the size of the surplus, whereas under the "leader sacrifice" it only redistributed it. Leading by example, then, is a better mechanism to induce effort.

1.5.2 Interest Groups

The point of view that is common to all the models discussed in section 1.4 is that the ability of higher management to exercise its authority is limited by its informational disadvantage and by the differences between its objectives and its subordinates' objectives. Dewatripont and Tirole (1995) have pointed out that many organizations do not try to design incentives that align the subordinates' objectives with those of the organization, but rather ask employees to defend objectives which are deliberately defined in a narrow way.

The main advantage of having interest groups or advocates of specific causes fight to influence the organization is that in this way the incentives to gather information
can be higher. Suppose that the top management is debating whether to make a particular decision or not, and that there is not enough information at present to know whether the decision is worthwhile. If a single person is entrusted to gather information to help the organization decide, she might be afraid of finding out that, after hours of studying the matter, there are still as many pros as cons. Hence, if the organization can only provide rewards contingent on the decision made, and not on the quality of the decision made by the subordinate, the subordinate will have low incentives to find out new information, which could counterbalance the information she already has. On the contrary, when the organization uses two different employees to find out the pros and cons respectively, each employee can only increase his reward by looking harder for more information.

1.6 Conclusions

Whereas the incomplete contracting approach is dominated by the idea that it is relatively simple for organizations to allocate authority in order to provide employees with appropriate incentives, the asymmetric information approach has stressed that this allocation is subject to serious constraints — constraints that stem from the fact that different positions give access to different kinds of information. A natural direction in which further insights could be gained would be to combine the two approaches in order to understand how authority generates incentives to make relationship-specific investments when different allocations of authority create different informational asymmetries. When employees with less authority have an informational advantage over those with more authority, the latter's incentives to invest in relationship-specific human capital might be small, as opposed to what the incomplete contracting literature claims.

To illustrate how informational asymmetries matter in an incomplete contracting world, suppose that the return of some specific ex-ante investments depends on actions which have to be taken ex-post. Consider an allocation of power where one of the parties, A, has all the residual rights of control, while the other party, B, has
none. Assume that the ex-post actions are more successful if $A$ is able to use some information that $B$ privately observes. To induce truthful revelation, $A$ has to leave some rents to $B$, and this reduces his incentives to invest ex ante. On the other hand, if $A$ decides not to use $B$'s information, he can get a larger share of the ex post surplus, but the incentives to invest ex ante will be small because, without $B$'s information, the ex post production decisions will be more inefficient. Hence, there might be a trade-off between the ex-ante efficiency of specific investments and the efficient use of the subordinate's information ex post.

In a framework like this, some of the insights of the asymmetric information literature could be used to derive consequences for the optimal allocation of authority, which could be compared with the conclusions of the incomplete contracts/symmetric information literature. The concept of authority would be enriched in this way, because it is more realistic to assume that there are limits to the firm's ability to allocate power among employees, as the asymmetric information models do, than to assume that the firm can decide to distribute power in any way, as the incomplete contracting literature assumes.
Chapter 2

Authority, Visibility, and Incentives

2.1 Introduction

Some recent studies have documented the adoption of new human resource practices by US firms, and have presented evidence of their positive effect on productivity.\(^1\) Among these new practices, employee participation plans seem to be particularly widespread: approximately 50 percent of the establishments in Osterman's (1994) survey reported to be using self-directed work teams. Employee participation plans are designed to increase the decision rights of employees at relatively low positions in the firm.\(^2\) After such plans are put into practice, these employees have more means to affect the performance of the firm, because they are allowed to make more decisions or more important ones. This has lead some authors to argue that these plans have positive effects on performance because the workers who are given more authority

---

\(^1\)See, for example, Osterman (1994); Appelbaum and Batt (1994, 1995); Ichniowski, Kochan, Levine, Olson and Strauss (1996); and Ichniowski, Shaw and Prennushi (1997).

\(^2\)In this sense, other terms such as "employee involvement", "job enrichment", or "teamwork" are equivalent to employee participation. These terms, however, are not equivalent to my notion of employee participation if they refer to forms of participation that are merely consultative, such as quality circles or work councils. Finally, by employee participation I do not mean the participation in the company's profits through incentive schemes, although I do analyze the relationship between authority and incentive pay ("explicit incentives"). Levine (1995) and chapter 7 of Lawler (1994) contain more details about different forms of participation.
become more motivated, and work harder:

"The expected advantages of enriched jobs are many. Basically, the arguments in favor of this approach contend that enriched jobs produce greater motivation (...) than simplified jobs. The increased motivation means that the employees will be more productive and will produce higher-quality work." (Lawler [1994], p. 193)

I argue that there is a trade-off between giving more power to some employees or to others: in order to enrich some employees' jobs (or, in other words, to increase employee participation in the production process), it is often necessary to reduce the power of other employees. For instance, when some employees are allowed to make changes in the organization of their work, their supervisors lose power.\footnote{The firm can sometimes give more discretion to some employees by simply eliminating rules, and in that case it could seem that no other employee's power has been reduced. However, this is not so if the power to design rules lies in some of the employees. On the other hand, if the origin of rules is custom, then it is possible for the firm to increase some employees' discretion without reducing that of others.} Taking this into account, I analyze the determinants of the optimal distribution of authority in a firm. I also argue that authority not only motivates employees, but also affects the effectiveness of other instruments that the firm may use to provide incentives. Specifically, I study how authority affects the costs and benefits of using bonuses based on firm performance.

Throughout this chapter I explore the idea that authority makes employees more visible. When an individual has a large amount of authority, the decisions he makes have a large impact on the performance of the firm: such an employee often decides between several investment projects, organizes various aspects of work, or defines the objectives of his subordinates, while employees with less authority are usually left with tasks which require less initiative.\footnote{In fact, in the literature on employee participation, the low level of motivation of these employees is often attributed to the little amount of initiative that the firm expects from them.} As a consequence, an outsider who observes the performance of a firm learns more about the productivity of the employees at higher positions than about those at lower positions. For example, after a company
goes bankrupt, its CEO and some of the top managers are likely to be punished by the market, but middle managers will not be blamed. Similar reasoning applies to any unit of a firm where some measure of performance is available but the individual contributions of the members are not observed: an industrial plant, a branch office of a bank, a store, or the regional division of a corporation; and to other kinds of organizations, such as government agencies or political parties. In all these cases, the distribution of authority makes some employees more visible than others. The employees at higher positions realize how easy it is for outsiders to learn about them and tend to work harder, all else equal. Thus, authority generates incentives by affecting visibility.

In order to formalize this idea I use two building blocks: a team production problem (as in Holmström [1982a]), to capture the idea that the firm does not observe the individual performance of workers and can only observe an imperfect signal of their joint output; and employee career concerns (as in Holmström [1982b]), formalizing the idea that when workers are very visible they exert a lot of effort in order to make outsiders believe that they are very productive. The combination of these two elements provides a framework where it is possible to analyze the incentive role played by authority. I derive two main sets of results. First of all, I show that when career concerns are the only source of incentives, all employees are risk-neutral and a priori identical, and there are constant returns to scale, an output-maximizing firm chooses to distribute authority unequally among its employees. This challenges the view that one of the benefits from distributing authority equally is that employees become more motivated. The main reason why an unequal distribution of authority arises is that there is a complementarity between each employee's authority and effort in the firm's revenue function: if an employee starts to work harder for some exogenous reason, it is profitable to give him more power; but having more power, he becomes more visible and exerts more effort, so it is profitable to give him even more power. Finally, I also show that the firm faces a trade-off between maximizing the employees' incentives and minimizing the conflicts of interest across positions. Thus, the fact that the firm prefers to distribute authority in an unequal way indicates that the existence of
conflicts among employees is not an off-equilibrium feature, but rather a characteristic of the equilibrium of the firm.

The second main result refers to the issue of how authority affects the costs and benefits of using other instruments (different from authority) to provide incentives. I briefly study the relationship between authority and performance pay ("explicit" incentives) when firm performance is (imperfectly) observed but the individual performance of workers is not observed at all. I find these two instruments to be related in three ways. First of all, the higher the employee's position (or authority), the cheaper it is for him to influence the firm's performance. As a consequence, if the firm were to give the same incentive rate to two employees at different positions, the one at the higher position would exert more effort. Secondly, since authority generates incentives, it is not necessary to give high formal incentives to employees at high positions: the latter realize how visible they are and tend to work harder than other employees, all else equal. Finally, the distribution of authority affects the variance of performance, which is minimized when all employees have equal power. If the workers are risk-averse, this affects the cost of providing formal incentives. Thus, when employees do not have large career concerns and are not very risk-averse, it is optimal for the firm to give higher explicit incentives to employees at higher positions.

To my knowledge, the main theme of this chapter—that authority generates incentives via visibility—has not been studied before. In Prendergast (1995) and Aghion and Tirole (1997), employees derive private benefits from exercising authority, but such benefits are considered as exogenous throughout the analysis. On the contrary, I analyze career concerns as a mechanism through which authority affects the workers' payoffs endogenously. By endogenizing the benefits of authority, I am able to identify some of the trade-offs that firms face when they allocate workers to positions, as well as to characterize the optimal relationship between authority and performance pay. I also depart from those models in that we consider a simpler definition of authority: I assume that the firm is able to directly choose a level of authority for each employee, whereas Prendergast (1995) and Aghion and Tirole (1997) assume that the firm can only give authority to a particular employee, who then decides how
much of his authority to delegate. In Aghion and Tirole’s model, the manager has “formal” authority over a certain issue when he has the right to decide. Since it is costly for him to find out what the best decision is, and his subordinate may sometimes be better informed, the manager chooses to delegate authority in some cases, and his subordinate ends up having “real” authority (in those cases). Thus, the allocation of real authority emerges as the equilibrium of a game where the two employees decide how much information to collect. The better the manager’s information, the more likely that he will decide, and the lower his subordinate’s incentives to become informed. On the contrary, in my model the level of authority of each employee is not determined by another employee’s (his superior’s) actions, but only by the firm’s decision. Thus, I assume that formal and real authority coincide.

The chapter is organized as follows. In the next section I set up the model and derive some preliminary results on the learning process. In section 2.3 I analyze the optimal allocation of authority under the assumption that authority is the only instrument the firm can use to generate incentives. In section 2.4 I consider the firm’s allocation of authority as given and study how an optimal explicit incentive scheme should depend on each employee’s position. Finally, section 2.5 presents the conclusions.

2.2 Authority and Learning

2.2.1 Set-up

In this section I briefly define the model of team production with career concerns that I use (with some variations) throughout the paper. I basically extend Holmström’s (1982b) model to consider a case where the principal employs two agents instead of one. This is similar to Meyer (1994) and Jeon (1996), with the only difference that each employment contract offered by the principal in my model specifies a wage and a position in the firm.
Production

A risk-neutral firm (the principal) employs two workers, A and B (the agents), at periods \( t = 1, 2 \) and maximizes the discounted sum of expected profits using \( \delta \) as a discount rate. The firm’s technology at period \( t \) has the following constant returns to scale form:

\[
y_t = \phi_A (\eta_A + e_{At}) + \phi_B (\eta_B + e_{Bt}) + \epsilon_t
\]  

(2.1)

where \( y_t \) is output, \( e_{At} \) is agent A’s effort, \( \eta_A \) is agent A’s ability and \( \eta_B \) and \( e_{Bt} \) are similarly defined for agent B. Agent A’s potential productivity is \( \eta_A + e_{At} \), but once he is hired, his effective contribution to the firm depends on the position where he is placed, characterized by the parameter \( \phi_A \). If he is placed at a low position (low \( \phi_A \)), anything he does has a smaller impact on output than it would have had, had he been allocated to a higher position. The crucial assumption is that the total amount of authority that the firm can give to its employees is fixed: \( \phi_A + \phi_B = 1 \). This creates a trade-off between giving authority to one of the employees or the other. The abilities \( \eta_A \) and \( \eta_B \) are constants unknown to everyone (including the agents themselves), and all players have identical prior beliefs about ability such that the prior distribution of \( \eta_i \) is Normal with mean \( \eta_{i0} \) and variance \( \sigma_i^2 \) for \( i \in \{ A, B \} \) and the prior covariance between \( \eta_A \) and \( \eta_B \) is zero. Finally, the random variable \( \epsilon_t \) is a productivity shock to the firm, and is assumed to be normally distributed with mean 0 and variance \( \sigma_{\epsilon}^2 \).

The shocks are independently distributed.

