ORGANIZATIONAL INERTIA AND DYNAMIC INCENTIVES[*]

by

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ABSTRACT

Why would an organization give to internal interest groups the incentives and power to block changes that might be beneficial to the overall organization ? How will an organization choose to allocate rents and decision power ? Why and in what sense does such an allocation generate inertia ? The dynamic principal-agent model presented in this paper is meant to address those questions in a formal way. We model the level of inertia as an endogenous rational choice made by the organization (principal). Our results are three-fold: first, the efficient organizational response to the presence of private information on the value of change will in general be to bias the decision rule towards the *status quo*; second, the compensation of the agent differs (an upfront payment versus a distribution of stock options) according to whether the information on the value of change is private to the principal or the agent; finally, the efficient distribution of 'real' authority for recommending change in an organization need not always be profitably retained by the principal.
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1. INTRODUCTION

Fighting inertia, favoring continuous change and building flexible companies or agile corporations have become popular buzzwords in the management literature. Inertia and flexibility are for all practical purposes antonyms in the literature on organizations. With few exceptions, flexibility has a positive tune: more flexibility is always better and more efficient.[1] If flexibility[2] is so valuable, why then is it the case that so many organizations (including, not the least, public bureaucracies) appear to fail to meet the challenge of change ? Indeed, many large and powerful companies have reacted too slowly to the need of change and either went bankrupt or were brought to the brink of bankruptcy and obsolescence before adapting. Similarly, the political cost of changing obsolete socioeconomic policies has been blamed for the growing burden of government welfare programs. Inertia is a pervasive problem that organizations face in spite of frequent calls for change and flexibility by different stakeholders. Why is inertia so prevalent ?

Rumelt (1995) claims that the most crucial problem facing top level management is not product-market strategy but organizational change: "If managers are to commit energy, careers, time, and attention to a program of change, there must be trust that the direction chosen will not be lightly altered. Here we touch the central paradox that change may require the promise of future inertia." Today's inertia may be the result of a commitment necessary to implement change at some earlier date: to raise the power of incentives, some organizations end up promising future rents to their members. Over time, these rents, disseminated across the organization, inhibit change as different groups in the organization want to protect their rents. Sclerosis and inertia set in until the very survival of the organization and of the rents themselves

[1] A report from Business International (1991) stresses the need for companies to be flexible given the important changes in the way competition is likely to operate in the future: markets are becoming more volatile. On the basis of a large number of case studies, Business International claims that flexibility is the all-inclusive concept integrating a whole set of recent management theories, and moreover that "... collaboration inside and outside the company is the way flexibility is achieved."

[2] There are few formal definitions of flexibility in the literature. George Stigler (1939) pioneered the analysis of cost flexibility by stating that firms have in general to make a choice among different equipments or technologies giving rise to different cost configurations, some more flexible than others. More formal definitions of flexibility were given by Marshak and Nelson (1962) and Jones and Ostroy (1984) in decision theoretic contexts. Those definitions are reviewed and discussed in Boyer and Moreaux (1989). Harrigan (1985) defines 'strategic' flexibility as "... [The] firms' abilities to reposition themselves in a market, change their game plans, or dismantle their current strategies when customers they serve are no longer as attractive as they once were." Valuing flexibility in investments and in organization in general is the central theme of the real options literature; see Boyer et al. (2003, 2004).

are in danger. Even then, the organization may be unable to orchestrate change.

Inertia in organization may take many forms or come from many sources and its analysis is present under different names in many strands of the literature in economics, psychology and management. It underlies the analysis of the rational suppression of potentially valuable information in organizations [Crémer (1995), Friebel and Raith (2003)], of the inflexible rules in constitutions [Boyer and Laffont (1999)], of the relative value of commitment and flexibility [Boyer and Moreaux (1997)], of the evolutionary theory of surviving organizations [Hannan and Freeman (1984), Boone and van Witteloostuijn (1997), Carroll and Hannan (2000)]. Boyer (2004) examines the behavior of corporations toward their purchase of D&O (directors and officers) liability insurance. Using an original data set, he presents evidence of significant inertia in the structure of such insurance contracts (policy limit and deductible) which tends to remain constant even in the presence of changes in firm risk and risk exposure.

To set the stage for the approach to organizational inertia we will take in this paper, let us briefly consider different settings, typical of common situations in organizations. A first setting relates to the fact that career possibilities, bonuses and promotions, are commonly linked to the successful *completion* of projects. If that is so, one may expect that better informed agents will tend to pursue a project even if they know that an alternative mutually exclusive project now represents a more profitable opportunity for the firm. Abandoning the initial project in favor of the alternative project will be detrimental to the agent's career. To counter such opportunism, it will in general be necessary to jointly determine in a proper career evaluation process the rewards accruing to the agent in the two mutually exclusive projects. In an interview with *The Economist* (1995.03.18), Livio DeSimone, Chairman and CEO of 3M, stressed that employees become less innovative if their job security is threatened and therefore, it is a policy of 3M to give such job security to its labor force. In order to avoid too much inertia, he has imposed tough innovation goals (30% of annual sales must come from products less than four years old; 10% from products introduced during the year) and very demanding organizational characteristics (marketing folks have direct contacts with scientists; R&D staff are directly involved in product strategy; cross-functional teams abound).

It may even be necessary in such contexts to value and reward a recommendation to abandon a project coming from those who were responsible to provide the necessary efforts to achieve its successful completion ! Such career concerns may of course take different forms. Prendergast and Stole (1996) develop a model of individual decision making when decisions are a signal of people's ability to learn. Considering the manager of an investment project, they show that, to appear as a fast learner, the manager exaggerates his own information and becomes unwilling to change his investment program as new information arrives (inertia), a result that they relate to the existing psychology literature concerning cognitive dissonance reduction.

Inertia appears also in the "political cover-up" of unfavorable information by agents. Such situations occur because the efforts sunk by the agent in defending an initial position cannot be transferred to the alternative position. The new information, on the increased benefits associated with the alternative position and/or on the reduced benefits associated with the initial position, may be hidden or manipulated by the agent to make it appear less favorable to the alternative than it really is. It may again be necessary, from an organizational performance viewpoint, to value and reward the failure in making the initial position a success. In a paper dedicated to advocacy, Dewatripont and Tirole (1999) argue that competition among enfranchised advocates of special interests may improve performance (flexibility in our context) by relying on different viewpoints, each being proposed by specific interested parties rather than by non-partisan representatives who may potentially be impaired by conflicting incentives.

In a different context, inertia may have positive value in situations where an independent appraisal concludes that a partially completed project should be abandoned because its completion will involve additional costs which cannot be recuperated from the total future benefits to be generated by the project. Systematically applying the textbook principle "bygones are bygones" may lead to reduced ex ante efforts to make the initial project profitable. The principal may find necessary, and profitable, to commit ex ante to pursue such projects even if information, unfavorable to pursuing the project, is revealed to her. Agents who are asked to switch to task/project B before completing task/project A (and seeing the outcomes of their efforts) and later to switch to C before completing B may end up investing no effort in raising the probability of success of the task/project under the expectation that it will not be completed.

In a population ecology perspective, Hannan and Freeman (1984) develop an evolutionary model of inertia. They observe that organizations, when compared with ad hoc collectives, are characterized by higher levels of reliability and accountability. Reliability refers to the organization's capacity to produce quality products in a consistent way, while accountability refers to the capacity to document processes in order to take corrective actions if necessary. High levels of reliability and accountability will be attained through reproducible and stable structures built on three major pillars, namely institutionalization, standardization and routines. Those pillars also turns out to be factors of inertia. In Hannan and Freeman's model, structural inertia appears as a by-product of reliability and accountability. In a similar vein, Carroll and Hannan (2002) write (p.6): "Research in corporate demography suggests that an organization's history strongly constrains its subsequent possibilities. In particular, research shows that the social and economic conditions at the time of an organization's founding have a lasting effect upon its structure and operation ... Overcoming this inertia is much more difficult than the literature on management implies, especially for core features of an organization such as its mission and its form of authority ... [A]mple theory and evidence suggest that the *process of change* itself might be so disruptive that attempting radical change elevates the risk of mortality."

One may criticize this evolutionary model of inertia insofar as reliability and accountability may very well require sufficient flexibility to adapt at proper times to changing conditions, either internal or external. Hence, it is possible and maybe equally likely that organizations that have high level of reliability and accountability are in fact highly flexible ones, especially in contexts where production and/or marketing conditions change frequently or where those conditions are highly volatile and require frequent changes in the mix of products, inputs and/or in the relative pace of development of investment projects. A striking example of such a situation can be found in the telecommunication industry where technological change and market or competition volatility require, for increased reliability and accountability, increasing levels of flexibility.

