Optimal Dissent in Organizations*

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Abstract

This paper is a theoretical exploration on the costs and benefits of "passive resistance" in the chain of command. In our model, the organization consists of two employees: an informed decision maker (she) in charge of selecting a project, and an uninformed implementer (he) in charge of its execution. Both employees have intrinsic and possibly differing preferences over projects. Overall success depends on both project selection and its implementation.

We find that a certain level of disagreement in the chain of command may be useful to (1) prevent bad decisions from being taken and (2) give credibility to the accuracy of the decision maker's orders. Hence, there is an optimal level of dissent in organizations, which is larger when the extent of the decision maker's private information is higher.

We apply our analysis to two questions: (1) the political independence of government agencies and (2) the current debate on corporate governance.

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1 Introduction

In organizations, a key role of managers is decision making. Yet, there are limits to what they can ask from their team. Sometimes, subordinates simply dislike to work on certain projects. Some other times, they do not believe their boss is really giving the right order. Such disobedience need not arise as an open conflict, but rather as a lack of enthusiasm and initiative. This paper studies these limits to managerial authority. Somewhat surprisingly, we find that a certain level of disagreement in the chain of command may be useful to (1) prevent bad decisions from being taken and (2) give credibility to the accuracy of the decision maker's choices. That there is an optimal level of dissent in organizations is more than just a theoretical speculation, and has, we argue, important practical implications ranging from the political independence of government agencies to the current debate on corporate governance.

This paper provides a theoretical exploration of the costs and benefits of "passive resistance" in the chain of command. The idea that members of an organization may have conflicting interests is certainly not new to the economics literature; The novel intuition brought by our analysis is that these conflicts may be, on balance, efficiency improving. The large body of literature on incentives in organisations[1] generally takes it as given that members of organizations would prefer to shirk or pursue pet projects rather than strive for the common good. This is a "technological" constraint that must be taken into account in organization design. In a somewhat tayloristic vein, some earlier papers insist on top-down monitoring in organizations to reduce worker's shirking (see e.g. Calvo and Wellisz [1980]). Some recent contributions have focused on delegation of authority as a way to preserve incentives when principal agent preferences diverge too much (Aghion and Tirole [1997], Dessein [2002], Zabojnik [2002]). Others have looked at devices to reduce the divergence in interests (definition of a narrow strategy as in Rotemberg and Saloner [1994], of a clear managerial vision as in Van Den Steen [2005]). However, what is common to this literature is that disagreement is, almost by definition, harmful to organizations.

The role of dissent changes, however, once we start to acknowledge the division of labor in organizations among (1) those who make decisions and (2) those who have to implement them. Implementers may question decisions taken by managers; Managers expect this and factor it into their orders. Put differently, both categories of employees may end up monitoring each other, and dissent may be favorable to organizational efficiency. Our analysis makes it clear how and when this is the case.

[1]The other part of the economics literature on organizations sets incentives aside. Some of it looks at the question of coordination among benevolent agents ("team theoretic" models, e.g. Marschak and Radner [1972] or Aoki [1984]). In the spirit of Weber and Simon, other papers seek to optimize information processing out using a network of boundedly rational agents (e.g. Radner [1993]).

In our model, the organization consists of two employees: a decision maker (she) in charge of selecting a project, and an implementer (he) in charge of its execution. To select the project, the decision maker enjoys an informational advantage over the implementer (she goes to meetings, conferences, has access to confidential memos). Furthermore, we assume that both employees have intrinsic and possibly differing preferences over projects. Overall success depends on both project selection and its implementation.

The key feature of our set-up is that the decision maker has to anticipate the implementer's effort at executing her decision. This is where her authority is constrained, and for two different reasons. First, there is a risk of *mismatch*. If the implementer dislikes the chosen project, he will cut down on effort and success will be less likely. Second, the implementer is worried about the true motivation of the order: He does not know if the order reflects the decision maker's private information or simply her own bias. The implementer questions the order's *legitimacy*. A lack of credibility in the decision maker's objectivity reduces the implementer's incentives to provide effort.

We analyze the role of dissent on organizational performance, and find that it increases the use of information in decision making (reactivity). Indeed, when the decision maker does not share the same goals as her implementer, she has less incentives to follow her own preferences. Hence, dissent prevents bad decisions from being taken. The overall effect of dissent on incentives is however, ambiguous. First, since the decision maker can credibly claim that her order is motivated by information rather than her bias, the implementer has more faith in the project quality: "Objective" incentives are improved. Second, because the implementer is now less likely to have a preference bias towards the project, his willingness to put in effort is smaller. The implementer's "subjective incentives" are reduced. Overall, dissent is good when reactivity to information and objective incentives to implement matter the most ; It is bad when subjective incentives are crucial. Somewhat paradoxically, this suggests that dissent is optimal when the decision makers' informational advantage at judging projects is large.