Competition

The principal is subject to labor market competition. The value of agent \( i \) in the market is \( \gamma \eta_i \), with \( 0 < \gamma \leq 1/2 \). The principal has to pay at least their market values to the agents, and provided he does so, he can allocate authority between them in the way most profitable to him.
Utility functions

The two agents have the same strictly increasing and convex disutility of effort $c(e)$ and the same utility function. Their reservation utility is 0 (the same for both agents). I also assume that they discount the future at the same rate, $\delta$, as the principal. Finally, I consider a risk-neutral and a risk-averse case. In the risk neutral case, the utility function is

$$U_{rn}(w_{i1}, w_{i2}; e_{i1}, e_{i2}) = \sum_{t=1}^{2} \delta^{t-1} [w_{it} - c(e_{it})]$$  \hspace{1cm} (2.2)

where $w_{it}$ is the wage paid to agent $i \in \{A, B\}$ at period $t$. In the risk-averse case I use the following exponential utility function:

$$U_{ra}(w_{i1}, w_{i2}; e_{i1}, e_{i2}) = -\exp \left( -\gamma \sum_{t=1}^{2} \delta^{t-1} [w_{it} - c(e_{it})] \right).$$  \hspace{1cm} (2.3)

Using this intertemporal utility function is equivalent to assuming that the agents have access to a perfect capital market and therefore allows me to abstract from the issue of how the principal can use the contracts to smooth the agents' income over time.

Timing

As noted before, there are only two periods. The decisions are made in the following order:

- The market offers each agent $i$ a wage $w_{i1}$ for period 1.
- The principal offers each agent $i$ a position $\phi_{i}$ for both periods, and a wage $w_{i1}$ for period 1.
- The agents accept or reject the principal’s offers.
- First-period production takes place: the agents choose $e_{A1}$ and $e_{B1}$.
- The productivity shock $\epsilon_{1}$ is realized, and all players observe $y_{1}$.  

45
• The market offers each agent a second-period wage \( w^m_{i2} \).
• The principal offers each agent a second-period wage \( w_{i2} \).
• The agents accept or reject the principal’s offers.
• Second-period production takes place.
• The productivity shock \( \epsilon_2 \) is realized, and all players observe \( y_2 \).

The assumption that the principal commits to a certain allocation of authority \( \phi_i \) is relaxed later on (section 2.3.2). I then assume that the principal uses the information about period-1 performance to change the allocation of authority at period 2. On the other hand, it is important to note that all players (the principal, the two agents, and the outside firms) observe the realization of output at the same time. Therefore, if the effort choices are known in equilibrium, then all players have exactly the same beliefs at every point on the equilibrium path of the game.\(^5\)

2.2.2 Preliminary Results

I now derive the basic results that characterize the Bayesian updating process and that I use in the remaining sections for the analysis. For this, let the levels of effort chosen by the agents in equilibrium be denoted by \( e^*_i \) (for \( i \in \{A, B\} \) and \( t \in \{1, 2\} \)). Because of the normality assumptions, the posterior beliefs at period \( t \) about \( i \)'s ability can be expressed as a weighted average of today’s signal and all past signals.\(^6\)

\[
\eta_{it} = (1 - t\alpha_{it})\eta_{i0} + \alpha_{it} \sum_{s=1}^{t} \left( \frac{z_s}{\phi_i} - \frac{\phi_{-i}}{\phi_i} \eta_{-i0} \right). \tag{2.4}
\]

where

\[
\alpha_{it} \equiv \frac{\phi_i^2 \sigma_i^2}{(\phi_A^2 \sigma_A^2 + \phi_B^2 \sigma_B^2) t + \sigma_i^2}.
\]

\[
z_t \equiv y_t - \phi_A e^*_{At} - \phi_B e^*_{Bt}. \tag{2.5}
\]

\(^5\)I have assumed that all players have the same prior beliefs. Moreover, because of the linearity of the production function, the choices of effort are indeed known in equilibrium.

\(^6\)The posterior variance-covariance matrix is shown in the appendix to this chapter.
Thus $\alpha_{it}$ is an updating coefficient: it measures the rate at which the principal updates his beliefs about agent $i$. In the context of an organization, $\alpha_{it}$ can be interpreted as a measure of accountability: the higher this coefficient, the more the principal blames $i$ for a bad result or rewards him for a good one. The variable $z_t$ denotes the estimate of the team productivity that the players construct after observing period $t$'s output, $y_t$. Thus, at each point in time the beliefs about each agent's ability are a weighted average of past beliefs and the new information contained in $z_t$, as in any linear normal learning model and, in particular, as in Holmström's (1982b) career concerns model. The only departure from previous models of career concerns being the introduction of the authority parameter, $\phi_i$, I now characterize how it affects the learning process:

**Lemma 2.1 (Authority and Learning)**

- $\alpha_{i1}$ is increasing in $\phi_i$ (authority).

- There exists a critical value of authority $\hat{\phi}_i$ such that the reputational returns to authority for agent $i$ are increasing if $\phi_i < \hat{\phi}_i$ and decreasing otherwise. If $\sigma_\varepsilon < \sigma_i$, then $0 < \hat{\phi}_i < 1$.

**Proof:** Differentiating $\alpha_{i1}$ with respect to $\phi_i$, we find $\frac{\partial \alpha_{i1}}{\partial \phi_i} > 0$ and $\frac{\partial^2 \alpha_{i1}}{\partial \phi_i^2} > 0$ or $< 0$ depending (respectively) on whether $\phi_i$ is low or high.

This result characterizes the Bayesian updating rule used by the principal. The first part of the result reflects the intuition that employees at higher positions should be more accountable for the firm's performance. Consider A's productivity in the firm at period 1, $\phi_A(\eta_A + e_{A1})$. When A is expected to play the pure strategy $e_{A1}^*$, its variance is $\phi_A^2 \sigma_A^2$. This measures the principal's prior uncertainty about A's value to the firm. For a given $\sigma_A^2$, such uncertainty increases with authority because the failures and successes of employees at higher positions affect the firm's performance more. The high rate at which the principal updates his information about employees with high authority follows from this: the information about ability generated by the

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7In fact, $\phi_i = 1$ corresponds exactly to Holmström's (1982b) model.
production process is more valuable whenever prior information is of worse quality. To see this, it suffices to divide the production function (2.1) by \( \phi_A \) in order to get

\[
y_t' = \eta_A + e_{At} + \epsilon_t'
\]

where

\[
y_t' = \frac{1}{\phi_A} y_t
\]

\[
\epsilon_t' = \frac{1}{\phi_A} [\phi_B (\eta_B + e_{bt}) + \epsilon_t].
\]

In this formulation, the variance of the noise is

\[
V(\epsilon_t') = \frac{1}{\phi_A^2} [\phi_B^2 \sigma_B^2 + \sigma_{\epsilon_t}^2],
\]

and an increase in A's authority is equivalent to an increase in the precision of his signal, \( y_t' \).

The second part of the lemma is illustrated in Figure 2.1. The marginal effect of authority (\( \phi_A \)) on the updating coefficient (\( \alpha_{A1} \)) is increasing for low values of authority, and decreasing for high values. Thus, as the principal gives more authority to A, his learning increases at an increasing rate until it reaches a point where decreasing returns appear. This result has a very intuitive explanation that I develop below (see lemma 2.2).

2.3 Optimal Allocation of Authority

2.3.1 Commitment Case

I now analyze the allocation of authority that a profit-maximizing principal would choose when he commits not to change his decision after observing the first-period
output. Since the updating coefficients $\alpha_{A1}$ and $\alpha_{B1}$ play a crucial role in determining the agents' career concerns, it is useful, as a first step, to find the allocation of authority that maximizes the sum $\alpha_{A1} + \alpha_{B1}$:

**Lemma 2.2** If the two agents are ex-ante identical, then the value of $\phi_i$ that maximizes $\alpha_{A1} + \alpha_{B1}$ is a corner solution $\phi_i^* \in \{0, 1\}$. The minimizing value is $1/2$.

**Proof:** The lemma is proved by differentiating $\alpha_{A1} + \alpha_{B1}$ with respect to $\phi_A$. ■

To understand the result, let $\sigma^2_A = \sigma^2_B = \sigma^2$ and notice that the sum of the updating coefficients can be expressed as

$$\alpha_{A1} + \alpha_{B1} = \frac{(\phi_A^2 + \phi_B^2) \sigma^2}{(\phi_A^2 + \phi_B^2) \sigma^2 + \sigma^2_\epsilon} = \frac{\sigma^2_j(\phi_A)}{\sigma^2_j(\phi_A) + \sigma^2_\epsilon},$$

where $\sigma^2_j(\phi_A) \equiv (\phi_A^2 + \phi_B^2) \sigma^2$ is the prior variance of the team productivity. Thus, $\alpha_{A1} + \alpha_{B1}$ is just the rate at which a Bayesian principal would update his beliefs about an agent of prior ability $\phi_A \eta_{A0} + \phi_B \eta_{B0}$ and prior variance $\sigma^2_j(\phi_A)$ after observing
In other words, it is the rate at which the principal updates his beliefs about the team\(^8\). But the rate of updating of a Bayesian principal is higher the higher the initial uncertainty about the agent or, in this case, about the team. As a consequence, \(\alpha_{A1} + \alpha_{B1}\) has to be maximized at the corners (\(\phi_i^* \in \{0, 1\}\)), since it is for these values of \(\phi_A\) that the prior uncertainty about the team, \(\sigma_A^2(\phi_A)\), is highest.

To analyze the profit-maximizing distribution of authority, let \(w_{it}(\eta_{it-1}, e_{it}^*)\) be the wage offered to agent \(i\) at period \(t\) given his expected ability (\(\eta_{it-1}\)) and effort (\(e_{it}^*\)). Similarly, let \(w_{it}^m(\eta_{it-1})\) denote the wage offered to agent \(i\) by the market in period \(t\). Competition in the labor market imposes the following zero-profit and arbitrage constraints:

\[
w_{it}^m(\eta_{it-1}) = \gamma \eta_{it-1}. \tag{2.7}
\]

\[
w_{it}(\eta_{it-1}, e_{it}^*) - c(e_{it}^*) = w_{it}^m(\eta_{it-1}) \tag{2.8}
\]

for \(i \in \{A, B\}\) and \(t \in \{1, 2\}\). These constraints are important because they are the source of career concerns for the employees: if workers were not able to bid up their wages every time they were believed to have a higher ability, they would not exert any effort, given that it is not possible to write contracts contingent on future output. Moreover, they exhibit a feature that can be empirically tested, namely that wages corresponding to higher positions are more sensitive to firm performance than those corresponding to lower positions:

**Remark 2.1** At higher positions, wages are more sensitive to performance: \(\frac{\partial w_{itx}}{\partial \eta_{it}}\) is increasing in \(\phi_i\).

This can be derived from the equations (2.8) and (2.9) above, which yield

\[
w_{it2}(\eta_{i1}, e_{i2}^*) = \gamma \eta_{i1} + c(e_{i2}^*).
\]

\(^8\)In the single-agent case, with \(y_t = \eta + \epsilon_t\), \(\eta \sim N(\eta_0, \sigma^2)\), and \(\epsilon_t \sim N(0, \sigma^2)\), the posterior ability is \(\eta_1 = (1 - \alpha_1)\eta_0 + \alpha_1 y_1\) and the updating rate is \(\alpha_1 = \frac{\sigma^2}{\sigma^2 + \sigma^2}.\)
Therefore

\[
\frac{\partial w_{i2}}{\partial y_1} = \gamma \alpha_{i1},
\]

and, from lemma 2.1, \( \alpha_{i1} \) is increasing in \( \phi_i \). On the other hand, effort is given by the IC constraints

\[e^*_i = argmax_{e_{it}}[\delta \gamma \eta_{it} - c(e_{it})], \quad (\text{IC})\]

leading to \( c'(e^*_{i1}) = \delta \gamma \alpha_{i1} \) and \( e^*_{i2} = 0 \). Thus, \( c'(e^*_{A1}) + c'(e^*_{B1}) = \delta \gamma (\alpha_{A1} + \alpha_{B1}) \).

This shows the link between the rates of updating for the agents and their incentives.

In particular, in view of this expression the result of lemma 1 can be interpreted as saying that total incentives (the sum of the two agents') are maximized by distributing authority unequally:

**Remark 2.2** The sum of the two agents' incentives is maximized at the corners (\( \phi_i = 1 \)).

Finally, the following IR constraints have to be satisfied at period \( t \):

\[
w_{i1} + \delta E(w_{i2}) - c(e_{i1}) \geq 0. \quad (\text{IR1})
\]

\[
w_{i2} \geq 0 \quad (\text{IR2})
\]
Hence, defining $F(.) \equiv c^{-1}(.)$, an output-maximizing\(^9\) principal chooses $\phi_A$ in order to maximize\(^10\)

$$
\sum_{i \in \{A,B\}} \left( \phi_i [\eta_{i0} (1 + \delta) + F(\delta \gamma \alpha_{i1})] \right)
$$

subject to $\phi_A + \phi_B = 1$.