For such reasons, we feel that the theory of inertia must be developed on firmer grounds. Such a theory must be able to make explicit how inertia enters into a value maximization or a survival problem rather than as a by-product or unforeseen consequence of organizational design. In that vein, we develop a model of inertia based on the rational maximization of the organization value. In such a rational value maximization context, inertia appears as a way to reduce informational rents some members may be able to capture. More precisely, we consider the allocation of rents and power to initiate, bring or block change as the result of the organizational design itself. The relatively simple model presented in this paper is meant to address in a formal way the following questions: Why would an organization give to interest groups within the organization the incentives and power to block changes that might be beneficial to the overall organization ? How will an organization choose to allocate rents and decision power ? Why and in what sense does such an allocation generate inertia ? We model the *endogenous* determination of the level of inertia as a *direct, explicit and rational* choice made by the organization.

We represent an organization as composed of a principal (the owner/manager/supervisor), who is the residual claimant, and an agent (the executive/worker/supervised). The agent is asked to exert unobservable, specific and sunk effort to increase the probability of success of an initial project. Later on, new information (a signal) is obtained on the profitability of an alternative project. The projects being mutually exclusive, the organization must decide whether or not to abandon the initial project in favor of the alternative one. If the organization decides to switch to the alternative project, the agent is again asked to exert unobservable, specific and sunk effort to increase the probability of success of the alternative project. Finally, the outcome for the selected project is observed and shared according to the contract between the principal and the agent. Our objective is to better understand the unavoidable arbitrage between incentives and flexibility in dynamic contexts of asymmetric information and to characterize the general features of an appropriate response to this challenge. More flexibility to abandon the initial project to pursue the alternative project will in general be detrimental to the level of specific efforts that the agent will be willing to exert to increase the probability of success of the initial project: hence the fundamental trade-off between *ex ante* incentives and *ex post* flexibility. Moreover, the existence of informational rents will generate distortions in the choice between project 1 and project 2.

We consider three different informational structures or organizational forms: the signal may be observed by both the principal and the agent, by the principal only, or by the agent only. In each setting, the agent's efforts, both for the initial and the alternative projects, are unobservable by the principal. In order to induce the agent to provide the proper level of effort, the principal must reward the agent if the project undertaken is successful while limited liability prevents the principal from financing this reward through a penalty in case of failure. Payments to the agent must be non-negative in all cases. The principal must select and commit (credibly) to a compensation profile and a switching decision rule providing the necessary incentives for the provision of effort and the truthful revelation of the signal observed. We will show that the efficient organizational response to the non-congruence of the principal's and agent's self-interest will in general be to bias the decision rule towards the *status quo*. We therefore confirm in a formal way Rumelt's (1995) assertion of the paradox that successful change may require the promise of future inertia and Dewatripont and Tirole's (1996) statement that ex ante efficiency may require a commitment to ex post inefficiency.

We compare the results (incentive compatible payment profile and switching rule) obtained in the different frameworks. We also discuss the efficient distribution of authority in an organization in the following sense. If the signal on the profitability of the alternative project can or should, for some technical or economic reasons, be observed only by *either* the agent *or* the principal, who should be responsible for observing the signal and recommending change ? As we will see, the effective or real authority regarding change need not always be retained by the principal even if she is as efficient as the agent in observing the signal.

We present the formal model in section 2. We analyze in section 3 the benchmark case where the signal is common knowledge, in section 4 the case where the signal is observed only by the principal, and in section 5 the case where the signal is a private information of the agent. We compare the results in section 6 and we derive implications regarding the choice of organizational form, more precisely the efficient distribution or delegation of authority in an organization. The Appendix contains the detailed proofs of the propositions and corollaries.

Our results are three-fold. First, the efficient organizational response to the presence of private information on the value of change will in general be to rationally bias the decision rule towards the *status quo*. Second, the compensation profile of the agent differs according to whether the information on the value of change is private to the principal or the agent: an up-front payment in the first case versus a distribution of stock options in the second case. Finally, the efficient distribution of 'real' authority for recommending change in an organization need not always be profitably retained by the principal: the agent is more likely to be endowed with the 'real' authority to initiate change the smaller the expected profitability of the *status quo* is, the larger the expected profitability of change to the alternative is when the signal is bad, and the higher the cost of effort to raise the probability of success of the alternative project is.

2. THE MODEL

The model we develop builds on a bare-bones abstract representation of an organization. The results are not specific to one set or type of organizations. The factors of inertia we identify are therefore general and likely to be present in all organizations where some features of incomplete information are present. We derive predictions regarding the level of inertia in organizations as a function of their respective socioeconomic context.

The organization is represented by a principal and an agent, both risk neutral. After investing in an initial project, the organization will observe a signal θ on the profitability of an alternative project. Based on the observed value of θ, the organization may choose either to pursue the original project 1 or to abandon it in favor of the alternative project 2. The timing of observations and decisions is as follows. First, the agent invests an unobservable level of effort e which may be low (ℓ) or high (h) in the initial project 1, at a cost V_1^ℓ and V_1^h respectively. This investment in effort determines the probability of success p_1^e of that project, with $p_1^h > p_1^\ell$. Effort is specific to the project and considered as sunk. Second, the signal θ about the probability of success of an alternative project 2 is observed: it may be good or favorable (g) with probability ρ and bad or unfavorable (b) with probability $(1-\rho)$. The projects being mutually exclusive, the organization must decide either to abandon the initial project in favor of the alternative one or to maintain the initial project (the *status quo*). If project 2 is selected, then the agent must again provide some unobservable level of effort e_2 which is either low (ℓ) or high (h), at a cost of V_2^ℓ and V_2^h respectively. The probability of success of project 2 depends on effort $e_2 \in \{\ell, h\}$ and on the value of the signal $\theta \in \{g, b\}$ and is given by p_2^{hg}, $p_2^{\ell g}$, p_2^{hb} or $p_2^{\ell b}$. Finally, the outcome (success or failure, net profits) of the project chosen is observed and distributed.

The outcomes of the projects are random. The expected level of net profits depends on the project pursued, on the level of effort invested by the agent and on the value of θ. Let R_1^e be the expected return from project 1 when effort e has been exerted by the agent and let $R_2^{e\theta}$ be the expected return of project 2 given e and θ. Finally, let ψ denote the cost of effort per unit of efficiency in raising the probability of success, namely $\psi_1 \equiv \frac{V_1^h}{p_1^h - p_1^\ell}$, $\psi_2^g \equiv \frac{V_2^h}{p_2^{hg} - p_2^{\ell g}}$, $\psi_2^b \equiv \frac{V_2^h}{p_2^{hb} - p_2^{\ell b}}$.

An incentive system takes the general form of a compensation profile w specifying a payment contingent on the project pursued (1 or 2), on whether it is a success s or a failure f, and on whether the announced value of θ is g or b: $w = \{w_1^s, w_1^f, w_2^{sg}, w_2^{fg}, w_2^{sb}, w_2^{fb}\}$. Limited liability requires that $w \geq 0$. A switching rule, which specifies when project 1 will be abandoned in favor of project 2, is a pair $r = (r_g, r_b)$, where r_g $[r_b]$ denotes the probability that the alternative project is chosen when the value of θ observed or announced is g $[b]$.

We wish to limit our attention to cases where both the effort and the signal are "meaningful" in the following sense: when the signal θ is common knowledge, the principal always prefers to elicit a high level of effort for both project 1 and project 2, $e_i = h$, and a switch to project 2 occurs if and only if the signal is favorable, $\theta = g$. To concentrate on those (more interesting) cases, we restrict our attention to exogenous parameters $[R_1^e,\ R_2^{e\theta},\ \rho,\ p_1^e,\ p_2^{e\theta},\ V_1^e,\ V_2^e]$ such that:[3]

A1-a: $\quad p_1^h > p_1^\ell, \quad p_2^{hg} > p_2^{\ell g}, \quad p_2^{hb} > p_2^{\ell b} = 0, \quad V_1^\ell = V_2^\ell = 0.$

A2 : It is better for the Principal to induce high effort in all projects :

$$R_1^h - p_1^h \frac{\psi_1}{1-\rho} > R_1^\ell, \quad R_2^{h\theta} - p_2^{h\theta}\psi^2 > R_2^{\ell\theta} \text{ for } \theta \in \{g, b\}.$$

A3 : It is better to switch to the alternative project when the signal is favorable :

$$R_2^{hg} - p_2^{hg}\psi_2^g > R_1^h.$$

A4 : It is better to stick to the original project when the signal is unfavorable :

$$R_1^h - p_1^h \frac{\psi_1}{1-\rho} > R_2^{hb} - p_2^{hb}\psi_2^b.$$

Our objective is to explore in this context how information asymmetries affect the structure of incentives and the decision to undertake project 2. We will consider three alternative information structures. In the first case (benchmark case), the signal θ is jointly observable by the principal and the agent; in the second case, it is observable only by the principal and in the third case, it is observable only by the agent.[4]

[3]The assumptions $p_2^{\ell b} = 0$ and $V_1^\ell = V_2^\ell = 0$ are made without loss of generality.