That dissent may improve the ability of the decision maker and her implementer to communicate may seem counterintuitive in light of recent analysis by Dessein [2002]. In his model, low congruence between a principal and her agent prevent any informative communication from happening, because talk is cheap and both parties have too much incentive to lie. In this case, full delegation to the agent is optimal, while this is very rarely the case in our framework. The key difference is that, in his model, both principal and agent fight over the selection of the project. In our model, because of labor division, the game is not always zero-sum. Our result is closer to Dewatripont and Tirole [2005]'s model of communication. In their paper, a sender sends a message and a receiver implements; both make effort at communicating. When both parties have similar preferences, they free ride on each other's comunication effort, and communication breaks down, a result similar to ours but for very different reasons. While they focus on free riding in communication investments, we focus on the legitimacy of the order, i.e. the perception by the implementer of the order's motivation (objective information vs. bias).

In our model, dissent prevents talk from being totally cheap because the decision maker needs to elicit the implementer's support. Our model thus endogenizes the ability of the decision maker to talk credibly. This is in sharp contrast with signaling models in organization (Hermalin [1997]) and political economy (Cukierman and Tomasi [1998]), where communication is assumed to be feasible. In these models, the leader may send credible messages by "hurting herself". In our model, the ability to "restrain oneself" is endogenous to the chain of command: self restriction is feasible when the implementer has different preferences.

Finally, we discuss three natural applications of our theory. The first one is to the current debate on "corporate governance", which has so far focused mainly on the board of directors as a device to improve corporate decision making. Yet, financial economists have found very little empirical evidence that directors affect the firm's behavior. Our analysis suggests that dissent in the chain of command, i.e. *below* the firm's CEO could be an effective device to improve performance. In a companion paper (Landier, Sraer and Thesmar [2005]), we show that companies with more "independently-minded" top executives (independent in the sense that they were appointed before the CEO) (1) have better economic and market performance and (2) make less expansive acquisitions. These results are not a test of our theory (since other explanations could be put forth[2]), but they point in the right direction.

Secondly, our analysis sheds light on the optimal degree of political independence of government agencies. The management literature suggests that government agencies should be as independent as possible from the political power (see for instance Horn [1995]). We argue that this is consistent with an interpretation of the model where the decision maker (politicians) is biased but has privileged information about social demand. The implementer (the agency) is politically neutral and thus a priori disagrees with the politicians. Our analysis suggests that when social demand is critical (for example field knowledge about the acceptance of reform), a neutral bureaucracy is helpful at eliciting right orders from the top. When the politician does not know much more about problems than the bureaucracy (for example, whether a terrorist attack is likely in the near future), then it is best for incentive purposes to politicize the agency.

Last, we look at the effect of uncertainty in our model. This comparative static is motivated by an old finding in the sociology of organizations: Starting with Woodward [1958] and Burns and Stalker [1965], observers and practitioners of organizations started to acknowledge that the Tayloristic organization, based

[2]A possibility is that senior executives may be more prone to "blow the whistle" and warn the board of directors, major shareholders or even the media in case of corporate misbehavior.

on extensive labor division and strong hierarchy, was dysfunctional in uncertain environments. Sloppier hierarchies, less formal communication between shop floor employees and the management turned out to be optimal for firms dealing with turbulent product markets. This is, luckily, a prediction of our model. We look at an extension where one decision (the "status quo") is much more likely to be the right one than the other ("change"). When the optimality of status quo is very likely the optimal organization is non reactive, and features both pro "status quo" implementer and decision maker. In low uncertainty environments, the best organizations are monolithic. When there is some uncertainty as to when the "status quo" is the right decision, the optimal organization is reactive: it has change averse implementers, but a "status quo" averse decision maker. Hence, our model suggest that reactivity is best achieved through hiring decision makers from the "outside": this helps the two parties to communicate more effectively.

Section 2 exposes the set-up of the model and discusses its different assumptions; Section 3 explores the various equilibrium of the decision-making game; Section 3.4 is interested in the optimal organizational design; Finally, section 5 explores the three applications of our theory.

2 The Model

2.1 Set-Up

The organization belongs to an owner who seeks to maximize expected profits. It has two employees: a decision maker (DM, she) and a implementer (I, he). The decision maker selects a project and the implementer implements it.