**Proposition 2.1** Suppose the two agents are risk-neutral and ex-ante identical. An output-maximizing firm chooses to give all the authority to one of the agents: $\phi_A^* = 1$ or $\phi_B^* = 1$.

**Proof:** Since the agents are ex ante identical, they have the same prior ability, and the distribution of authority only affects output through effort. Letting

$$
\alpha_{A1}(\phi_A) \equiv \frac{\phi_A^2 \sigma^2}{[\phi_A^2 + (1 - \phi_A)^2] \sigma^2 + \sigma_e^2},
$$

the firm’s output at $\phi_A = 1$ (net of the ability terms) is $F[\delta \gamma \alpha_{A1}(1)]$. At any interior point ($0 < \phi_A < 1$), on the other hand, output is

$$
\phi_A F[\delta \gamma \alpha_{A1}(\phi_A)] + \phi_B F[\delta \gamma \alpha_{B1}(\phi_B)]
$$

where $F[\delta \gamma \alpha_{A1}(\phi_A)] < F[\delta \gamma \alpha_{A1}(1)]$ and $F[\delta \gamma \alpha_{B1}(\phi_B)] < F[\delta \gamma \alpha_{A1}(1)]$. Hence either $\phi_A = 1$ or $\phi_B = 1$ maximizes output.\(\blacksquare\)

This proposition shows that there are no purely motivational gains from distributing authority equally, thus contradicting the intuitive argument that a transfer of authority towards employees at low positions increases the firm’s production. From the point of view of the firm, the only reason not to give all the power to one of the employees (and to give none to the other) is that the worker with all the authority

---

\(^9\)The output-maximization problem is not of interest in itself, but only because it highlights some of the effects that are at play in the profit-maximization problem. As discussed below, the difference between the output- and the profit-maximizing solutions is simple.\(^10\)I have substituted the constraints (2.8), (2.9) and (IC) into the expected output function. The individual rationality constraints do not bind when the other constraints are satisfied.
would end up exerting so much effort that he would have to be compensated with a very high wage.

The result is basically due to the complementarity between authority and effort in the firm's revenue function. To understand the intuition, suppose authority is equally distributed between A and B, and imagine that A, for some exogenous reason, decided to work harder. To take advantage of it, the firm would want to give him more power. But having more power, A would have more career concerns and would work even harder, making it profitable for the firm to give him more power. On the other hand, when A's authority is increased, B's is reduced and B exerts less effort. But this is a small loss for the firm, since the impact of B's effort on production is smaller than that of A's. Such is the conclusion of the proof.\footnote{The only property of the updating coefficients that I use in the proof (besides symmetry) is that they are increasing functions of authority: I have not used the convexity results (lemmas 2.1 and 2.2). However, lemma 2.2 would become important if I was to consider production functions more general than (2.1): then, both the convexity properties of the updating coefficients and the complementarity between authority and effort would be necessary for the result.}

The result does not say that a profit-maximizing firm would choose a completely unequal distribution of authority. From the profit-maximization problem above, the expected wage bill is

$$E\left( \sum_{i \in \{A,B\}} [w_{i1} + \delta w_{i2}] \right) = \sum_{i \in \{A,B\}} ((1 + \delta)\gamma \eta_{i0} + c[F(\delta \gamma \alpha_{i1})]).$$

Given the convexity of the cost function $c(.)$, the labor costs will tend to be higher for the firm when authority is distributed unequally. Thus, there are cost saving reasons for distributing authority equally: it is not profitable to put too much authority in the hands of a particular employee because he will tend to work very hard and will have to be compensated for it. It is more costly for the firm to induce additional effort from employees who are already working very hard (i.e. those at high positions) than from employees who are at lower positions and are exerting less effort.

Furthermore, when agents are risk-averse the above contract where authority is concentrated in one employee is not optimal, because the employee with full authority
bears too much risk. Before period-1 production takes place, the variance of the period-2 wage is

\[ V(w_{i2}) = V(\gamma \eta_{i1}) = \gamma^2 \sigma_i^2 \alpha_{i1}, \]

which is increasing in \( \phi_i \). This is so because employees at higher positions are made more accountable for the firm's performance, which is uncertain. As a consequence, a very risk-averse employee who is given a lot of authority has to be compensated with a very high risk premium, and the firm might prefer to reduce the employee's authority (even if this makes incentives worse) to provide him with some insurance:

**Proposition 2.2** Suppose the agents are risk-averse (with utility functions represented by [2.4]) and ex-ante identical. Then the firm chooses a more equal distribution of authority than in the risk-neutral case.

**Proof.** If agent \( i \) is sufficiently risk-averse, the constraint (IR1), rewritten as

\[ (1 + \delta) \gamma \eta_{i0} - \frac{\tau}{2} \delta^2 V(w_{i2}) \geq 0 \]

will bind when \( \phi_i \) is high.■

Finally, another qualification to proposition 2.1 is that a very unequal distribution of authority will not be optimal when the two agents' tasks are highly complementary. If the production function takes the form

\[ y_t = \phi_A (\eta_A + e_{A_t}) + \phi_B (\eta_B + e_{B_t}) + \zeta A_t e_{B_t} + \epsilon_t \]

instead of (2.1), and \( \zeta > 0 \) is high, the firm finds it optimal to divide authority equally, because the lack of incentives of the employee at the lower position causes too big a reduction in the other employee's productivity. In this case, the learning process is the same as in the case we have studied before, because the effort levels are known in equilibrium and are substracted away (as in [2.5]). As a consequence, the IC constraints are the same as before, but the firm has a stronger preference for
dividing authority equally.

2.3.2 No-commitment Case

The commitment assumption is reasonable when it is very costly to reallocate workers to positions (e.g. because of position-specific human capital accumulation). However, the costs of reallocation are in many cases low compared to the benefits that the firm derives from improving the match between employees and positions. In fact, one of the reasons why learning is valuable to the firm is precisely that it helps allocate employees to the positions most suitable to them. This element was not present in the previous analysis, since I was assuming that each agent remained at the same position for two periods, irrespectively of the firm’s performance in period 1. I now use $\phi_{it}$ (for $i \in \{A, B\}$ and $t \in \{1, 2\}$) to denote agent $i$'s position in period $t$, and I interpret $\phi_{i1} < \phi_{i2}$ as a promotion for agent $i$.

The Conflict of Interest

The principal’s problem at the beginning of period 2 (after $y_1$ has been observed) is very simple. Since the agents exert no effort at period 2 (there are no more periods after that), the optimal decision is to give all the power to the agent with the highest ability: $\phi_{A2} = 1$ if $\eta_{A1} > \eta_{B1}$, $\phi_{B2} = 1$ if $\eta_{A1} < \eta_{B1}$, and any $\phi_{A2} \in [0, 1]$ if $\eta_{A1} = \eta_{B1}$. When A and B make their effort choices in period 1, they take into account that their probabilities of being promoted are $\text{Prob}\{\eta_{A1} > \eta_{B1}\}$ and $\text{Prob}\{\eta_{A1} < \eta_{B1}\}$ respectively. After some manipulation,

$$
\eta_{A1} \geq \eta_{B1} \Leftrightarrow \eta_{A0}(\phi_{B1}\sigma_{B}^2 + \sigma_z^2) - \eta_{B0}(\phi_{A1}\sigma_{A}^2 + \sigma_z^2) + z_1(\phi_{A1}\sigma_{A}^2 - \phi_{B1}\sigma_{B}^2) \geq 0. \quad (2.9)
$$

The coefficient of $z_1$ in this expression determines whether a good performance in period 1 (high $z_1$) increases or reduces agent A’s chances of being promoted. If $\phi_{A1}\sigma_{A}^2 > \phi_{B1}\sigma_{B}^2$, an increase in period-1 performance increases A’s probability of promotion. On the other hand, if $\phi_{A1}\sigma_{A}^2 < \phi_{B1}\sigma_{B}^2$, a better period-1 performance can only reduce A’s chances of promotion. To understand why good performance might
actually reduce A’s chances, remember from section 2.2.2 that

\[ \eta_{A1} = (1 - \alpha_{A1})\eta_{A0} + \alpha_{A1} \left[ \frac{z_1}{\phi_{A1}} - \frac{\phi_{B1}}{\phi_{A1}} \eta_{B0} \right]. \]

Suppose A and B are ex-ante identical, and \( \eta_0 = \eta_{A0} = \eta_{B0} \). Ex post (after \( y_1 \) is observed), A’s ability is a weighted average of \( \eta_0 \) and a measure of performance, and so is B’s. Suppose A had initially more authority than B (\( \phi_{A1} > \phi_{B1} \)). This implies that \( \alpha_{A1} > \alpha_{B1} \): the beliefs about A are more affected by performance than those about B. As a consequence, if performance is better than the principal had expected (\( z_1 > \eta_0 \)), then A gets most of the credit for it, and \( \eta_{A1} > \eta_{B1} \). However, if performance is worse than expected, A gets most of the blame, and \( \eta_{A1} < \eta_{B1} \). If A has more authority than B in the first period, then B can only hope to be promoted if the team performs poorly in period 1: in that case, the principal thinks that both A and B are less able than he thought, but his opinion about A is relatively worse than that about B, because A had been given more power (\( \phi_{A1} > \phi_{B1} \)). This creates a conflict of interest between employees at high and low positions: the former tend to have a very strong preference for good outcomes (high performance), while the latter actually prefer bad outcomes, because they can only expect to receive more power when the firm performs poorly and some employees at higher positions are fired.

In this context, the initial allocation of authority \( \phi_{i1} \) can be used to reduce the conflict of interest:

**Remark 2.3** If \( \phi_{A1} = \frac{\sigma_B^2}{\sigma_A^2 + \sigma_B^2} \), there is no conflict of interest in period 1

From (2.10), when the initial authority is allocated in this way the promotion decision is independent of period-1 performance, and the conflict of interest disappears. With this initial distribution of authority, the principal commits not to change the employees’ positions at period 2. To achieve this, he gives more power to the agent that he knows better ex ante, i.e. to the agent with the lower prior variance. The reason for doing this is that a Bayesian principal tends to update more slowly his beliefs about the agents that he knows better and, as a result, these agents benefit less from the
firm's good performance unless they are given more authority to compensate.  

**Authority and Incentives**

I now analyze the firm's choice of authority for the first period, $\phi_{11}$. One of the interesting issues to study is whether the existence of a conflict of interest leads the principal to distribute authority in a more equal way. To answer this question, I assume that it is not profitable for the principal to hire new workers (other than A and B) in period 2; and that the workers have bargaining power over the principal in that period. Under these assumptions, the conflict of interest is strongest: suppose, for example, that the firm can replace A and B with new workers in the event of low period-1 performance. Then the two agents (not only the one with more power) would have an interest in the team performing well, because otherwise they would both be fired. On the other hand, suppose that no new workers can be hired, and that A and B do not earn any rents from working for the principal (as opposed to working with one of the small outside firms). Then, the agents' second-period utilities would not be affected by the promotion decision, since they would earn the same wage whether the principal keeps them in them or fires them. As a consequence, the conflict of interest would disappear.