[4]We do not model the process by which a 'new' project is discovered. One possible way to model this process in the first context is to suppose that effort can be extended either to raise the probability of success $p_c(e_c)$ of the current project 1 or to raise the probability $p_n(e_n)$ of discovering a new and better project. Designing efficient schemes for total effort provision $e_c + e_n = e$ at cost $\psi(e)$ and for allocating that effort between the two objectives is clearly a major concern of organizational design. See for example Sinclair-Desgagné and Gabel (1997) who claim that a properly designed auditing procedure could induce a higher effort level e_c *and* a higher effort level e_n: the procedure would call for an audit of e_c if a new and better project is found with a payment made in case e_c is found to be high. Moreover, the value of e could depend on market structure as one can infer from Tirole (1988, chap. 4).

3. THE SIGNAL θ IS OBSERVED BY THE PRINCIPAL AND THE AGENT.

The effort level exerted by the agent is always a private information of the agent and therefore, the principal must offer a compensation profile such that it is privately beneficial for the agent to provide a high level of effort. To achieve this, the principal must create a wedge for each project between the payments made in case of success and failure. This, together with limited liability, generates an informational rent for the agent. Assuming that the agent's reservation wage is 0, those effort incentive conditions are:[5]

$$w_2^{sg} - w_2^{fg} \geq \frac{V_2^h}{p_2^{hg} - p_2^{\ell g}} \equiv \psi_2^g \tag{1}$$

$$w_2^{sb} - w_2^{fb} \geq \frac{V_2^h}{p_2^{hb} - p_2^{\ell b}} \equiv \psi_2^b. \tag{2}$$

For project 1, the wedge $(w_1^s - w_1^f)$ must take into account the fact that the project may be abandoned in favor of project 2 once the effort cost is sunk. From the switching rule (r_g, r_b), project 1 is pursued with probability $\rho(1-r_g)+(1-\rho)(1-r_b)$ and so the wedge must satisfy

$$(w_1^s - w_1^f) \geq \frac{\psi_1}{\rho(1-r_g)+(1-\rho)(1-r_b)} > \psi_1 \equiv \frac{V_1^h}{p_1^h - p_1^\ell}, \tag{3}$$

which shows that greater flexibility must be compensated by a higher w_1^s.

[5]If project 2 is chosen when $\theta = g$, the incentive condition is

$$p_2^{hg} w_2^{sg} + (1-p_2^{hg}) w_2^{fg} - V_2^h \geq p_2^{\ell g} w_2^{sg} + (1-p_2^{\ell g}) w_2^{fg}$$

that is the wedge must satisfy (1). Similarly, if $\theta = b$, the wedge must satisfy (2). The limited liability assumption implies $w_2^{fg} \geq 0$, and therefore $w_2^{sg} \geq \psi_2^g$. Hence, we obtain that the net payment received by the agent is no less than $p_2^{hg}\psi_2^g + w_2^{fg} - V_2^h \geq p_2^{\ell g} V_2^h/(p_2^{hg} - p_2^{\ell g}) + w_2^{fg} > 0$, and therefore exceeds the agent's reservation utility and the agent receives an informational rent. In the case of project 1, the agent knows that a switch will occur to project 2 with probability $\rho r_g + (1-\rho) r_b$. If there is such a switch, then the agent will obtain a rent of $p_2^{h\theta}\psi^2 - V_2^h$ from the compensation profile relevant for project 2. But given that ρ is independent of whether the effort put into project 1 is high or low, the value of the appropriate rent is added on both sides of the relevant incentive constraint for e_1. Therefore, the effort inducing wedge for project 1 depends on the probability that a switch will occur but is independent of the rent itself accruing to the agent from the realization of project 2. Hence, the agent will put a high level of effort in project 1, $e_1 = h$, when

$$[\rho(1-r_g)+(1-\rho)(1-r_b)][p_1^h(w_1^s - w_1^f) + w_1^f] - V_1^h \geq [\rho(1-r_g)+(1-\rho)(1-r_b)][p_1^\ell(w_1^s - w_1^f) + w_1^f]$$

that is when the wedge satisfies (3). *Ex ante*, the agent receives from project 1 an expected payment

$$p_1^h[\rho(1-r_g)+(1-\rho)(1-r_b)]\frac{\psi_1}{[\rho(1-r_g)+(1-\rho)(1-r_b)]} - V_1^h + w_1^f = p_1^h V_1^h/[p_1^h - p_1^\ell] + w_1^f$$

which is also the *ex post* rent from project 1 if the decision to pursue project 1 is taken.

When θ is observable and contractible, the optimal organizational design will maximize the principal's expected profits subject to the limited liability constraints ($w \geq 0$) and the high effort incentive constraints (1), (2) and (3).

Proposition 1 *: Under A1-a, A2, A3 and A4, when the signal θ is observed by both the principal and the agent, then the principal chooses a compensation profile w which induces the agent to exert a high level of effort for projects 1 and 2, that is,*

$$w_1^f = w_2^{fb} = w_2^{fg} = 0;\ w_1^s = \psi_1/(1-\rho);\ w_2^{sb} = \psi_2^b, \quad w_2^{sg} = \psi_2^g$$

and a switching rule $r = (r_b, r_g) = (0, 1)$ such that a switch to project 2 occurs if and only if $\theta = g$.[6] (All proofs are given in the Appendix)

We use the above as a benchmark for the following sections.[7] We will show that when the signal is private information of either the principal or the agent, switching to project 2 may not always occur when $\theta = g$, indicating the existence of inertia. Moreover, we will show that, if the signal cannot be observed by both the principal and the agent, the principal will sometimes be better off observing the signal herself and sometimes be better off letting the signal be observed by the agent only (empowerment of the agent). We will derive the condition under which either case occurs.

[6] This result holds also in the case where the signal is observed by both the principal and the agent but is not contractible. The principal, as the residual claimant, implements the optimal compensation profile with $r_b = 0$ and $r_g = 1$. The principal has no incentive to misreport θ. If $\theta = g$, we have $R_2^{hg} - p_1^{hg}\psi_2^g > R_1^h > R_1^h - p_1^h \frac{\psi_1}{1-\rho}$ and thus the principal will prefer to recommend change. If $\theta = b$, the principal knows that if she recommends change, the agent will choose a low level of effort unless $(w_2^s - w_2^f) \geq \psi_2^b$. Since by assumption $R_1^h - p_1^h \frac{\psi_1}{1-\rho} > \max\{R_2^{\ell b} - V_2^{\ell}\ ,\ R_2^{hb} - p_2^{hb}\psi_2^b\}$, it is not in her interest to recommend change.

[7] Note that from a social welfare point of view, a switch to the alternative project should occur *ex post* when $\theta = g$ (should not occur when $\theta = b$) if and only if the expected net total benefits from project 2, assuming that the agent exert a high level of effort in all cases, are larger (smaller) than the expected gross total benefits from the original project, that is, if and only if

$$R_1^h \begin{cases} < R_2^{hg} - V_2^h & \text{if } \theta = g \\ > R_2^{hb} - V_2^h & \text{if } \theta = b \end{cases}$$

Under the assumptions of the model, the switching rule $r_b = 0$ and $r_g = 1$ is also the socially optimal rule. Indeed we have: $R_1^h < R_2^{hg} - p_2^{hg}\psi_2^g < R_2^{hg} - V_2^h$ and $R_1^h > R_1^h - p_1^h \frac{\psi_1}{1-\rho} > R_2^{hb} - p_2^{hb}\psi_2^b = R_2^{hb} - V_2^h$.