Project Structure

There are two projects, labeled 1 and 2.[3] There are also two *equally likely* states of nature (θ), also labeled for convenience 1 and 2. Projects can either fail, in which case they deliver 0 to the firm's owner or succeed and deliver R. The implementer must choose an implementation effort e, which is assumed to be unobservable and discrete: $e \in \{0, 1\}$. Exerting high effort ($e = 1$) entails a private, non transferable, cost $\tilde{c}$ to the implementer. $\tilde{c}$ is random and is *a priori* distributed according to a c.d.f. $F(.)$. $F(.)$ is common knowledge.

To be successful, the effort level of the implementer must be high ($e = 1$) and the good project must be selected (i.e. project i in state of nature i). We

[3] Our qualitative results do not depend on the number of projects possible. To anticipate with our results below, note that if there were more than 2 projects possible, it would still be the case in our model that the implementer has different preferences than the decision maker. This would still compel him to assign a smaller weight to her own preferences, and more weight to objective information. Thus, dissent would still foster organizational reactivity.

thus make here the extreme assumption that project selection and implementer's effort are perfect complements. This is done for the sake of exposition's clarity and entails no loss of generality as long as project selection and implementer's effort are weak complements in the production function (an assumption similar to Dewatripont and Tirole [2005]).

The decision maker has superior information on the state of nature. More precisely, we assume that she receives a binary private signal $\sigma \in \{1, 2\}$ on the state of nature, such that:

$$\mathbb{P}(\sigma = \text{``}i\text{''} | \theta = i) = \alpha > \frac{1}{2}, \text{ for all } i = 1, 2$$

While the signal σ is private information to the decision maker, its precision α is common knowledge.

Agents' Utilities

The owner is risk-neutral and maximizes expected profit.

To simplify exposition, we first assume that monetary incentives cannot be offered, for instance because agents are infinitely risk averse on the monetary part of their utility. Thus, the decision maker and the implementer derive utility only from private benefits attached to the successful completion of a project. We defer the discussion on monetary incentives to section 4.3.

The decision maker obtains private benefit $\overline{B}$ (resp. $\underline{B}$) when her most (resp. least) preferred project is chosen and succeeds. When the project fails, she receives no private benefit. In order to fix ideas, but without loss of generality, we will assume throughout the paper that the preferred project of the decision maker is project **1**. We also assume that this is public information, even though this last assumption is not crucial.

Similarly, the implementer obtains private benefit $\bar{b}$ (resp. $\underline{b}$) if his most (resp. least) preferred project is chosen and succeeds. When the project fails, he receives no private benefit. Throughout the paper, we assume that the decision maker doesn't know the implementer's preferred project when she gives the order. This assumption is also made for expositional purposes, and is by no means necessary to our results.

Ex ante, at the organizational design stage, there is no systematic bias in the decision maker and implementer's preferences: they are equally likely to prefer either one of the two projects.

Finally, we define β as the ex ante probability that both decision maker and implementer prefer the same project. We interpret β as a measure of the organization homogeneity (or congruence of tastes). Organizational design by the organization's owner here boils down to the choice of β.

Sequence of Events and Information Structure

The sequence of events has four stages:

1. **Organizational design**: The owner of the firm chooses the level of homogeneity β, which is the probability that the implementer will prefer project 1, like the decision maker. β then becomes public information.

2. **Decision making**: The decision maker receives her private signal σ about the state of nature. She then selects a project. The order is assumed irreversible.[4][5] At the moment of project selection, the decision maker still ignores the implementer's preferred project.

3. **Implementation**: The implementer is hired and his preferred project, as well as his implementation cost $\tilde{c}$ are revealed. He has to implement the project selected in period 2, but can decide whether or not to exert effort.

4. **Outcome**: The project either succeeds (yielding profit R to the organization and private benefits to the agents) or fails (profit 0).

The corresponding time line is drawn in figure 1.

[Insert Figure 1 about here.]

2.2 Equilibrium Concept

An equilibrium of this model consists of two strategies. First, the *decision rule* for the decision maker maps signals into orders; it captures the extent to which orders really reflect signals. Second, the *implementer's beliefs* about the informativeness of the order; the implementer uses these beliefs to decide his effort level.

We look for standard perfect Bayesian equilibria of this game (Fudenberg and Tirole [1991]), which impose two natural constraints here. First, given the implementer's beliefs, the DM's decision rule must be privately optimal. Second, given the DM's decision rule, the implementer form his expectations using Bayes' rule. Decision rules and beliefs that satisfy these two constraints are equilibria.