In the second period, if $\eta_{A1} < \eta_{B1}$ agent A is fired ($\phi_{A2} = 0$) and gets his reservation utility of $\gamma \eta_{A1}$ by working at one of the outside firms. On the other hand, if $\eta_{A1} > \eta_{B1}$, agent A receives full authority in period 2 ($\phi_{A2} = 1$). In that case, since the principal has no bargaining power, A is paid

$$w_{A2} = \eta_{A1} - (1 - \gamma)\eta_{B1}.$$  

Agent A cannot receive a wage greater than this because it would then be profitable for the principal to set $\phi_{A2} = 0$ instead of $\phi_{A2} = 1$ (to fire A instead of B): agent B would be willing to work for the principal at $w_{B2} = \gamma \eta_{B1}$ and the principal's profits

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12Thus, the reason why the firm would like to give more authority to the employees it knows better is not risk aversion: the firm is in fact risk-neutral.
would then be \((1 - \gamma)e_{B1}\) instead of \(e_{A1} - w_{A2}\). Therefore, before period-1 production has taken place agent A’s expected period-2 utility can be expressed as

\[
E(U_{A2}) = P\{\eta_{A1} < \eta_{B1}\} E(\gamma \eta_{A1}|\eta_{A1} < \eta_{B1}) + P\{\eta_{A1} > \eta_{B1}\} E[\eta_{A1} - (1 - \gamma)\eta_{B1}|\eta_{A1} > \eta_{B1}]
\]

\[= \gamma E(\eta_{A1}) + (1 - \gamma)P\{\eta_{A1} > \eta_{B1}\} E(\eta_{A1} - \eta_{B1}|\eta_{A1} > \eta_{B1}).\]

(2.10)

Thus, agent A expects to earn his outside option and a promotion bonus, whose size depends on the ability differential \(\eta_{A1} - \eta_{B1}\), which in turn depends on the initial distribution of authority and the first-period output. The higher this differential, the higher A’s bargaining power, and the higher his wage. When the agents are a priori identical (with \(\eta_{A0} = \eta_{B0} = \eta_0\) and \(\sigma_A^2 = \sigma_B^2 = \sigma^2\), the expected ability differential is

\[
E(\eta_{A1} - \eta_{B1}|\eta_{A1} > \eta_{B1}) = \begin{cases} 
\frac{\phi_{A1} - \phi_{B1}}{\phi_{A1}} E(z_1|z_1 > \eta_0) - \eta_0 & \text{if } \phi_{A1} > \phi_{B1}, \\
\frac{\phi_{A1} - \phi_{B1}}{\phi_{A1}} E(z_1|z_1 < \eta_0) - \eta_0 & \text{if } \phi_{A1} < \phi_{B1}.
\end{cases}
\]

In equilibrium, each agent chooses period-1 effort to maximize the expected second-period utility. Thus, A’s first-period effort is characterized by the first-order condition

\[
c'(e_{A1}) = \delta \frac{\partial E(U_{A2})}{\partial e_{A1}}
\]

where

\[
\frac{\partial E(U_{A2})}{\partial e_{A1}} = \gamma \frac{\partial E(\eta_{A1})}{\partial e_{A1}} + \frac{\partial P\{\eta_{A1} > \eta_{B1}\}}{\partial e_{A1}} (1 - \gamma) E(\eta_{A1} - \eta_{B1}|\eta_{A1} > \eta_{B1}) + P\{\eta_{A1} > \eta_{B1}\} (1 - \gamma) \frac{\partial E(\eta_{A1} - \eta_{B1}|\eta_{A1} > \eta_{B1})}{\partial e_{A1}}.
\]

This expression measures the (undiscounted) marginal return of A’s first-period effort. The first term on the right-hand side is the marginal return that corresponds to the commitment case (section 2.3.1). The other two terms measure the marginal effect

58
of effort on the promotion bonus. From the previous discussion (section 2.3.2), it is clear that the presence of a promotion bonus increases the incentives of the agent who had more authority in the first period and reduces the other agent's. Thus, if $\phi_{A1} > \phi_{B1}$ then

$$\frac{\partial E(U_{A2})}{\partial \phi_{A1}} = \gamma \alpha_{A1} + \frac{1 - \gamma}{2} \phi_{A1} \left( \frac{\alpha_{A1}}{\phi_{A1}} - \frac{\alpha_{B1}}{\phi_{B1}} \right)$$

$$\frac{\partial E(U_{B2})}{\partial \phi_{B1}} = \gamma \alpha_{B1} - \frac{1 - \gamma}{2} \phi_{B1} \left( \frac{\alpha_{A1}}{\phi_{A1}} - \frac{\alpha_{B1}}{\phi_{B1}} \right).$$

In fact, the promotion effect could even make B's incentives negative. In that case, B would try to "sabotage" the firm (i.e. he would exert negative effort) in order to increase his chances of promotion. However, as the principal increases $\phi_{A1}$ and reduces $\phi_{B1}$, the increase in A's incentives more than offsets the reduction in B's:

**Lemma 2.3** Suppose the agents are ex-ante identical. Then $\frac{\partial E(U_{A2})}{\partial \phi_{A1}} + \frac{\partial E(U_{B2})}{\partial \phi_{B1}}$ is maximized at $\phi_{11} = 1$ and minimized at $\phi_{11} = 1/2$.

**Proof.** After some manipulation, the sum of the two agents' marginal returns to effort can be conveniently expressed as

$$\frac{\partial E(U_{A2})}{\partial \phi_{A1}} + \frac{\partial E(U_{B2})}{\partial \phi_{B1}} = \gamma (\alpha_{A1} + \alpha_{B1}) + (1 - \gamma) \frac{1}{2} (\sqrt{\alpha_{A1}} - \sqrt{\alpha_{B1}})^2,$$

where $\alpha_{A1} + \alpha_{B1}$, from lemma 2.2, is maximized at the corners. ■

This result is similar to lemma 2.2, but stronger, since the possibility for the principal to reallocate authority at the end of the first period increases the misalignment of incentives between the agents in comparison with the commitment case. To understand the intuition behind the lemma, suppose the principal decides to make

---

$^{13}$With ex-ante identical agents, further manipulation yields

$$\frac{\partial E(U_{B2})}{\partial \phi_{B1}} = \frac{1}{2} \alpha_{B1} \left( \gamma - (\phi_{A1} - \phi_{B1}) \right).$$

Therefore, B's incentives are negative if $\gamma < \phi_{A1} - \phi_{B1}$, i.e. if the principal faces little labor market competition. The reason for this is clear from (2.11): period-2 utility is a weighted average of the outside option and the promotion bonus. If labor market competition is very weak in period 2, the promotion bonus is relatively more important.
the initial distribution of authority more unequal by giving more power to A. As a consequence B exerts less and less effort, because in this way he increases his chances of being promoted. However, B has also less and less power to affect the firm's output and, therefore, his probability of promotion. Hence, his effort reduction is relatively small compared to the increase in A's effort: as \( \phi_{A1} \) increases, A not only benefits more from any good period-1 performance, but also has more power to affect performance.

Finally, a result similar to proposition 2.1 can be derived in the no-commitment case: if we replace \( \alpha_{A1} \) and \( \alpha_{B1} \) with \( \tilde{\alpha}_{A1} \) and \( \tilde{\alpha}_{B1} \), given by

\[
\tilde{\alpha}_{A1} = \alpha_{A1} + \frac{1 - \gamma}{2\gamma} \phi_{A1} \left( \frac{\alpha_{A1}}{\phi_{A1}} - \frac{\alpha_{B1}}{\phi_{B1}} \right), \\
\tilde{\alpha}_{B1} = \alpha_{B1} - \frac{1 - \gamma}{2\gamma} \phi_{B1} \left( \frac{\alpha_{A1}}{\phi_{A1}} - \frac{\alpha_{B1}}{\phi_{B1}} \right),
\]

the proof of proposition 2.1 can be reproduced and we can state:

**Proposition 2.3** Suppose the two agents are risk-neutral and ex-ante identical. Suppose also that the allocation of authority is changed after the first-period output \( (y_1) \) is observed. Then an output-maximizing firm chooses to give all the authority to one of the agents at the beginning of period 1: \( \phi_{A1}^* = 1 \) or \( \phi_{B1}^* = 1 \).

**Proof.** The proof of proposition 2.1 can be reproduced because \( \tilde{\alpha}_{A1} \) and \( \tilde{\alpha}_{B1} \) are respectively increasing and decreasing in \( \phi_{A1} \). ■

Despite the similarity with proposition 2.1, this result is different in that it adds the idea that the existence of a conflict of interest between employees with high and low authority is a feature of the equilibrium: it is not optimal for the principal to eliminate the conflict of interest, even though it is possible.
2.4 Explicit Incentives and Authority

Characterizations of optimal incentive schemes sometimes overlook the fact that the costs and benefits of explicit incentives depend on the employees' positions in the company. Authority generates incentives and it is likely to affect the design of other incentive instruments. For example, a bonus scheme based on the firm's profits is likely to have a large effect on the CEO's incentives if the latter realizes that the quality of his work has a big impact on performance. However, employees at lower positions might think that even if they work very hard the effect of their effort on profits is small or inexistenent, and might decide not to work harder. In this section I briefly explore some of the links between authority and explicit incentives by adapting Gibbons and Murphy's (1992) model to include team production and authority. Throughout this section, I consider the parameters of authority $\phi_A$ and $\phi_B$ as given and analyze how the firm should design explicit incentive schemes for employees at different positions.

I assume that the agents are risk-averse (with utility functions given by [4]) and that the firm offers a linear incentive contract

$$w_{it} = k_{it} + b_{it}y_{it}$$

at the beginning of each period $t \in \{1, 2\}$ for $i \in \{A, B\}$. The contract is thus defined by a salary ($k_{it}$) and a constant incentive rate ($b_{it}$). In previous sections all the analysis was made assuming $b_{it} = 0$ and $\phi_i$ variable, and we now analyze how the firm will choose $b_{it}$ when $\phi_i$ is given. Because of the dynamics of learning on one hand and the possibility of choosing the incentive rate on the other, the employees' incentives come from two sources: career concerns and explicit incentives.

In period 2, there are no career concerns (as in previous sections) and effort is determined by the explicit incentives only:

$$c'(e_{A2}) = \frac{\partial w_{A2}}{\partial e_{A2}} \iff c'(e_{A2}) = b_{A2}\phi_A.$$
This condition corresponds to the intuition that a bonus scheme based on the company's performance is more effective when the employee has more authority, because in that case his effort has a larger impact on the firm's performance and therefore on his wage. On the other hand, the individual rationality constraints are determined by the offers made by the market,

\[ k_{A2} + b_{A2} E(y_2|y_1) - c(e_{A2}) - \frac{r}{2} b_{A2}^2 V(y_2|y_1) \geq \gamma_{A1}. \]

where \( V(y_2|y_1) \) is the variance of second-period output conditional on first-period output. The principal chooses the incentive rates \( b_{A2} \) and \( b_{B2} \) in order to maximize expected profits subject to the incentive compatibility and individual rationality constraints. The optimal incentive rate is

\[ b_{A2} = \frac{\phi_A^2}{\phi_A^2 + rc''(e_{A2})V(y_2|y_1)}. \]

An increase in A's authority has two effects on the optimal incentive rate. First of all, holding the posterior variance of output constant, it reduces the cost of giving incentives to A. This is so because the more authority A has, the more any additional unit of his effort gets reflected in the performance of the firm, and therefore the more he gets rewarded through the formal incentive scheme: authority increases the marginal return of his effort. The second effect is on the posterior variance of output. The more equal the authority, the lower \( V(y_2|y_1) \), and the cheaper it is to give incentives to A: the posterior variance of output can in fact be expressed as

\[ V(y_2|y_1) = \frac{\sigma_\xi^2}{1 + \frac{\sigma_\xi^2}{\phi_A^2 \sigma_A^2} + \frac{\sigma_\xi^2}{\phi_B^2 \sigma_B^2}} + \sigma_\xi^2 = \sigma_\xi^2(\alpha_{A1} + \alpha_{B1} + 1) \]

and is therefore minimized at \( \phi_A = \phi_B = 1/2 \) (see lemma 2.2). Thus, when \( \phi_A < 1/2 \) the two effects reinforce each other, while when \( \phi_A > 1/2 \) they tend to compensate each other: giving more responsibility to A partly reduces the cost of incentives by increasing A's influence on the performance signal, but at the same time it increases the cost of incentives by increasing the variance of output.
Example. In the one-period version of the game \((V(y_2|y_1) = V(y_1))\), with a quadratic cost function, \(c(e) = \frac{\varepsilon}{2} e^2\), and ex-ante identical workers, it is optimal to give higher explicit incentives to employees at higher positions: the optimal incentive rate in that case,

\[
b_A = \frac{\phi_A^2}{\phi_A^2 + (\phi_A^2 \sigma^2 + \phi_B^2 \sigma^2 + \sigma_e^2) rc'}
\]

is increasing in \(\phi_A\). In this case, the first effect dominates the second, and authority and explicit incentives are complements: an increase in authority increases the marginal benefit to the firm of increasing the incentive rate \(b_A\).[

In period 1, the agents' incentives are determined by the explicit incentive rate and the career concerns. Maximizing A's expected utility with respect to \(e_{A1}\),

\[
c'(e_{A1}) = b_{A1} \phi_A + \delta \frac{\partial k_{A2}}{\partial e_{A1}} = b_{A1} \phi_A + \delta[\gamma \alpha_{A1} - b_{A2} \phi_A (\alpha_{A1} + \alpha_{B1})].
\]