4. THE SIGNAL θ IS OBSERVED ONLY BY THE PRINCIPAL.

We assume, in this section, that the signal on the profitability of the alternative project is observed only by the principal. The principal, who cannot commit not to use opportunistically her private information on θ, must choose a compensation profile w and a switching rule r such that the agent exerts the high level of effort expecting rationally that the principal will reveal truthfully the observed signal and apply the announced switching rule, given the principal's interests in telling the truth about the signal.[8]

To better see the principal's problem of credibility, let us first consider the full information solution payment profile w and switching rule r characterized in Proposition 1. The principal can deviate from telling the truth by manipulating her message in two ways: she can pretend that the alternative project is bad (she reveals $\theta = b$ and project 1 is pursued) when it is good (she observes $\theta = g$), or alternatively, she can pretend that the alternative project is good when she observes $\theta = b$. Under the assumptions of the model, the former is never profitable. Indeed, from Assumption A3, we have:

$$R_2^{hg} - p_2^{hg}\psi_2^g \ > \ R_1^h - p_1^h \frac{\psi_1}{1-\rho}.$$

The principal has no interest in pursuing the original project by claiming that a good alternative project is bad even if her announcement is taken as truthful by the agent. On the other hand, pretending that the alternative project is good when she observes $\theta = b$ could be profitable. Telling the truth is less profitable than lying when $\theta = b$ (therefore always switching to project 2), whenever

$$R_2^{hb} - p_2^{hb}\psi_2^g > R_1^h - p_1^h \frac{\psi_1}{1-\rho} \tag{4}$$

By assumption A4, we have $R_1^h - p_1^h \frac{\psi_1}{1-\rho} > R_2^{hb} - p_2^{hb}\psi_2^b$. Therefore, if $\psi_2^g \geq \psi_2^b$, that is, if inducing high effort is more costly for a good project than for a bad project, condition (4) never holds and the principal has no interest in misreporting θ even if the agent believes the announcement. However, if (4) holds, that is, if ψ_2^g is sufficiently smaller than ψ_2^b, we must impose an incentive compatibility constraint on the principal's announcement in order to make

[8] See Laffont and Martimort (2002) for a discussion of "Informed Principals". They write: "The literature on informed principals is relatively thin but complex" (p. 360). We like to think that our paper is an interesting contribution to this literature.

it credible. To concentrate on the more interesting case, we will assume that (4) holds, which implies that:

$$\text{A1-b: } p_2^{hg} - p_2^{\ell g} > p_2^{hb} - p_2^{\ell b}, \text{ that is, } p_2(e,\theta) \text{ is supermodular.}$$

If inducing high effort is less costly for a good project than for a bad project (Assumption A1-b), the contractual relationship between the agent and the principal must be modified to constrain the opportunistic behavior of the principal. This will lead to additional agency costs.

More generally, given a compensation profile w and a switching rule r, truth-telling conditions are respectively given in the Appendix by (17), which guarantees that the principal will not pretend that project 2 (the signal θ) is bad when it is good, and (18), which guarantees that she will not pretend that project 2 is good when it is bad. The principal's problem is now to maximize her profit subject to the effort incentive conditions and the two additional constraints (17), which will turn out to be non-binding, and (18), which may be binding and can be rewritten as:

$$[R_1^h - \left(p_1^h(w_1^s - w_1^f) + w_1^f\right)] \geq [R_2^{hb} - \left(p_2^{hb}(w_2^{sg} - w_2^{fg}) + w_2^{fg}\right)] \tag{5}$$

The way to insure that 5 is satisfied at the lowest cost to the principal is to set w_2^{fg} above 0, i.e. give the agent a fixed lump sum payment whenever Project 2 is undertaken. This acts as a "golden parachute", a compensation given to the agent whenever Project 1 is abandoned. In order to satisfy (4), we must set:

$$w_2^{fg} = \max\{0,\ (R_2^{hb} - p_2^{hb}\psi_2^g) - (R_1^h - p_1^h\frac{\psi_1}{1-\rho r_g})\}. \tag{6}$$

The implication of this is that (i) the principal must bear extra agency costs, (ii) since these costs are increasing and convex in r_g, it *may* be optimal to choose $r_g < 1$, representing a distortion (inertia) from the complete information switching rule characterized in Proposition 1, that is, a bias towards the *status quo*. We can illustrate those results as follows (see Figure 1). The principal's expected profit $\Pi(r_g)$ can be written as

$$\Pi(r_g) = (1-\rho r_g)R_1^h + \rho r_g R_2^{hg} - C^P(r_g) \tag{7}$$

where $C^P(r_g)$ is the expected payment to the agent,

$$C^P(r_g) \quad = \quad p_1^h\psi_1 + \rho r_g p_2^{hg}\psi_2^g \tag{8}$$

$$+\rho r_g \max\left\{(R_2^{hb} - p_2^{hb}\psi_2^g) - (R_1^h - p_1^h \frac{\psi_1}{1-\rho r_g}); 0\right\}.$$

Let us define $\tilde{r}_g^P$ as the value of r_g for which $(R_2^{hb} - p_2^{hb}\psi_2^g) = (R_1^h - p_1^h \frac{\psi_1}{1-\rho r_g})$.[9] One can verify that the function $\Pi(r_g)$ is increasing and linear for $r_g \leq \tilde{r}_g^P$ but concave for $r_g \geq \tilde{r}_g^P$, with a kink at $\tilde{r}_g^P$. The difference between $C^P(r_g)$ and its linear part $p_1^h\psi_1 + \rho r_g p_2^{hg}\psi_2^g$ is the extra agency cost necessary to credibly convey that the principal will not misreport θ.[10] The optimal level of flexibility is unique and always lie in the interval $[\tilde{r}_g^P, 1]$.[11] The optimum r_g^P may be either at the kink $\tilde{r}_g^P$ (which may be at 0) of the expected labor cost curve, or at the tangency point between the convex portion of the labor cost curve and an isoprofit curve, or at the end point 1.

One can verify that $r_g^P < 1$ if and only if the following two conditions are met.

$$\begin{aligned} R_2^{hb} - p_2^{hb}\psi_2^g &\geq R_1^h - p_1^h \frac{\psi_1}{(1-\rho)} \\ R_2^{hb} - p_2^{hb}\psi_2^g &\geq \left(R_2^{hg} - p_2^{hg}\psi_2^g\right) - p_1^h \frac{\psi_1}{(1-\rho)^2}, \end{aligned}$$

and that complete inertia, that is $r_g^P = 0$, is optimal if and only if

$$(R_2^{hb} - p_2^{hb}\psi_2^g) + p_1^h\psi_1 \geq R_2^{hg} - p_2^{hg}\psi_2^g \geq 0.$$

More generally, we obtain the following:

Proposition 2 *: When the signal θ on the profitability of the alternative project 2 is observed only by the principal, we have the same incentive scheme except that w_2^{fg} is given by* (6)*. Because the extra agency costs so generated are increasing and convex in the probability of undertaking the alternative project, it may be optimal for the organization (the Principal) to sometimes stick to the original project (inertia) even if the signal of profitability of the alternative project is good.*

The optimal flexibility level is maximal if the principal finds no value in misreporting the value of the signal θ even if she could do it without cost (and $w_2^{fg} = 0$). When she has to bear extra costs to make her announcement credible, she may choose $r_g^P < 1$ in order to save on the

[9] Let $\tilde{r}_g^P = 0$ when $R_2^{hb} - p_2^{hb}\psi_2^g > R_1^h - p_1^h\psi_1$ and $\tilde{r}_g^P = 1$ when $R_2^{hb} - p_2^{hb}\psi_2^g < R_1^h - p_1^h \frac{\psi_1}{1-\rho}$.

[10] Truth telling condition (18), under which the principal reveals truthfully θ when $\theta = b$, is binding if $r_g^P > \tilde{r}_g^P$.

[11] As shown above, the slope of the isoprofit curves is $\rho(R_2^{hg} - R_1^h)$. The slope of the expected labor cost function to the left of $\tilde{r}_g^P$ is $\rho p_2^{hg}\psi_2^g$. By A3, the latter is smaller.

informational rent. In some cases, the best the principal can do is to never abandon project 1 (maximal inertia): the incentives for the principal to always pretend that project 2 is good when $\theta = b$ are so strong that it becomes too costly to credibly convey that project 2 is good. Complete inertia is then better for the principal and is implemented in the organization.[12] Finally, we have:

Corollary 2.1 : *The level of inertia in an organization (when the principal is the only one being informed of the value of the alternative project) is positively related to* $p_1^h\psi_1 \equiv p_1^h \frac{V_1^h}{p_1^h - p_1^\ell}$ *and to* $(p_2^{hg} - p_2^{hb})\psi_2^g \equiv \frac{p_2^{hg} - p_2^{hb}}{p_2^{hg} - p_2^{\ell g}} V_2^h$ *and negatively related to the difference* $(R_2^{hg} - R_2^{hb})$*. That is, the level of inertia*

- *increases with* V_1^h *and* V_2^h*, the cost of effort, with* R_2^{hb}*, the profitability of project 2 when effort is high but the signal is unfavorable (that is because a larger* R_2^{hb} *increases the incentive to lie when* $\theta = b$ *and therefore makes it more difficult and costly for the principal to credibly convey that project 2 is good);*
- *decreases with* $(p_1^h - p_1^\ell)$*, the efficiency of effort in increasing the probability of success of project 1, with* $(p_2^{hb} - p_2^{\ell b})$*, the efficiency of effort in increasing the probability of success of project 2 when the signal* θ *is unfavorable, with* $(p_2^{hg} - p_2^{\ell g})$*, the efficiency of effort in increasing the probability of success of project 2 when the signal* θ *is favorable if* $p_2^{hb} < p_2^{\ell g}$*, with* R_2^{hg} *and* R_1^h*, respectively the profitability of project 2 when effort is high and the signal is favorable and the profitability of project 2 when effort is high (that is because they both make it easier for the principal to credibly claim that project 2 is good).*

[12] If one interprets the original project as a bold change from a previously pursued strategy, the complete inertia result may be understood as necessary to induce the optimal level of effort by the agent to raise the probability of success of this 'original' change in strategy: no more change will be made whatever the new information (θ) to be observed or gathered in the future.

5. THE SIGNAL θ IS OBSERVABLE ONLY BY THE AGENT.

We consider now the case where the signal on the profitability of the alternative project is observed only by the agent. Under the common knowledge (of θ) incentive scheme, the agent may pretend that the alternative project (the signal θ) is bad when it is in fact good. This would be profitable for the agent if always sticking to the original project (lying when $\theta = g$) is better for him than telling the truth and engaging in the new project when $\theta = g$, that is, if and only if:

$$p_2^{hg}\psi_2^g - V_2^h < p_1^h \frac{\psi_1}{1-\rho} \tag{9}$$

He can also pretend that the alternative project is good when it is bad ($\theta = b$) and, since the original project would never be completed, perform no effort on the initial project. This would be profitable if and only if:

$$\text{and} \quad p_1^h \frac{\psi_1}{1-\rho} - V_1^h \geq (1-\rho) \max_{e\in\{\ell,h\}} (p_2^{eb}\psi_2^g - V_2^e). \tag{10}$$

Under our assumptions, both (9) and (10) may be satisfied *under the complete information compensation scheme and switching rule* (Proposition 1): the rent obtained from pursuing a good project 2 may not be high enough to induce the agent to abandon project 1 when he has invested (sunk cost) a high level of effort in it, while at the same time be high enough for the agent to prefer exerting no effort in project 1 and always recommending a project change.

In order to guarantee truthful revelation, the principal must provide the incentives necessary to prevent opportunism by the agent. Again, this will generate extra agency costs. In order to identify those, we consider the general principal-agent problem. As usual, we must impose truth telling incentive conditions to guarantee that the agent will not always claim that $\theta = b$, thereby generating too much inertia, or always claim that $\theta = g$, thereby generating too much flexibility at the expense of too little effort invested in project 1. We show in the Appendix that, under A1-a, A1-b, A2, A3 and A4, we must have $w_1^f = w_2^{fg} = 0$ and $r_b = 0$. Furthermore, the incentive constraints can then be written as:

$$p_2^{hg} w_2^{sg} - V_2^h \geq p_1^h w_1^s \tag{11}$$

$$p_1^h w_1^s \geq \max\{p_2^{hb} w_2^{sg} - V_2^h, 0\} + \frac{\max\{V_1^h - (1-r_g)(p_1^h - p_1^\ell)w_1^s, 0\}}{(1-\rho)r_g}. \tag{12}$$

It follows that the solution to the principal's problem can take three different forms (cases) depending on whether the above truth telling conditions are binding or not.

Proposition 3A : *If* $p_1^h \frac{\psi^1}{1-\rho} < p_2^{hg}\psi_2^g - V_2^h$, *neither* (11) *nor* (12) *are binding. Hence, the principal can do as well as if the signal* θ *were observable. We have* $w_1^f = w_2^{fg} = 0$, $w_1^s = \psi_1/(1-\rho)$, $w_2^{sg} = \psi_2^g$, $r_b = 0$, $r_g = 1$.

Condition 11 is satisfied by construction. Since the incentive are not sufficient to induce high effort if project 2 is bad, we have $\max\{p_2^{hb}w_2^{sg} - V_2^h, 0\} = 0$ and $V_1^h/(1-\rho) \le p_1^h w_1^s = V_1^h/(1-\rho)(p_1^h - p_1^\ell)$. It follows that condition 12 is also satisfied. The intuition is that the rent accruing to the agent when the alternative project is good ($\theta = g$) is high enough that he will not lie about θ. In this case, there are no agency costs associated with the fact that θ is observable only by the agent.

Proposition 3B : *If* $p_2^{hg}\psi_2^g - V_2^h < p_1^h \frac{\psi^1}{1-\rho} < p_2^{hg}\left[\psi_2^b + \frac{p_1^h \psi^1}{p_2^{hb}}\right] - V_2^h$, *then* (11) *is binding but* (12) *is not. We have* $w_1^f = w_2^{fg} = 0$, $w_1^s = \frac{\psi_1}{1-\rho r_g}$, $p_2^{hg} w_2^{sg} = \left[p_1^h \frac{\psi^1}{1-\rho r_g} + V_2^h\right]$, $r_b = 0$.

In order to prevent the agent from always claiming that project 2 is bad, the principal must offer a w_2^{sg} higher than the level otherwise necessary to induce effort in project 2. As long as $\max\{p_2^{hb}w_2^{sg} - V_2^h, 0\}$ remains small enough, condition (12) remains non-binding. The condition of Proposition 3B guarantees this. The extra rent necessary to elicit truthful behavior from the agent is then given by

$$\rho r_g p_2^{hg}(w_2^{sg} - \psi_2^g) = \rho r_g \max\left\{0\ ,\ p_1^h \frac{\psi_1}{1-\rho r_g} - p_2^{hg}\psi_2^g + V_2^h\right\}. \tag{13}$$

It is increasing and convex in r_g, thereby implying a bias towards the *status quo*. The optimal r_g^A solves:

$$\max_{r_g \in [0,1]} (1-\rho r_g)R_1^h + \rho r_g\left(R_2^{hg} - V_2^h\right) - p_1^h \frac{\psi^1}{1-\rho r_g}. \tag{14}$$

In particular, inertia ($r_g^A < 1$) appears if $\left(R_2^{hg} - V_2^h\right) < R_1^h + p_1^h \frac{\psi^1}{(1-\rho)^2}$.

Proposition 3C : *If* $p_2^{hg}\left[\psi_2^b + \frac{p_1^h \psi^1}{p_2^{hb}}\right] - V_2^h < p_1^h \frac{\psi^1}{1-\rho}$, *then both* (11) *and* (12) *are binding. The values* w_2^{sg} *and* w_1^s *are then chosen such that the both constraints* (11) *and* (12) *hold with strict equality.*

The organizational design must now prevent the agent from exerting no effort in the initial project and always pretending that the alternative is good, and at the same time prevent him from exerting high effort in the initial project and always pretending that the alternative project is bad. The former is achieved by increasing w_1^s and the latter by increasing w_2^{sg}. Solving for (11) and (12), we obtain:

$$\begin{aligned} w_1^s &= \max\left\{\frac{\psi_1}{1-\rho r_g}, \frac{\psi_2^{hg} V_1^h - V_2^h \left(p_2^{hg} - p_2^{hb}\right)(1-\rho) r_g}{(p_2^{hg} - p_2^{hb}) p_1^h (1-\rho) r_g + (1-r_g)(p_1^h - p_1^\ell) p_2^{hg}}\right\} \\ w_2^{sg} &= \frac{p_1^h w_1^s + V_2^h}{\psi_2^{hg}} \end{aligned}$$

The principal's problem is in this case more complex to analyze. One can show that the above extra agency costs are increasing but not necessarily convex. We will not develop further this case.

In order to give the agent the necessary incentives to report truthfully the value of the signal θ, it may be necessary to increase the payment w_2^{sg} above ψ_2^g (Case 2): the agent gets a better deal when the alternative project is a success and since $w_2^{sg} - w_2^{fg}$ is also increased, the agent is overinduced to provide a high level of effort. The increase in w_2^{sg} is similar to issuing, in addition to the provision of incentives for effort, extra stock options on the success of project 2. However, these adjustments may imply that the agent has now an interest in reporting that project 2 is good when in fact it is bad. To make sure that this does not happen, it may be necessary to increase both w_1^s and w_2^{sg} (Case 3): the agent is then properly induced to reveal the observed θ (extra stock options are issued for both projects 1 and 2) and is overinduced to exert a high level of effort in both projects 1 and 2. Hence, the incentive intensity for effort is stronger when the agent is responsible for observing the signal θ and recommending change. This result is reminiscent of Milgrom and Roberts' (1992, chap. 12) discussion of the complementarity between discretion and incentives.