The second term in the right-hand side of this expression measures the effect of career concerns on agent A's first-period effort. Interestingly, this term need not be positive: after some manipulation,

\[
\gamma \alpha_{A1} < b_{A2} \phi_A (\alpha_{A1} + \alpha_{B1}) \Leftrightarrow rc''(e_{A2}) V(y_2|y_1) < \frac{\phi_A}{\gamma \sigma^2} [\phi_A^2 \sigma^2 + \phi_B^2 \sigma^2 - \gamma \sigma^2 \phi_A].
\]

Agent A might have negative career concerns when he is not very risk-averse. By exerting more effort in period 1, he tries to make the principal and the market believe that his ability is higher than it is. But this can have a negative effect on his wage: having observed a good period-1 signal, the firm and the market will believe that the two agents are more able than they thought. As a consequence, they will expect the variable part of their wages to be higher, and will compensate this by reducing the salary (a smaller salary is expected to be enough to have the workers accept the offers). This reduction may be big and create negative career concerns. It will be so when risk aversion is low: otherwise, period 2's incentive rate will be small and A will be protected against the effect of the change in beliefs on his salary.
Finally, the principal takes the previous constraints into account and chooses the first-period incentive rate that maximizes profits. In the same way as in Gibbons and Murphy (1992), this rate can be decomposed into three terms:

\[ b_{A1} = \frac{\phi_A^2}{\phi_A^2 + r \sigma'(e_{A1})V(y_1)} - \delta \frac{\gamma - b_{A2}\phi_A\alpha_{A1} - b_{A2}\alpha_{B1}}{\phi_A} - \frac{r\delta b_{A2}[\phi_A^2 + (1 - \phi_A)^2]\sigma^2}{\phi_A^2 + r \sigma'(e_{A1})V(y_1)} \]

The optimal linear incentive rate is equal to the rate that would be optimal if there were no career concerns, or no-reputation rate, minus two corrections. The first one is a career concerns correction: the higher the agent’s career concerns, the lower the need for the principal to give him formal incentives. The second one is an insurance correction that takes into account that, in period 1, the agents are averse to period-2 uncertainty. When career concerns are not important (\(\delta\) is small), the last two terms are small and the distribution of authority has only two effects on the design of the explicit incentive rate: first of all, it affects the variance of the firm’s performance: the more equal the distribution of authority, the lower the variance of the firm’s performance, and the higher the optimal explicit incentive rate for every employee. Secondly, an increase in the authority of an employee increases the effect that his effort has on the firm’s performance, and therefore on his wage. As a consequence, it is profitable to increase that employee’s incentive rate and reduce the other employee’s. In some cases (see example above) this latter effect dominates and it is optimal to give higher explicit incentives to employees at higher positions. On the other hand, when career concerns are important, the interaction between authority and explicit incentives is more complicated, because employees at higher positions have more career concerns. In this case, the costs of giving explicit incentives to these employees might be low, but so will be the benefits: if employees with more authority have very strong career concerns, the benefits from inducing more effort from them (through an explicit incentive scheme) will be small.
2.5 Conclusions

This chapter’s main conclusion is that there are no purely motivational gains from distributing authority equally, despite the intuitive argument that giving power to employees at lower positions increases their motivation and should benefit the firm. This challenges the view commonly held that the success of employee participation schemes comes from their effect on worker motivation (see Lawler [1994]). When we take into account the trade-off between giving more authority to some employees or to others, we find that the gains from “empowering” employees at low positions are small compared with the losses that come from a reduction in the incentives of employees at higher positions. The reason is that the employees to whom the firm has given more power are not only more motivated, but also have a stronger influence on the firm’s performance. On the other hand, employees at lower positions are less motivated, but the extent to which they can affect the firm’s performance is very small. As a consequence, the firm prefers to give a high degree of authority to some employees even if this implies that other employees will have little incentives to work hard.

The second conclusion refers to the benefits of a more equal distribution of authority. I identify three factors that can make employee participation profitable: work overload, risk-aversion, and complementarities between tasks. Although employees at high positions are very motivated, it is also more costly to induce further effort from them: the wage increase necessary to induce more effort from an employee is lower at positions where the employee is exerting little effort, i.e. at lower positions. On the other hand, there are risk-sharing gains from employee participation: if ability is unknown and a very small number of employees make very important decisions, the variance of the firm’s performance is higher than it would be if more people could participate in the decisions. Finally, when the tasks of employees at different positions are highly complementary, the firm gains from distributing power more equally.

There are certainly other channels through which a more equal distribution of authority can have a positive effect on profits. Throughout this chapter, I have worked
under the assumption that employees were ex ante identical and that positions differed from each other in one aspect only: visibility. Another important aspect in which the allocation of authority matters is that different positions give access to different kinds of information. In this sense, one of the advantages of employee participation is that it provides upper managers with detailed information about production problems that arise in the lower levels of the hierarchy. The conclusions regarding the incentive properties of employee participation programs are in this sense partial elements of the problem.

Finally, I have briefly identified different ways in which the distribution of authority affects the design of explicit incentive schemes based on the firm’s performance. Despite these various interactions, an intuitive conclusion arises from the analysis. This conclusion is twofold: on one hand, it is less costly for the firm to use explicit incentives for employees at higher positions; but on the other hand the benefits are lower too. The costs are lower because the effort of employees at higher positions has a higher impact on the firm’s performance and therefore (if there is an explicit incentive scheme) on these employees’ wages. Thus, if the same incentive rate is given to employees at different positions, the effect on the upper managers’ effort will be higher. On the other hand, however, the benefits of using explicit incentives to motivate employees at higher positions are smaller: employees with more authority are more visible, have stronger career concerns, and therefore tend to work harder even in the absence of explicit incentives.
Chapter 3

Governments and Firms: A Comparison of Hiring Practices

3.1 Introduction

The process by which governments evaluate job candidates and select new employees is highly regulated. Bureaucratic constraints often imply that the managers of the departments where vacancies appear are allowed to play only a limited role—or no role at all—in the hiring process. After interviewing managers in several US government agencies, Ban (1995) concluded:

"The formal civil service is hardly well-loved by managers. They see it, accurately, as having been designed to limit their discretion. Managers resent the fact that they so obviously are not trusted, and they find that working within such constraining rules means that everything they attempt requires more of their energy and time than it should." (p.123)

This contrasts with the practices of most private companies, where line managers’ opinions are more important. Giving discretion to line managers ("decentralizing") is advantageous because these employees have normally better information about the characteristics of the job than the individuals that work in different other units of the government or that are placed higher up in the hierarchy. However, in order for hiring
to be efficient, discretion has to be combined with appropriate incentives: otherwise those in charge of hiring could be tempted to use their power to hire relatives, friends, or persons with similar political ideas. In this sense, the observed differences between governments and firms could be rationalized if there were reasons why it would be more costly to provide public employees than private sector employees with incentives. My objective in this chapter is twofold. First of all, I present evidence of the hiring practices used by governments in three developed countries—France, the United Kingdom and the United States—and compare them with the practices of private companies. Secondly, I provide an explanation for the fact that hiring practices leave less discretion to line managers in governments than in firms.

Of the three countries I analyze, France has the most centralized hiring system. Candidates to public jobs are most often required to take anonymous, written examinations whose structure and content is specified by law. The ranking of candidates is entirely determined by the exams. In the United Kingdom, formal examinations are combined with interviews, and that gives the individuals in charge of hiring some more freedom to determine the contents of the evaluation; but a central personnel agency uses periodical audits to control the appointments. Finally, the United States federal government uses various methods, that range from centrally administered written tests to other procedures where the agency in need of staff has considerable freedom. However, in all three countries these practices stand in sharp contrast with those common in private companies, where formal exams are extremely rare and managers have a much greater freedom to choose. In order to explain these differences between governments and firms, I begin with the observation that firms are in danger of going bankrupt if their performance is too low, while governments do not face this threat. It is clear that some government departments are essential: for example, it is not possible to close the Department of State even if the performance of public employees there is very low. On the other hand, other departments, government agencies, or State-owned companies are not essential, but the possibility of transferring resources to them makes it very difficult for the government to commit to close them down if
they do not perform well. As a consequence, these units face soft budget constraints.\footnote{Another way to understand the role of competition is to consider that product market competition in fact increases the precision of the performance measurements. This was noticed by von Mises in 1944:

"A bureaucrat differs from a nonbureaucrat precisely because he is working in a field in which it is impossible to appraise the result of man's effort in terms of money. The nation spends money for the upkeep of the bureaus, for the payment of salaries and wages, and for the purchase of all the equipment and materials needed. But what it gets for the expenditure, the service rendered, cannot be appraised in terms of money, however important and valuable this "output" may be." (von Mises [1944])

When employees are risk averse, the availability of good performance measures reduces the cost of providing them with incentives.}

The degree of product market competition, however, is not sufficient to explain why some organizations use more flexible hiring procedures than others: the threat of bankruptcy incentivates managers to hire efficiently only as long as they perceive that their hiring decisions have a significant effect on the firm's profitability. But this requires that the hiring rights be concentrated in a small number of employees: otherwise, if the hiring process was fully decentralized, each of the managers in charge of hiring would realize that choosing an inappropriate candidate has little impact on the performance of the firm; and as a consequence, even if the firm is subject to strong product market competition, managers would hire inefficiently. In practice, it is of course possible to induce efficient hiring even by low-level managers by designing appropriate incentive schemes: if managers are rewarded for the performance of their units, they will try to hire efficiently. In that case, even if their decision has a small effect on the firm's profits, it has a large effect on their pay or their prospects of promotion, and that might be enough to induce efficient hiring. But this means that in organizations where hiring decisions are very decentralized we should also observe high-powered incentives; and that, in the same way, centralization and low-powered incentives should be complements. Along these lines, I derive two main results from the model. First of all, I find that the organizations subject to strong competition on the product side find it profitable to decentralize the hiring decisions and to use high-powered incentives, while those with little competition optimally choose centralized hiring and low-powered incentives. This result is consistent with the evidence on the
internal organization of governments and firms. Secondly, I find that the form of decentralization matters: decentralization per se need not be profitable, even when the organization faces strong competition. In fact, decentralization might actually have perverse effects if incentives are not adequately designed, as Carmichael (1988) already pointed out.

The paper is organized as follows. In section 3.2 I review the evidence of governmental hiring practices in the three countries I have chosen. After that, I present and discuss the model (section 3.3), and conclude.

3.2 Empirical Evidence

In this section I provide evidence of a variety of constraints on hiring used by the Public Administration in three selected countries: France, Great Britain, and the US. The rigidity of governments' hiring practices manifests itself in different ways. First of all, the form of the selection process is determined either by law or by a specialized personnel agency of the government, instead of being decided upon directly by the specific department where the vacancy has appeared. Secondly, the selection process is, in many cases, carried out directly by this personnel agency, and therefore line managers have no influence in the process. Thirdly, even when line managers are allowed to choose among candidates, the form of the process is highly restricted. These restrictions include minimum qualification rules and various standardized testing requirements.

3.2.1 France

France exhibits the highest degree of rigidity among the three countries in our study. First of all, almost all vacancies have to be filled through formal competitive examinations. Approximately 90 percent of the positions are filled in this way every year.

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2 This study is limited to the British Civil Service. Northern Ireland has separate Civil Service institutions.
3 Other countries in continental Europe, such as Belgium, Italy or Spain have similar systems.
including public school teaching positions, administrative positions, or high-level positions in the executive branch. In total, hundreds of such examinations are given every year. Moreover, this is so by law and, as a consequence, there is no administrative unit of the government with a power to make substantial changes in the hiring procedures. For example, matters such as how many different tests are included in a given examination, whether those are oral or written, the minimal qualifications required from the candidates in order to apply, and the subjects covered by the tests are most often specified in the law. On the other hand, hiring committees are left to decide upon minor aspects, such as, for example, the specific questions asked in the test. Secondly, many examinations are written and anonymous. This minimizes the interaction between candidates and the hiring committee. In this way, the opportunities for collusion are reduced, but so is the ability of the committee to obtain relevant information about the candidates.

Thirdly, and perhaps more importantly, the candidates are not evaluated for specific jobs, but for very broad job categories, the corps. The jobs belonging to a given corps are characterized by requiring a similar educational background (for example, detailed knowledge of administrative law). However, these educational requirements are broad enough to give access to a variety of actual jobs in the Public Administration. This imposes important constraints on the screening process: on one hand, the examinations cannot be tailored to the specificities of each vacancy, since candidates are not evaluated for a specific position, but for a variety of them. As a consequence, the tests are more similar to academic exams than to job-related exams, and there is little role to be played by the people who know the job characteristics better — the line managers. On the other hand, and for the same reasons, no specific government unit is made responsible for selecting the candidates to the positions in that unit. Again, offering only a single common exam for a variety of positions reduces the possibilities of corruption, but at the same time makes it more difficult to select the appropriate candidates. Finally, the order in which the candidates are ranked after the examinations are completed is the order in which they have to be allocated to the jobs. This is clearly a more rigid rule than is used in other countries, where tests are
used to select a group of top candidates, who are then subject to the approval of the managers of the units where they are going to be employed.