6. CHOOSING THE ORGANIZATIONAL FORM: DELEGATING AUTHORITY OR NOT

We have seen that the optimal incentive system depends on the information structure characterizing the organization: observing the signal on the value of the alternative project or course of action provides the observer with the power to recommend or initiate change. The compensation package differs significantly in the three cases considered: (i) both the principal and the agent observe the value of the alternative project, (ii) only the principal does it, or (iii) only the agent does it. It will typically be the case that the agent's compensation profile w is characterized by the minimal effort-incentive compatible pay in case (i), by an additional upfront compensation payment if change occurs in case (ii), and by an additional stock options package in case (iii). Moreover, the level of inertia as measured by $(1 - r_g)$ will differ: r_g is equal to 1 in case (i), to r_g^P in case (ii), and to r_g^A in case (iii), with r_g^P and r_g^A typically less than 1.

In this section, we raise the following question. If the principal could decide on the informational structure, at some differential cost, which one would she choose ? Clearly, if the cost is the same for all structures, then the principal would choose the organizational form under which both the agent and her observe the signal θ in order to minimize total agency costs by avoiding the extra payments the other structures imply. For the remaining of this section, we will assume, for matter of simplification only, that the cost of having both observe the signal is prohibitively high compared to the cost of the other two information structures, which we will simply assume to be equal to zero. Hence the choice we want to characterize is between an informed agent and an informed principal,[13] the informed party being then responsible for recommending the pursuit of project 1 or a switch to project 2. Should the principal (the 'legal' residual claimant) exercise her *formal* authority to decide on change or should the *real* authority be delegated to the agent ? We already showed that:

Proposition 4 : *If* $\left[p_2^{hg} - p_2^{\ell g} \leq p_2^{hb} - p_2^{\ell b}\right]$, *the principal has no interest in misreporting the value of* θ *and therefore should retain the responsibility to become informed and the power to recommend whether to switch or not to the alternative project.*

[13] The level of effort always remains a private information of the agent.

However, if $p(e,\theta)$ is supermodular (i.e. $p_2^{hg} - p_2^{\ell g} > p_2^{hb} - p_2^{\ell b}$: assumption A1-b), then both the retention of authority by the principal and its delegation to the agent present problems. The agent has vested interests in the pursuit of project 1 and there is no reason to believe that his interests coincide with that of the principal or the organization as a whole. On the other hand, the principal as residual claimant may behave opportunistically in order not to pay the rent promised to the agent were project 1 pursued and succeeded and/or in order to fool the agent in putting high effort in an alternative bad project. In both cases, agency costs may have to be incurred to control such opportunistic behavior. Because agency costs are increasing at an increasing rate with the level of flexibility with which the organization can switch ex post to the alternative project, the principal may want to embed some inertia in her organization in order to reduce those agency costs.

Comparing the agency costs in the different contexts, we obtain:

Proposition 5 : *When $\left[p_2^{hg} - p_2^{\ell g} > p_2^{hb} - p_2^{\ell b}\right]$, the principal finds it profitable to give the authority to the agent if and only if, whatever the probability of switching r_g chosen, the agency cost incurred are smaller:*

$$(R_2^{hb} - p_2^{hb}\psi_2^g) - (R_1^h - p_1^h \frac{\psi_1}{1-\rho r_g}) > p_1^h \frac{\psi_1}{1-\rho r_g} - \left(p_2^{hg}\psi_2^g - V_2^h\right) \tag{15}$$

that is,

$$(R_2^{hb} - p_2^{hb}\psi_2^g) - R_1^h > -\left(p_2^{hg}\psi_2^g - V_2^h\right). \tag{16}$$

The left-side of the (15) corresponds to the extra benefit the principal gets when project 1 is abandoned in favor of a bad project 2 while the agent believes that project 2 is good; the right-side corresponds to the extra rents the agent gets when project 1 is pursued rather than a good project 2. If the former is larger, it is preferable to delegate authority to the agent. This proposition 5 gives a nice and simple characterization of the desirability for the principal of empowering the agent with the authority to recommend change. It solves in a sense the stage 0 of organizational design, that is, the stage when information structures are determined or "chosen". Although in most if not all principal-agent model, the (asymmetric) information structure is considered as given, it need not be in many real cases. We like to think that proposition 5 is a step in tackling the task of better understanding asymmetric information structures as the outcome of some rational efficiency calculus.

Using the expression for ψ_2^g, we can rewrite (16) as

$$R_1^h - R_2^{hb} + \frac{p_2^{hb} - p_2^{\ell g}}{p_2^{hg} - p_2^{\ell g}} V_2^h < 0$$

and therefore,

Corollary 5.1 : *The agent is more likely to be endowed with the responsibility of observing the signal θ and with the real authority of recommending change, (i) the smaller R_1^h; (ii) the larger R_2^{hb}; (iii) the smaller ψ_2^g, that is, the smaller V_2^h and/or the larger the efficiency of effort in raising the probability of success of a good project 2 , $(p_2^{hg} - p_2^{\ell g})$, if and only if $p_2^{hb} > p_2^{\ell g}$.*

Furthermore, one can verify from (26) and (27) in the Appendix that $\frac{\partial C^P(r_g)}{\partial r_g} \geq \frac{\partial C^A(r_g)}{\partial r_g}$ if and only if (15) holds. Therefore:

Corollary 5.2 : *Whenever it is preferable for the principal to delegate the real authority to the agent [retain such authority], we have $r_g^P \leq [\geq] r_g^A$: the authority is granted to the party who ultimately allows a more flexible organization.*

The result of Proposition 5 is illustrated in Figure 1 where the $C^A(r_g)$ function (26) is shown together with the $C^P(r_g)$ function (27) and the isoprofit curves of $\Pi(r_g, C)$. In Figure 1, we suppose that condition (15) is satisfied and it is therefore preferable to empower the agent with the responsibility of observing θ and the real authority to recommend change.

In a recent paper, Aghion and Tirole (1997) show that the allocation of formal authority in organizations, that is, the allocation of "rights" to decide, may differ significantly from the allocation of real authority, that is, the allocation of "effective control" on decisions. They consider different ways to *credibly* increase the subordinate's or agent's real authority in a formally integrated structure with the supervisor or principal keeping the "legal" rights to decide: the work overload of supervisors, the design of lenient discipline rules for deviant behavior by the agent, the timing of background studies leading to an urgency of decision, the repeated interactions leading to the principal's reputation for non-intervention, an improved performance measurement, and finally the splitting of decision rights between multiple superiors.

7. CONCLUSION

Using a simple model, we showed that a principal may find profitable to limit her flexibility to initiate change by giving the agents some power to block changes that she would like to undertake. We showed that inertia (bias towards the *status quo*) can be optimal from an *ex ante* point of view as a means to reduce informational rents.

We have shown that, when the principal retains the authority to initiate change, it will typically be the case that the agent's compensation profile calls for an upfront compensation package if a change does occur while, when the principal empowers the agent with that authority, it calls for a stock options package.

When the information structure is itself endogenously determined, the principal may sometimes be better off choosing an organizational form under which she becomes the informed party and retains the authority to recommend or implement change and sometimes be better off choosing an alternative organizational form under which the agent becomes the informed party and is empowered with initiating change. Even if the principal is the informed party, the agent can capture an informational rent because the principal needs to make her announcement credible in order to elicit effort from the agent at minimal cost. Inertia emerges endogenously in both cases as a way to reduce the agent's rents.

The current discussion and arguments for flexibility in production, human capital, financial structure and contracts, and more generally in organizations, neglect the fundamental dynamic trade-off which we characterized between flexibility and incentives and which is likely to be present in many situations.

APPENDIX

Proof of Proposition 1: Clearly, when the signal θ is common knowledge and contractible, we have $w_1^f = w_2^{fg} = w_2^{fb} = 0$. The principal has no reason to make positive any of those payments in case of project failure. Also, from the latter part of A2, the principal always prefers to elicit high effort in project 2 and so conditions (1), (2) and (3) will be binding. Hence, given some arbitrary switching rule (r_g, r_b), the best the principal can do is given by the expected profits:

$$
\begin{aligned}
&[\rho(1-r_g)+(1-\rho)(1-r_b)]\max\{R_1^h - p_1^h \tfrac{\psi_1}{\rho(1-r_g)+(1-\rho)(1-r_b)}\ ,\ R_1^\ell\} \\
&\qquad +\rho r_g[R_2^{hg} - p_2^{hg}\psi_2^g] + (1-\rho)r_b[R_2^{hb} - p_2^{hb}\psi_2^b] \\
&< \ [\rho(1-r_g)+(1-\rho)(1-r_b)][R_1^h - p_1^h \tfrac{\psi_1}{(1-\rho r_g)}] \\
&\qquad +\rho r_g[R_2^{hg} - p_2^{hg}\psi_2^g] + (1-\rho)r_b[R_2^{hb} - p_2^{hb}\psi_2^b] \\
&\leq \ [(1-\rho r_g)][R_1^h - p_1^h \tfrac{\psi_1}{(1-\rho r_g)}] + \rho r_g[R_2^{hg} - p_2^{hg}\psi_2^g] \\
&\leq \ [(1-\rho)][R_1^h - p_1^h \tfrac{\psi_1}{(1-\rho)}] + \rho[R_2^{hg} - p_2^{hg}\psi_2^g].
\end{aligned}
$$

The first inequality follows from A2 and $1-\rho r_g > 1-\rho > \rho(1-r_g)+(1-\rho)(1-r_b)$; the second inequality follows from A4; the third inequality follows from A3. The expected profits obtained from any switching rule (r_g, r_b) and effort levels (e_1, e_2) are therefore no greater than the profits obtained when $r_g = 1$, $r_b = 0$ and effort levels (h, h) are elicited QED

Proof of Proposition 2: The principal's truth telling conditions are as follows:

$$
\begin{aligned}
&r_g\ [R_2^{hg} - \left(p_2^{hg}(w_2^{sg} - w_2^{fg}) + w_2^{fg}\right)] - r_b[R_2^{hg} - \left(p_2^{hg}(w_2^{sb} - w_2^{fb}) + w_2^{fb}\right)] \qquad (17)\\
\geq\ \ & (r_g - r_b)[R_1^h - \left(p_1^h(w_1^s - w_1^f) + w_1^f\right)] \\
\geq\ \ & r_g[R_2^{hb} - \left(p_2^{hb}(w_2^{sg} - w_2^{fg}) + w_2^{fg}\right)] - r_b[R_2^{hb} - \left(p_2^{hb}(w_2^{sb} - w_2^{fb}) + w_2^{fb}\right)] \qquad (18)
\end{aligned}
$$

The first inequality means that the profit in Project 1 should not be high enough so that the principal with not want to always claim that Project 2 is bad. Conversely, the second inequality means that the profit in Project 1 should be high enough so that the principal will not want to always claim that Project 2 is good. Let us assume that constraint (17) is not binding (we will show that the solution to (**??**) without imposing (17) satisfies (17)). Since increasing w_1^f reduces the objective function and tightens the constraints, it is optimal to let $w_1^f = 0$. Since $R_1^h - p_1^h \frac{\psi_1}{1-\rho} \geq R_2^{hb} - p_2^{hb}(w_2^{sb} - w_2^{fb}) - w_2^{fb}$ by A4, the objective function is decreasing with r_b and reducing r_b weakens the constraints. It is therefore optimal to set $r_b = 0$. It is clearly optimal to set the wages such that constraints (1), (2) and (3) are binding. It follows that $w_1^s = \frac{\psi_1}{(1-\rho r_g)}$ and $(w_2^{sg} - w_2^{fg}) = \psi_2^g$. Given this, (18) becomes

$$R_2^{hb} - p_2^{hb}\psi_2^g - w_2^{fg} \leq R_1^h - p_1^h \frac{\psi_1}{1-\rho r_g} \tag{19}$$

and thus

$$w_2^{fg} = \max\{0\ ,\ (R_2^{hb} - p_2^{hb}\psi_2^g) - (R_1^h - p_1^h \frac{\psi_1}{(1-\rho r_g)})\}. \tag{20}$$

Substituting this into the profit function yields (7) where $C^P(r_g)$ represents the total payment to the agent as a function of the flexibility level r_g.

In order to complete the proof, we need to show that constraint (17) is then satisfied. Constraint (17) can be rewritten as:

$$r_g[R_1^h - p_1^h \frac{\psi_1}{1-\rho r_g}] \leq r_g[R_2^{hg} - p_2^{hg}\psi_2^g - w_2^{fg}]. \tag{21}$$

If $w_2^{fg} = 0$, then (21) is satisfied from A3. If $w_2^{fg} > 0$, then (19) must be binding and therefore (21) becomes

$$r_g[R_2^{hb} - p_2^{hb}\psi_2^g] \leq r_g[R_2^{hg} - p_2^{hg}\psi_2^g]. \tag{22}$$

If $(R_2^{hb} - p_2^{hb}\psi_2^g) \leq (R_2^{hg} - p_2^{hg}\psi_2^g)$, condition (22) is satisfied for all $r_g \in [0,1]$; If $(R_2^{hb} - p_2^{hb}\psi_2^g) > (R_2^{hg} - p_2^{hg}\psi_2^g)$, then profits are maximized for $r_g = 0$ and therefore (22) is satisfied. Thus, (17) is satisfied. *QED*

Proof of Corollary 2.1: From (7), we have:

$$\frac{d\Pi(r_g)}{dr_g} = \begin{cases} \rho[R_2^{hg} - p_2^{hg}\psi_2^g - R_1^h] \text{ if } \left[R_2^{hb} - p_2^{hb}\psi_2^g \leq R_1^h - p_1^h \frac{\psi_1}{1-\rho r_g}\right] \\ \rho\left\{\left[R_2^{hg} - p_2^{hg}\psi_2^g\right] - \left[(R_2^{hb} - p_2^{hb}\psi_2^g)\right] - \left[p_1^h \frac{\psi_1}{(1-\rho r_g)^2}\right]\right\} \text{otherwise} \end{cases}$$

Hence, the marginal benefit of increasing flexibility, r_g, is non-decreasing with $\left[R_2^{hg} - p_2^{hg}\psi_2^g\right] - \left[R_2^{hb} - p_2^{hb}\psi_2^g\right]$ and non-increasing with p_1^h and ψ_1.

Proof of Propositions 3A, 3B, and 3C: When the signal θ is observable only by the agent, the following two truth-telling incentive constraints must be imposed (recall: V_1^e is incurred before the signal is observed but V_2^e is incurred only after the signal is observed and and the switch to project 2 is made).

$$\left.\begin{array}{l} \max_{e\in\{\ell,h\}}\Big[[(1-\rho)(1-r_b)+\rho(1-r_g)][p_1^e(w_1^s-w_1^f)+w_1^f]-V_1^e\Big] \\ \qquad +\rho r_g \max_{e\in\{\ell,h\}}[p_2^{eg}(w_2^{sg}-w_2^{fg})+w_2^{fg}-V_2^e] \geq \\ \max_{e\in\{\ell,h\}}\Big[[(1-r_b)][p_1^e(w_1^s-w_1^f)+w_1^f]-V_1^e\Big] \\ \qquad +\rho r_b \max_{e\in\{\ell,h\}}[p_2^{eg}(w_2^{sb}-w_2^{fb})+w_2^{fb}-V_2^e] \end{array}\right\} \tag{23}$$

$$\left.\begin{array}{l} \max_{e\in\{\ell,h\}}\Big[[(1-\rho)(1-r_b)+\rho(1-r_g)][p_1^e(w_1^s-w_1^f)+w_1^f]-V_1^e\Big] \\ \quad +(1-\rho)r_b \max_{e\in\{\ell,h\}}[p_2^{eb}(w_2^{sb}-w_2^{fb})+w_2^{fb}-V_2^e] \geq \\ \max_{e\in\{\ell,h\}}\Big[[(1-r_g)][p_1^e(w_1^s-w_1^f)+w_1^f]-V_1^e\Big] \\ \quad +(1-\rho)r_g \max_{e\in\{\ell,h\}}[p_2^{eb}(w_2^{sg}-w_2^{fg})+w_2^{fg}-V_2^e] \end{array}\right\} \tag{24}$$

Condition (23) is necessary to guarantee that the agent will not always claim that $\theta = b$, thereby generating too much inertia and condition (24) is necessary to guarantee that the agent will not always claim that $\theta = g$, thereby generating too much flexibility at the expense of too little effort invested in Project 1. Under A1-a, A1-b, A2, A3 and A4, one can verify that it is always optimal to set $r_b = 0$. Undertaking a bad project is costly, and it does not serve to weaken either constraints (23) or (24) Hence constraints (23) and (24) can be combined as:

$$\begin{aligned} & p_2^{hg}(w_2^{sg}-w_2^{fg})+w_2^{fg}-V_2^h \geq p_1^h(w_1^s-w_1^f)+w_1^f \\ & \geq \max_{e\in\{\ell,h\}}[p_2^{eb}(w_2^{sg}-w_2^{fg})+w_2^{fg}-V_2^e] \\ & \quad + \frac{(\max_{e\in\{\ell,h\}}\Big[[(1-r_g)][p_1^e(w_1^s-w_1^f)]-V_1^e\Big]) - \Big[[(1-r_g)][p_1^h(w_1^s-w_1^f)]-V_1^h\Big]}{(1-\rho)r_g} \end{aligned}$$