To sum up, the involvement in the hiring process of the managers of the units where vacancies have to be filled is almost non-existent. Line managers are not part of the hiring committees. Moreover, selection procedures are designed in such a way that the persons in charge of hiring can exercise very little discretion.

3.2.2 Great Britain

Bureaucratic constraints on hiring are less strict in the British than in the French Civil Service; and they are also of a different kind. The main difference is that in Britain the more disaggregated units of government are in charge of the recruitment and selection of employees, and their decisions are overseen by a central agency, the Office of Civil Service Commissioners (OCSC), which contracts out periodical audits of the hiring decisions.

The first constraints on hiring refer to the way vacancies are publicized. Before an advertisement is published, the agency has to fix a closing date for the collection of applications, and all applications received during the established period have to be given equal consideration. These constraints are particularly important when government agencies are trying to attract candidates whose skills are under heavy demand in the labor market. On the other hand, due to these constraints the benefits from using informal channels to recruit candidates are reduced, since one of the main advantages of these channels is to shorten the search.

Secondly, the OCSC requires government agencies to carry out the recruitment process in a way that it is possible for them to demonstrate that the procedure has been fair. The important thing here is that it is the agency's duty to demonstrate that fairness has been respected, which restricts the discretion with which recruitment can be made. More precisely, the OCSC requires the agency to describe, before the selection process has started, a series of criteria relevant to the job, and to rank the candidates afterwards according to them. It is also required that all selection decisions be conducted by at least two people. Finally, the agency has to publish a minimal
amount of information regarding the method of selection that has been followed, including an explanation of how fairness has been respected; statistics about the proportion of women, ethnic minorities, and disabled people successful at each level; and information about the cases in which non-competitive methods of selection have been used.4

As I have already mentioned, audits are the main instrument of control used by the OCSC. To this purpose, the OCSC contracts with a private company, which carries out the audits. Each department or agency is audited once every three years. When violations are found, the auditing company makes recommendations and follows up on the agency to make sure that the corrections are put in place. The auditing company also carries out “topic” audits on specific issues: for example, lately some of the audits have revealed that agencies are hiring a large number of employees for temporary positions. Since the rules on competitive hiring do not apply to temporary appointments, there was a concern that such appointments might have been used to circumvent the rules. As a consequence, two “topics” audits have been carried out in 1996-98 concerning this issue.

Even though the system of control via auditing is the rule, there are two important cases in which hiring is controlled in a different way. First of all, Senior Civil Service appointments are not decided by the agencies, but by a central committee (the Senior Appointments Committee); and they require the written approval of the civil service commissioners. Secondly, the so-called “fast-stream” appointments, designed to offer a quick line of promotion to promising college graduates, have to be made according to a three-step procedure which consists of a mixture of written testing and interviews. At the first step, the candidates are subject to a day-long, written qualifying test which is administered locally by a private company contracted by the government. The second step consists of a two-day assessment through a series of tests, group exercises and interviews held at the Civil Service Selection Board in London. Finally,

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4Some appointments need not be carried out according to the rules of competition that I am describing. This is the case, e.g., of short-term appointments, secondments, or appointments of disabled people.

<table>
<thead>
<tr>
<th>Hiring Method</th>
<th>1995</th>
<th>%</th>
<th>1996</th>
<th>%</th>
<th>1997</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. COMPETITIVE APPOINTMENTS</td>
<td>125,269</td>
<td>54.6</td>
<td>99,104</td>
<td>49.3</td>
<td>99,475</td>
<td>47.9</td>
</tr>
<tr>
<td>A.1. Career Appointments</td>
<td>1,334</td>
<td>0.6</td>
<td>1,373</td>
<td>0.7</td>
<td>1,574</td>
<td>0.8</td>
</tr>
<tr>
<td>A.3. Reinstatements</td>
<td>7,890</td>
<td>3.4</td>
<td>7,197</td>
<td>3.6</td>
<td>7,368</td>
<td>3.5</td>
</tr>
<tr>
<td>A.4. Temporary/Limited Appointments</td>
<td>88,914</td>
<td>38.8</td>
<td>62,072</td>
<td>30.9</td>
<td>58,339</td>
<td>28.1</td>
</tr>
<tr>
<td>B. EXCEPTED APPOINTMENTS</td>
<td>103,732</td>
<td>45.3</td>
<td>101,529</td>
<td>50.6</td>
<td>107,955</td>
<td>52.0</td>
</tr>
<tr>
<td>B.1. Schedule A</td>
<td>33,471</td>
<td>14.6</td>
<td>31,860</td>
<td>15.9</td>
<td>36,127</td>
<td>17.4</td>
</tr>
<tr>
<td>B.2. Schedule B</td>
<td>15,587</td>
<td>6.8</td>
<td>18,530</td>
<td>9.2</td>
<td>23,976</td>
<td>11.6</td>
</tr>
<tr>
<td>B.3. Schedule C</td>
<td>283</td>
<td>0.1</td>
<td>236</td>
<td>0.1</td>
<td>282</td>
<td>0.1</td>
</tr>
<tr>
<td>B.4. Other</td>
<td>54,391</td>
<td>23.7</td>
<td>50,903</td>
<td>25.4</td>
<td>47,570</td>
<td>22.9</td>
</tr>
<tr>
<td>C. SENIOR EXECUTIVE SERVICE</td>
<td>202</td>
<td>0.1</td>
<td>145</td>
<td>0.1</td>
<td>183</td>
<td>0.1</td>
</tr>
<tr>
<td>D. TOTAL (A+B+C)</td>
<td>229,203</td>
<td>100</td>
<td>200,778</td>
<td>100</td>
<td>207,613</td>
<td>100</td>
</tr>
</tbody>
</table>

Source: US Office of Personnel Management, Office of Workforce Information.

the definitive decision is made after an interview with a Final Selection Board in London. Thus, the method of selection here resembles more that of the French system, where the managers of the agencies where the line managers under whose supervision the new employees are going to work play practically no role in the decision process.

3.2.3 United States

Compared to the French and the British, the US system may be summarized as an intermediate system, where federal employees can be hired in many ways, some of them resembling the French testing system, others being more decentralized, as in the British system. Table 3.1 contains a summary of the main categories of hiring for positions in the federal government.

The "competitive service" comprises the federal jobs for which the appointment procedures are regulated by law or by the central personnel agency, the Office of Personnel Management (OPM), and apply to all agencies. On the other hand, the "excepted service" consists of positions for which each agency is allowed to design specific requirements and procedures. Finally, the positions belonging to the Senior Executive Service correspond to top-level managers and have to be filled according to a selection process which is described in detail by the OPM. Most of the positions in

<table>
<thead>
<tr>
<th>Hiring Authority</th>
<th>1995</th>
<th>%</th>
<th>1996</th>
<th>%</th>
<th>1997</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>CS Certificate</td>
<td>10,925</td>
<td>38.4</td>
<td>7,884</td>
<td>26.4</td>
<td>9,472</td>
<td>28.0</td>
</tr>
<tr>
<td>Delegated Agreement</td>
<td>10,489</td>
<td>36.8</td>
<td>16,951</td>
<td>56.8</td>
<td>19,907</td>
<td>59.0</td>
</tr>
<tr>
<td>Direct Hire</td>
<td>5,454</td>
<td>19.2</td>
<td>3,755</td>
<td>12.6</td>
<td>2,977</td>
<td>8.8</td>
</tr>
<tr>
<td>Unspecified</td>
<td>1,597</td>
<td>5.6</td>
<td>1,245</td>
<td>4.2</td>
<td>1,412</td>
<td>4.2</td>
</tr>
<tr>
<td>Total</td>
<td>28,465</td>
<td>100</td>
<td>29,835</td>
<td>100</td>
<td>33,768</td>
<td>100</td>
</tr>
</tbody>
</table>

Source: US Office of Personnel Management, Office of Workforce Information.

the executive branch belong to the competitive service, while the ones in the legislative and judicial branches are for the most part excepted.

As shown in table 3.2, appointments through the competitive service are made in three different ways. CS certificate appointments are appointments for which OPM staff ranks the candidates and submit the list to the department or agency where the vacancy has to be filled. The selecting official in that agency (usually a supervisor) must then select from among the top three candidates (the so-called "rule of three")\(^5\). A similar system is followed at a more decentralized level under the method of "agency certificates": in that case, candidates are ranked by the staff of the employing department or agency according to procedures determined by the OPM; and the selecting official is again allowed to choose among the top three candidates.

--\(^5\)This rule constitutes a true limitation to managerial discretion for hiring, as was noted in a recent study by the US Merit Systems Protection Board:

"The prevailing view today is that the "rule of three" imposes too great a limitation on managerial discretion. This view is based in large measure on the belief that the examining tools presently used lack the capability to make fine distinctions among all highly qualified candidates. Under this reasoning, the determination of the "top three available candidates" is suspect.

The managerial discretion granted managers by the "rule of three" often is effectively eliminated by veterans preference. Since a veteran must be selected over a nonveteran with an equal or higher score unless OPM agrees with the reason for passing over the veteran, the presence of one preference eligible at the top of a certificate of eligibles effectively presents a selecting official with a "rule of one" situation, while two preference eligibles create a "rule of two" condition." (MSPB [1994], p. 66)
Table 3.3: Pay Components as a Share of Total Remuneration in %, Selected OECD Countries, 1985 and 1993

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>BS</td>
<td>GA</td>
<td>IA</td>
<td>BS</td>
<td>GA</td>
<td>IA</td>
</tr>
<tr>
<td>1. Secretary</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>One year of service</td>
<td>96.5</td>
<td>3.5</td>
<td>0.0</td>
<td>96.6</td>
<td>3.4</td>
<td>0.0</td>
</tr>
<tr>
<td>Middle of service</td>
<td>97.0</td>
<td>3.0</td>
<td>0.0</td>
<td>97.1</td>
<td>2.9</td>
<td>0.0</td>
</tr>
<tr>
<td>End of service</td>
<td>97.1</td>
<td>2.9</td>
<td>0.0</td>
<td>97.1</td>
<td>2.9</td>
<td>0.0</td>
</tr>
<tr>
<td>2. Tax controller</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>One year of service</td>
<td>82.4</td>
<td>2.7</td>
<td>14.8</td>
<td>82.6</td>
<td>2.5</td>
<td>14.9</td>
</tr>
<tr>
<td>Middle of service</td>
<td>82.6</td>
<td>2.5</td>
<td>14.9</td>
<td>83.5</td>
<td>2.4</td>
<td>14.1</td>
</tr>
<tr>
<td>End of service</td>
<td>82.6</td>
<td>2.5</td>
<td>14.9</td>
<td>82.6</td>
<td>2.5</td>
<td>14.9</td>
</tr>
<tr>
<td>3. Administrative officer</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>One year of service</td>
<td>76.6</td>
<td>2.3</td>
<td>21.1</td>
<td>76.7</td>
<td>2.3</td>
<td>21.0</td>
</tr>
<tr>
<td>Middle of service</td>
<td>77.3</td>
<td>2.3</td>
<td>20.4</td>
<td>77.4</td>
<td>2.3</td>
<td>20.3</td>
</tr>
<tr>
<td>End of service</td>
<td>77.8</td>
<td>2.3</td>
<td>19.9</td>
<td>77.8</td>
<td>2.3</td>
<td>19.9</td>
</tr>
<tr>
<td>4. Senior manager</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>One year of service</td>
<td>76.0</td>
<td>2.3</td>
<td>21.7</td>
<td>77.2</td>
<td>2.3</td>
<td>20.5</td>
</tr>
<tr>
<td>Middle of service</td>
<td>76.9</td>
<td>2.3</td>
<td>20.8</td>
<td>76.9</td>
<td>2.3</td>
<td>20.8</td>
</tr>
<tr>
<td>End of service</td>
<td>78.3</td>
<td>2.3</td>
<td>19.3</td>
<td>78.3</td>
<td>2.3</td>
<td>19.3</td>
</tr>
</tbody>
</table>


In contrast, there are cases in which the OPM allows agencies to make a job offer to any candidate meeting the qualification requirements for the position without having to wait for other candidates and elaborate a full ranking. The possibility of such "direct hires" is granted when there is evidence of a shortage of candidates.