We must have: $w_2^{fg} = 0$ and $w_1^f = 0$. If $w_2^{fg} > 0$, we could set $w_2^{fg} = 0$ and increase w_2^{sg} so that $[p_2^{hg}(w_2^{sg}-w_2^{fg})+w_2^{fg}-V_2^h]$ remains constant. This will not hurt the principal and will weaken constraint (24). A similar argument applies for w_1^f. Hence, we can rewrite constraints (23) and (24) as in written in (11)and (12).The rest follows from the discussion in the text. *QED*

Proof of Proposition 4: Clear from the text. *QED*

Proof of Proposition 5: We first establish that if condition (15) holds, then we are in the cases covered by Propositions 3A and 3B. Indeed, condition (15) together with A1-b and A4 imply that:

$$p_2^{hg}\psi_2^b - V_2^h > R_1^h - (R_2^{hb} - p_2^{hb}\psi_2^b) > p_1^h\frac{\psi_1}{1-\rho} \tag{25}$$

which implies that constraint (24) is non-binding. Hence, from Propositions 3A and 3B (equation (**??**), we have $w_1^s = \frac{\psi_1}{1-\rho r_g}$ and we can write the expected labor cost, when the signal θ is observed by the agent, as a function of the flexibility level as follows:

$$C^A(r_g) = p_1^h \psi_1 + \rho r_g p_2^{hg} \psi_2^g + \rho r_g \max\left\{0,\ p_1^h \frac{\psi_1}{1-\rho r_g} - \left(p_2^{hg}\psi_2^g - V_2^h\right)\right\} \tag{26}$$

Similarly, we can rewrite the expected labor cost, when the signal θ is observed by the principal, as follows:

$$\begin{aligned} C^P(r_g) \quad = \quad & p_1^h \psi_1 + \rho r_g p_2^{hg} \psi_2^g + \rho r_g \max\left\{0,\ p_1^h \frac{\psi_1}{1-\rho r_g} - \left(p_2^{hg}\psi_2^g - V_2^h\right)\right. \\ & \left. + (R_2^{hb} + (p_2^{hg} - p_2^{hb})\psi_2^g - V_2^h - R_1^h)\right\} \end{aligned} \tag{27}$$

It follows immediately that the agency cost associated with giving the authority to the agent is not larger, for any r_g, than the agency cost associated with giving the authority to the principal whenever condition (15) holds. Conversely, when (15) does not hold, the principal is better off assuming the authority even when constraint (24) is not binding; it will *a fortiori* be the case if it is binding (Proposition 3C). *QED*

Proof of Corollary 5.1: Clear from the text. *QED*

Proof of Corollary 5.2: Clear from the text. *QED*

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FIGURE 1
The allocation of authority to the agent

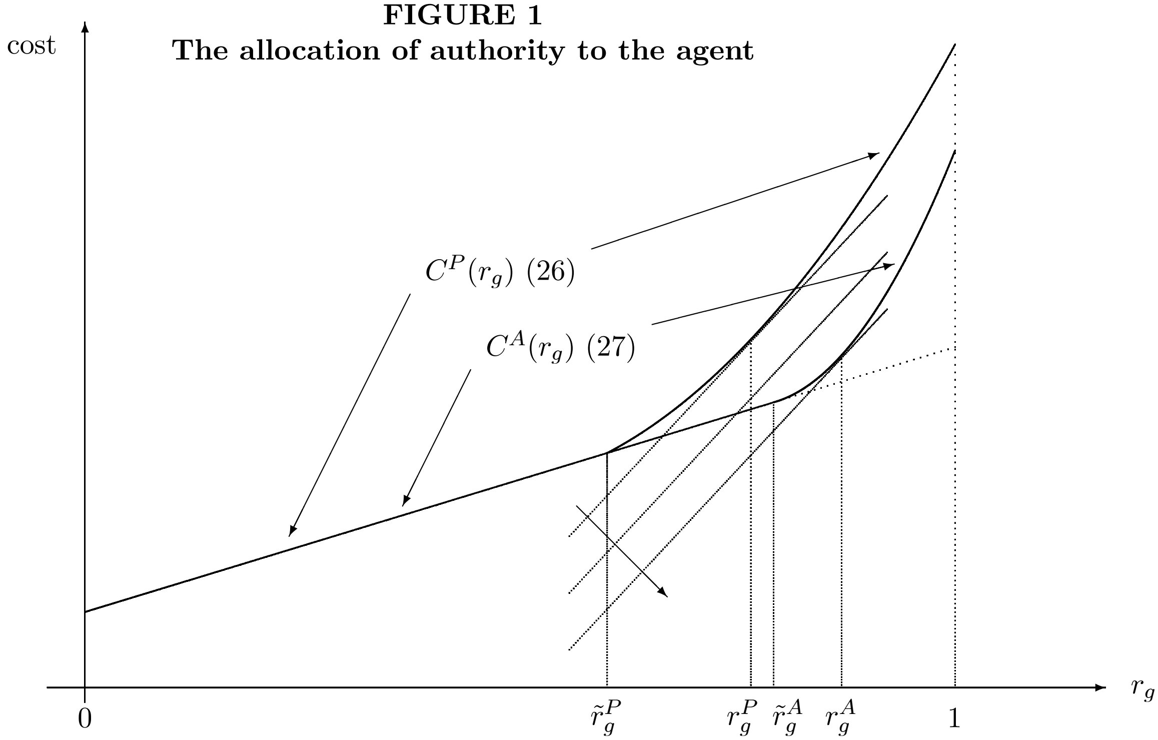

TABLE 1

The switching rules $(r_g,\ r_b)$ in the different contexts:

(Note that $r_b = 0$ always)

θ is observed by ↓	r_g
P and A	1
P only	$\begin{cases} 1, \text{ if } \frac{p_1^h \psi_1}{1-\rho} \leq \max\{R_1^h - (R_2^{hb} - p_2^{hb}\psi_2^g),\ (1-\rho)[(R_2^{hg} - p_2^{hg}\psi_2^g) - (R_2^{hb} - p_2^{hb}\psi_2^g)]\} \\ 0, \text{ if } p_1^h\psi_1 \geq (R_2^{hg} - p_2^{hg}\psi_2^g) - (R_2^{hb} - p_2^{hb}\psi_2^g) \\ \frac{1}{\rho}\left[1 - \min\left\{\left(\frac{p_1^h\psi_1}{(R_2^{hg}-p_2^{hg}\psi_2^g)-(R_2^{hb}-p_2^{hb}\psi_2^g)}\right)^{\frac{1}{2}},\ \max\{0,\ \frac{p_1^h\psi_1}{R_1^h-(R_2^{hb}-p_2^{hb}\psi_2^g)}\}\right\}\right], \text{ otherwise} \end{cases}$
A only	$\begin{cases} 1, \text{ if } \frac{p_1^h\psi_1}{1-\rho} \leq \max\{p_2^{hg}\psi_2^g - V_2^h,\ (1-\rho)(R_2^{hg} - V_2^h - R_1^h)\} \\ \frac{1}{\rho}\left[1 - \min\left\{\left(\frac{p_1^h\psi_1}{R_2^{hg}-V_2^h-R_1^h}\right)^{\frac{1}{2}},\ \frac{p_1^h\psi_1}{(p_2^{hg}\psi_2^g - V_2^h)}\right\}\right], \text{ otherwise} \end{cases}$

TABLE 2

The compensation profiles w in the different contexts:

(Note that $w_1^f = 0$ and $r_b = 0$ always, so we can set $w_2^{fb} = w_2^{sb} = 0$)

θ is observed by $\longrightarrow$	P and A	P only	A only
w_1^s	$\frac{\psi_1}{1-\rho}$	$\frac{\psi_1}{1-\rho r_g}$	$\max\{\frac{\psi_1}{1-\rho r_g}, \frac{p_2^{hg} V_1^h - V_2^h \left(p_2^{hg} - p_2^{hb}\right)(1-\rho) r_g}{(p_2^{hg} - p_2^{hb}) p_1^h (1-\rho) r_g + (1-r_g)(p_1^h - p_1^\ell) p_2^{hg}}\}$
w_2^{fg}	0	$\max\{0 , \left(R_2^{hb} - p_2^{hb}\psi_2^g) - (R_1^h - p_1^h \frac{\psi_1}{(1-\rho r_g)}\right)\}$	0
w_2^{sg}	ψ_2^g	$w_2^{fg} + \psi_2^g$	$\frac{1}{p_2^{hg}} \left(p_1^h w_1^s + V_2^h\right)$