Approximately a half of the appointments made in the last years have corresponded to positions excepted from the competitive service.

### 3.2.4 Pay Components

Hiring is not the only area where managerial discretion is restricted. Pay determination is also much more rigid in governments than in the private sector. A recent OECD survey (OECD [1995]) concluded that "the possibility of differentiating individual pay in the public sector remains very limited". The largest part of the wage and, in most cases, the only one, is a fixed salary, as shown in table 3.3.

This table is based on a survey conducted by the OECD in several government
departments of member countries. "Guaranteed allowances" are additions to the employees' salaries which depend on criteria such as category, occupation, location or age, and are granted to all employees equally. Thus, the basic salary and the guaranteed allowances are not performance-related. In the United Kingdom and the United States, individual allowances do not exist for any position.\textsuperscript{6} In France, on the contrary, individual allowances are paid at some positions, and in some cases may represent a high percentage of the total remuneration. However, individual allowances are not always performance related. Most of them are in fact based on job characteristics or skills (e.g. with the aim of retaining public employees whose qualifications are highly demanded in the private sector).

3.2.5 Firms

Firms use mostly interviews to select among their applicants, and formal examinations are rarely used. Richardson and Stubblefield's (1963) survey of small businesses in Utah already found that firms relied more heavily upon personal interviews and references or statements from previous employers than upon testing. More precisely, 98.7 percent of the respondents used personal interviews and 60.8 percent used checks with previous employers and/or references, but only 20.8 percent used tests. The same reliance on interviews has been observed by Delaney, Lewin and Ichniowski (1989) in a survey of 495 business units across the United States. One of their findings is that 99 percent of these units conducted interviews to select employees. Moreover, it was also found that the most widely used source of recruitment were employee referrals (on average, 89.5 percent of the units used employee referrals). This is interesting because, as we have seen, government hiring systems in France, Great Britain and the United States put special emphasis in avoiding such means of recruitment by making it compulsory for the employers to give equal consideration to all applications received during a predetermined period of time.

A third survey, by the American Management Association (AMA [1986]), asked

\textsuperscript{6}The positions that are not in table 3 are also remunerated through a basic salary only.
human resource managers to describe how they would do to select candidates for 12 hypothetical management positions (they were provided with job descriptions for those positions). For all positions, the human resource managers' answers were similar: 8 to 10 candidates would be interviewed and among those 3 or 4 would be referred to the position supervisor for further consideration. Most survey respondents (70 percent) would do no testing at all. It is interesting to note that some respondents in the sample argued that if they used tests they would have to prove the connection between the test results and their hiring choice in order to avoid problems with the Equal Employment Opportunity Commission (EEOC):

“They’re afraid the EEOC is going to rake them over the coals, and if they misuse the tests, they probably would get raked over the coals. There’s nothing in Title 7 [of the EEOC Act] that says you can’t test, but if you do test and use the results in your decision, you damn well better have the validation to back it up.”

At an anecdotal level, this is evidence of the discretion with which managers of firms make hiring decisions.

3.3 Model

Although, as we have seen, government hiring is organized in various ways in different countries, a common characteristic is that these systems have been designed with the purpose of limiting managerial discretion while leaving enough flexibility to allow agencies and departments to attract good candidates. In private companies, on the other hand, there is a smaller concern about what line managers might do if they are given too much responsibility on hiring. This is partly because managers in private companies are subject to stronger incentives. But incentives, as well as managerial discretion, are an endogenous variable in the design of the organization, and it has to be explained why governments would find it optimal to offer low-powered incentives. Since it is clear that the level of discretion given to line managers should depend on the
extent to which they are motivated to hire the right people, I present in this section
a model of managerial discretion which takes into account the interaction between
hiring decisions and production, i.e. between the incentives to hire efficiently and the
incentives to produce efficiently.

I assume that an organization is composed of three persons ranked in a hierar-
chical way: the owner of the firm, or principal (denoted by P); a line manager or
supervisor (denoted by S); and an agent (A). The three members are assumed to be
risk neutral, and the organization’s problem is to hire an agent in the most efficient
way. Candidates for the A position are of different qualities, but the ability of the
principal to discriminate the good from the bad is more limited than that of the
supervisor, who knows the vacant job more closely and can therefore tell more easily
what worker characteristics are more suitable to it.

3.3.1 Hiring

At the hiring stage, there is a vacancy for an A position and a pool of candidates that
the firm has to screen. The pool is described as a continuum of agents, each of them
defined by a parameter $r \in [0, 1]$, which measures the marginal product of effort of
each agent. Candidates with a higher $r$ are more productive than candidates with a
lower $r$. It is assumed that each agent knows the value of his marginal product, but
this value is unknown to either the principal or the supervisor, who can nonetheless
become informed about it through a costly process of screening.

The principal can choose to organize hiring in one of two ways. Under centralized
hiring, the principal himself chooses a candidate, and the supervisor plays no role in
the process. The principal’s ability to choose the right candidate is limited by the
fact that he does not know the job characteristics relevant to an A position as well
as the supervisor. To reflect this, I assume that the most the principal can do is
hire a candidate of fixed quality $r_p \in (0, 1)$. This is equivalent to assuming that the
principal marginal cost of screening is very high beyond a certain point and very small
before that point is reached. The alternative to centralized hiring is delegated hiring,
whereby the supervisor is allowed to screen the candidates and choose one of them.
The supervisor can find a candidate of quality \( r \) at cost \( C_H(r) \), with \( C_H'(r), C_H''(r) > 0 \). There are two reasons why it is costly for the supervisor to find good candidates. First of all, telling the difference between competing candidates is costly because the supervisor has to examine the candidates’ resumés or set up a series of interviews or tests. One can always choose a random candidate at very little cost, but making sure that the candidate is better than the average is costly in general. The second reason is that the supervisor might be very inclined to hire a particular candidate for purely personal or political reasons: in such a case, \( C_H(r) \) measures the opportunity cost to the supervisor of hiring a more able candidate rather than a friend of his or someone with the same political ideas but a lower \( r \).

### 3.3.2 Production

The production process has two main characteristics. First of all, only the supervisor and the agent have a productive role. Specifically, I assume that the outcome of production, \( y \), can be “good quality” \((y = B > 0)\) or “bad quality” \((y = L < 0)\), and that the probability of a good-quality production is

\[
\pi = \pi(e_S, re_A) = e_S(1 + re_A), \tag{3.1}
\]

where \( e_S \) and \( e_A \) are the supervisor’s and the agent’s efforts respectively. Because of his position of authority, the supervisor has a higher impact on the probability of success than his subordinate. On the other hand, hiring a competent agent (choosing a high \( r \)) increases the principal’s marginal product of effort, since his orders are put into practice with more effectiveness. The costs of effort to the supervisor and the agent are denoted by \( C_e(\cdot) \), with \( C_e', C_e'' > 0 \). Specifically, I assume that \( C_e(e) = \frac{\epsilon e}{2} e^2 \).

The loss that the principal suffers when production is unsuccessful, \( L \), depends on the competitiveness of the market where the product is sold. In a very competitive market, poor performance leads to large losses, which include a probability that the firm goes bankrupt. On the other hand, less competitive markets can be characterized
by a low $L$ (in absolute value). In particular, when product market competition does not exist, as is the case for the Public Administration, $L$ is close to zero. As a consequence, in order to understand the differences between governments and firms I analyze the comparative statics with respect to $L$.

The second characteristic of production is that it is organized hierarchically: the principal has authority over the supervisor, who in turn exercises authority over the agent. In this context, authority is the right to punish or reward another employee. I assume that the principal monitors the supervisor with intensity $m_P \in [0, 1]$ at a cost $C_P(m_P) = \frac{c_P}{2} m_P^2$. Monitoring enables the principal to evaluate the quality of production and to reward the supervisor accordingly. I assume that when quality is good, then the principal is aware of it at no cost. This is a reasonable assumption given that in that case his subordinate would have nothing to lose by revealing to him that production has been successful. On the other hand, if the quality has turned out to be bad, then the principal can only find out if he monitors production. The variable $m_P$, in this sense, measures the probability that the principal finds out that the outcome has been bad given that the outcome has been bad. When the principal finds out that production has been unsuccessful, he can exercise his power over the supervisor and punish him by imposing a disutility of $D_S$ upon him.

In the same way as the principal has authority over the supervisor, the supervisor himself can punish his subordinate if he finds out that his effort has been inappropriate. However, in order to do so, he has to have enough information about the production choices available. If the supervisor has put very little effort into the production process, it is very likely that he will not have good information about how it could have been improved and, as a consequence, about whether his subordinate made the right choices or not. I therefore assume that the probability that the supervisor has enough information to be able to punish his subordinate is

$$m_S = m_S(e_S, re_A) = e_S(1 - re_A).$$

(3.2)
When the supervisor punishes his subordinate, he inflicts a disutility of $D_A$ on him.

### 3.3.3 Timing

The sequence of play in the model can be summarized in the following three stages:

- **Stage 0:** The principal chooses the method of hiring (centralized vs. delegated), and the agent is hired.

- **Stage 1:** The principal chooses the intensity of his monitoring ($m_P$).

- **Stage 2:** The supervisor and the agent simultaneously choose how much effort to exert (effort levels $e_S$ and $e_A$ respectively).

The main dynamic element in the model is the interaction between the incentives at the hiring and production stages of the game. This interaction comes from the fact that hiring is an investment in human capital and, as a consequence, affects the provision of incentives at the production stage. Hiring a good agent increases the probability of success and reduces the chances that the supervisor is punished. As a consequence, the supervisor’s willingness to screen the candidates thoroughly and to choose the most appropriate one depends on the intensity with which he is monitored by the principal: supervisors subject to high-powered incentives have objectives closer to those of the principal, and are more likely to hire the right candidates.

### 3.4 Results

#### 3.4.1 Optimal Hiring and Production

To simplify the notation, let us denote the principal’s, the supervisor’s, and the agent’s utility functions at stage $t \in \{0, 1, 2\}$ by $U_{Pt}$, $U_{St}$, and $U_{At}$ respectively. I now solve the model backward to find the subgame-perfect equilibrium.
Stage 2

At this stage the supervisor and the agent choose their levels of effort \((e_S \text{ and } e_A)\) respectively. Letting \(w_S\) and \(w_A\) denote their respective wages, their utility functions at this stage can be written as:

\[
U_{c^*}(e_S, re_A; m_P) = w_S - [1 - \pi(e_S, re_A)]m_PD_S - C_e(e_S) \tag{3.3}
\]

\[
U_{A2}(e_S, re_A; m_P) = w_A - m_S(e_S, re_A)D_A - C_e(e_A) \tag{3.4}
\]

The supervisor and the agent choose their effort levels simultaneously. Using expressions (1) and (2), it is clear that \(U_{S2}\) and \(U_{A2}\) are supermodular in \((e_S, e_A, r, m_P)\). Therefore the stage-2 game is supermodular and the set of Nash equilibria will be increasing in \((r, m_P)\), by Milgrom and Roberts (1990) theorem 6. Furthermore, it is possible to show that the Nash-equilibrium strategies will be a supermodular function of \((r, m_P)\). This result is going to prove useful in order to find the subgame-perfect equilibrium of the whole multi-stage game.

**Proposition 3.1** The Nash-equilibrium strategies \(e^*_S\) and \(e^*_A\) are increasing and supermodular in \((r, m_P)\). The function \(\pi^*(r, m_P) \equiv \pi(e^*_S(r, m_P), re^*_A(r, m_P))\) is supermodular in \((r, m_P)\).

**Proof:** see appendix.

When a better agent is hired (higher \(r\)), both the supervisor and the agent work harder at the production stage. A more able agent works harder because the job is easier to him. The supervisor, on the other hand, works harder because having a more able agent in his unit makes it less costly for him to attain the objectives that he wants to attain. Finally, there is also an indirect mechanism which makes more able agents work harder: in an environment where his supervisor is working very hard, the agent would have a greater chance of being caught if he decided to be lazy (as opposed to a situation where the supervisor would be doing very little work).
fear of this punishment also makes the more able agents work harder than the less able.

Stage 1

At this stage the principal chooses the intensity with which to monitor his subordinates \((m_P)\). On the equilibrium path, his utility is:

\[ U_{P1}(m_P; r) = \pi^*(r, m_P)B - [1 - \pi^*(r, m_P)]L - C_P(m_P) \tag{3.5} \]

where \(\pi^*(r, m_P)\) is the probability of success when the supervisor and the agent choose their Nash-equilibrium strategies at stage 2. Using proposition 1, it is clear that \(U_{P1}\) is a supermodular function of \((r, m_P, L)\), and the choice of monitoring intensity that maximizes the principal’s utility, \(m^*_P\), is increasing in \((r, L)\). Furthermore, the following stronger result can be obtained:

**Proposition 3.2** If \(c_e > \frac{3}{2}D_A + 1\), then \(m^*_P\) is supermodular in \((r, L)\).

**Proof:** see appendix.

By proposition 3.1, when a better agent is hired, the marginal return of the principal’s monitoring effort increases. This is due to the fact that the most direct effect of his monitoring effort is to make the supervisor work, and this is relatively easier when the supervisor’s subordinate is very able. Thus, it is good for the principal to hire a good agent because in this way it is less costly for him to monitor his immediate subordinate, the supervisor.

Stage 0

Letting \(r_P\) and \(r_S\) denote the candidates chosen by the principal and the supervisor respectively, the principal will delegate the hiring decision if \(r_S > r_P\). Since \(r_P\) is exogenously given, we only have to find the supervisor’s choice to find out whether it is optimal for the principal to delegate the hiring decision.
When he is allowed to hire, the supervisor chooses the value of $r$ that maximizes

\[ U_{S_0}(r; L) = U_{S_1}^*(r, L) - C_H(r) \]

(3.6)

where $U_{S_1}^*(r, L) \equiv U_{S_1}(m_p^*; r) \equiv U_{S_2}(c^*_s, r e_x^*; m_p^*)$.

**Proposition 3.3** *The supervisor’s choice of candidate, $r^*_S$, is an increasing function of $L$.***

**Proof:** see appendix.

If the market where the firm sells its product is very competitive, $L$ is large, and the principal has an incentive to monitor the supervisor very intensively. As a consequence, the supervisor’s incentives are closely aligned with those of his superior, and there is little danger that he might hire inefficiently if the principal decides to delegate hiring.

### 3.4.2 Discussion: Governments and Firms

One of the basic differences between a government department or agency and a firm is that government organizations do not sell their services in a market. Sales are at most a secondary activity. As a consequence, a firm might be pushed out of the market if the quality of its output is too low, but most government departments cannot be closed even if their performance is very low. Thus the parameter $L$ is a good measure of one of the essential differences between governments and firms.

The model shows that human resource practices form a system of complements. $L$ is the parameter that moves the system: as product market competition increases, the cost to the principal of a bad performance increases and, as a consequence, he decides to monitor the supervisor more closely. This makes the supervisor work harder and reduces the probability of a bad outcome. Moreover, the agent is also induced to work harder, for two related reasons: first of all, the marginal return of his effort is higher because his supervisor is working harder. Secondly, since the supervisor is working harder, he is more likely to catch the agent and punish him if he does not
work enough. Finally, the high incentives and high effort that are generated at all levels have an effect on the hiring decisions: the supervisor finds it more profitable to hire higher-quality agents because the abilities of such agents are better taken advantage of when agents are subject to high-powered incentives. In this way, the model predicts that organizations subject to stronger product market competition are characterized by higher incentives (and effort) at all levels and more delegated hiring.

The second important conclusion from the model is that strong product market competition does not by itself explain the observed differences between governments and firms: it need not be profitable for a firm in a very competitive market to decentralize hiring unless production is organized appropriately. Two examples are useful to illustrate this:

Example 1 (Carmichael [1988]): Internal tournaments

Suppose the supervisor and the agent are going to compete in the future for a better position in the company. Then an increase in the agent’s quality \( r \) might reduce the marginal return of the supervisor’s effort. If this is so, it is not optimal for the principal to delegate hiring even if \( L \) is large, because the supervisor will use his discretion to hire low-quality agents (who have less chances to win the tournament). This is the argument used by Carmichael to explain the existence of tenure in academic institutions. When a department’s budget is limited and there is no tenure, junior professors compete with senior professors: if in a given year the department receives a very good pool of candidates, it may be optimal to replace some of the senior professors with junior professors. Knowing this, senior professors would try to report untruthfully the information about the candidates in order to keep their positions. With tenure, senior professors would have the incentives to truthfully reveal that information.
Example 2 (Aghion and Tirole [1997]): Formal authority

Organizational structures where formal authority is important create work situations where the efforts of a subordinate and his superior are substitutes: an employee's effort has an effect on the performance of the firm only if his superior allows his (the subordinate's) opinion to be taken into account. However, a subordinate is less likely to be asked his opinion when his superior is working very hard, because in that case the latter is likely to have enough information about the different production choices to be able to decide without consulting his subordinate. Thus, we should expect a higher decentralization of hiring in more participative organizations.

To sum up, two conditions are necessary for the delegation of hiring to be profitable: a high degree of product market competition and strong complementarities between the managers who are allowed to hire and their subordinates. Most often, government organizations satisfy none of these conditions. Clearly, product market competition is usually inexistent or very weak. On the other hand, limited budgets (as in Carmichael [1988]) and the importance of formal authority (Aghion and Tirole [1997]) create situations where the work efforts of the supervisors and their subordinates are substitutes. This reduces even further the potential effectiveness of delegating hiring decisions in government organizations.

3.5 Conclusions

Governments use a variety of institutional arrangements to limit the power of line managers to decide on hiring issues. In France, civil service examinations play such a predominant role that the role of line managers in hiring their subordinates is practically non-existent. In Great Britain line managers play a more important role in the hiring process, but their choices are monitored by a central agency via periodical audits. Finally, the United States federal government allows agencies and departments to use a variety of hiring mechanisms. Some of them involve a very centralized process of decision making while others leave more discretion to line managers, although not as much as in private companies. On the other hand, the pay systems in the public
administration are considerably rigid and, in particular, pay for performance is almost inexistent.

I have related the organization of hiring to the sensitivity of pay to performance in order to explain the observed differences between governments and firms. The main conclusion of the analysis is that differences in the degree of product market competition can explain hiring differences. The top managers of firms subject to strong competition have strong incentives to reward or punish middle managers according to their performance, because poor firm performance may lead to large losses and eventually to bankruptcy; whereas most government departments or agencies cannot be closed even if their performance is very low. As a consequence, the incentives of middle managers tend to be very well aligned with those of top managers in firms subject to strong competition, and the latter can with little worry let the former take responsibilities in hiring.
Appendix A

Appendix to Chapter 2

Under the normality assumptions I have made, the posterior beliefs conditional on
the sequence \( \{y_1, y_2, ..., y_t\} \) are normal with mean \((\eta_{At}, \eta_{Bt})\) and covariance matrix
\[
\Omega_t = \frac{1}{[\phi_A^2 \sigma_A^2 + \phi_B^2 \sigma_B^2]t + \sigma^2} \begin{bmatrix}
\sigma_A^2 (\sigma^2 + \phi_B^2 \sigma^2_t) & -\phi_A \phi_B \sigma_A^2 \sigma_B^2 t \\
-\phi_A \phi_B \sigma_A^2 \sigma_B^2 t & \sigma_B^2 (\sigma^2 + \phi_A^2 \sigma_A^2 t)
\end{bmatrix}
\]  \hspace{1cm} (A.1)

As \( t \to \infty \), \( \Omega_t \to \Omega_\infty \) where
\[
\Omega_\infty = \frac{\sigma_A^2 \sigma_B^2}{\phi_A^2 \sigma_A^2 + \phi_B^2 \sigma_B^2} \begin{bmatrix}
\phi_B^2 & -\phi_A \phi_B \\
-\phi_A \phi_B & \phi_A^2
\end{bmatrix}
\] \hspace{1cm} (A.2)

so the principal never learns completely the abilities of the agents. In fact, what
the principal learns completely is the average expected productivity, \( \phi_A \eta_A + \phi_B \eta_B \).
By choosing the authority coefficients \( \phi_A \) and \( \phi_B \), he can choose how much to learn
about each agent. Given that the quantity of authority is limited \((\phi_A + \phi_B = 1)\), the
principal has to compare the benefits of learning more about an agent with the costs
of learning less about the other. A particular case occurs when \( \phi_A = 1 \): we then have
Holmström’s (1982b) model and the principal ends up learning A’s ability perfectly
(but does not learn anything about B).
Appendix B

Appendix to Chapter 3

B.1 Proof of Proposition 1

The monotonicity of $e^*_S$ and $e^*_A$ in $(r, m_P)$ is a direct consequence of the fact that the stage-2 game is supermodular (see Milgrom and Roberts (1990)). I obtain the supermodularity part of the proposition by differentiation: the Nash-equilibrium strategies are

\[ e^*_S = \frac{m_P D_S}{c_e - r^2 m_P D_S D_A}. \]  \hspace{1cm} (B.1)

\[ e^*_A = \frac{1}{c_e} \frac{m_P r D_S D_A}{c_e - r^2 m_P D_S D_A}. \]  \hspace{1cm} (B.2)

and therefore

\[ \frac{\partial^2 e^*_S}{\partial r \partial m_P} = \frac{2c_e r m_P D_A D_S^2}{(c_e - r^2 m_P D_S D_A)^2} > 0. \]  \hspace{1cm} (B.3)

\[ \frac{\partial^2 e^*_A}{\partial r \partial m_P} = \frac{D_A}{c_e} \frac{\partial e^*_S}{\partial m_P} + \frac{r D_A}{c_e} \frac{\partial^2 e^*_S}{\partial r \partial m_P} > 0. \]  \hspace{1cm} (B.4)
\[ \frac{\partial^2 \pi^*}{\partial r \partial m_P} = \frac{\partial^2 e_S^*}{\partial r \partial m_P}(1 + r e_A^*) + \frac{\partial e_S^*}{\partial r} \frac{\partial e_A^*}{\partial m_P} + \frac{\partial e_S^*}{\partial m_P}(e_A^* + r \frac{\partial e_A^*}{\partial r}) + e_A^*(\frac{\partial e_A^*}{\partial m_P} + r \frac{\partial^2 e_A^*}{\partial r \partial m_P}) > 0. \]  
(B.5)

**B.2 Proof of Proposition 2**

After some small manipulation, the first-order condition of the maximization of \( U_{P1}(m_P; r) \) with respect to \( m_P \) can be written as:

\[ [e_S D_S(c_e - r^2 m_P D_S D_A) + r^2 m_P D_A D_S^2(r D_A + 1)](B + L) - c_p m_P(c_e - r^2 m_P D_S D_A)^2 = 0. \]  
(B.6)

and implicit differentiation yields:

\[ \frac{\partial m_P^*}{\partial r} = \]

\[ = \frac{r m_P D_A D_S^2(2 c_e - 3 r D_A - 2)(B + L) - 4 c_p r m_P^2 D_A D_S(c_e - r^2 m_P D_A D_S)}{r^2 D_A D_S^2(r D_A + 1 - c_e)(B + L) - c_p(c_e - r^2 m_P D_A D_S)^2 + 2 c_p r^2 m_P D_A D_S(c_e - r^2 m_P D_S D_A)}. \]  
(B.7)

Therefore when \( c_e > \frac{3}{2} D_A + 1 \) this derivative increases with \( L \).

**B.3 Proof of Proposition 3**

It suffices to prove that \( U^*_{S1}(r, L) \) is a supermodular function. Given that

\[ U^*_{S1}(r, L) = U_{S2}(e_S^*, r e_A^*, m_P^*) \]  
(B.8)

we have

\[ \frac{\partial U^*_{S1}}{\partial L} = \frac{d U^*_{S2}}{d L} = \frac{\partial m_P^*}{\partial L} \left( \frac{\partial U_{S2}}{\partial m_P} + \frac{\partial U_{S2}}{\partial e_A} \frac{\partial e_A^*}{\partial m_P} + \frac{\partial U_{S2}}{\partial e_S} \frac{\partial e_S^*}{\partial m_P} \right). \]  
(B.9)
By the envelope theorem, $\frac{\partial U_{S2}}{\partial e_S} = 0$. Moreover, by proposition 1 $\frac{\partial e_A^*}{\partial m_p}$ is increasing in $r$ and, by proposition 2, so is $\frac{\partial m_p^*}{\partial L}$. Finally,

$$\frac{\partial U_{S2}}{\partial m_p} = -[1 - e_S^*(1 + re_A^*)] \tag{B.10}$$

is increasing in $r$ (since $e_S^*$ and $e_A^*$ are increasing in $r$ by proposition 1) and so is

$$\frac{\partial U_{S2}}{\partial e_A} = e_S^* m_p^* D_S \tag{B.11}$$

(because $e_S^*$ is increasing in $r$ by proposition 1 and so is $m_p^*$ according to proposition 2).
Bibliography