[4]Because, for example, a large project specific investment needs to be made at this point.

[5]This assumption helps us to avoid the possibility of messages sent by the implementer to the decision maker: indeed, without this irreversible investment, the implementer and the decision maker could bargain over the project to select and the implementer could try to reveal his preferred project to the decision maker. Anticipating with our results below, one can prove that, while it is true that, under some conditions, such messages might destroy the role played by dissent in the organization, it remains optimal to have dissenting implementers for a large class of parameters.

3 Organizational Homogeneity Affects Reactivity

In this section, we first fix the level of organizational homogeneity β and characterize the equilibria. We begin with the implementer's effort choice (section 3.1), given the order he receives. We then solve for the decision maker's order choice, which is optimal given the implementer's beliefs and effort choice (section 3.2). Finally, we move to organizational design (section 3.4), which amounts to finding the β that maximizes shareholder profits.

3.1 Implementer's decision

The implementer must decide whether or not to exert effort. High effort costs c to him, but increases the probability of success. When order 1 (resp. order 2) has been given, μ_1 (resp. μ_2) is the implementer's posterior belief that the real state of nature is 1 (resp 2). Put differently, μ_i is the implementer's belief that order i is the right course of action.

To ease exposition, we only consider explicitly here the case when the implementer is ordered 1 (order 2 results in similar equations). If the implementer prefers project 1, then he puts in high effort when:

$$\mu_1 \bar{b} - c \geq 0$$

However, if the implementer prefers project 2, he is less likely to put in high effort to follow the order. He does so when:

$$\mu_1 \underline{b} - c \geq 0$$

Ex ante, the implementer likes 1 with probability β. Thus, when the decision maker orders action 1, she expects that high effort will be put in with probability:

$$\mathbb{P}(\text{high effort}|\text{order=“1”}) = \beta F(\mu_1 \bar{b}) + (1-\beta) F(\mu_1 \underline{b})$$

High effort is more likely to be exerted when the implementer (1) believes it is the right course of action and (2) is more likely to prefer project 1.

3.2 The decision maker's choice

We consider now the decision of the DM, conditionally on her private signal. In some cases, a separating equilibrium emerges: the decision maker always bases her order on the signal she observes. In these situations, the organization is said to be “reactive”, because it uses all the information available. In some other cases, the decision maker always orders her preferred project, without taking the signal into account. Such equilibria are said to be “non reactive”. Between these two classes of equilibria, the decision only partly incorporates the signal in her orders. This section looks at the effect of β on the prevalence of reactivity, non reactivity, and semi reactivity[6].

Reactive Equilibrium

Consider an equilibrium where (1) the strategy of the decision maker is to select the project indicated by the signal and (2) the posterior belief of the implementer attributes a full informational content to the order. We look for conditions for this equilibrium to be sustainable.

In this equilibrium, the implementer's posteriors are given by:

$$\mu_1 = \mu_2 = \alpha$$

Furthermore, we assume that the implementer takes lies at face value. Thus, the above beliefs are also true out of equilibrium (when the decision maker does not follow her signal). Such out-of-equilibrium beliefs make it more difficult for the reactive equilibrium to exist, but do not affect the qualitative results of our analysis.

These posteriors are rational when the decision maker *always* prefers to order what the signal tells her to. Therefore, two incentive constraints must be satisfied in this equilibrium. First, when the signal is 2, the decision maker must prefer to order 2:

$$\begin{aligned} & \underbrace{\alpha}_{\text{Proba. of state 2}} \cdot \underbrace{\left(\beta F(\alpha \underline{b}) + (1-\beta) F(\alpha \bar{b})\right)}_{\text{Proba. of effort with order 2}} \cdot \underbrace{\underline{B}}_{\text{Low DM benefit}} \\ \geq \quad & \underbrace{(1-\alpha)}_{\text{Proba. of state 1}} \cdot \underbrace{\left(\beta F(\alpha \bar{b}) + (1-\beta) F(\alpha \underline{b})\right)}_{\text{Proba. of effort with order 1}} \cdot \underbrace{\bar{B}}_{\text{High DM benefit}} \end{aligned}$$

A priori, her own preferences compel her to order 1 instead of 2 ($\bar{B} > \underline{B}$). However, the signal tells her 2 is more likely to succeed, which drives her to order 2 ($\alpha > 1 - \alpha$). Finally, if $\beta > 1/2$, the implementer is more likely to prefer 1, and therefore less likely to put in effort when ordered 1. As a result, when β is large enough, the decision maker is more likely to order 1. When $\beta < 1/2$, low β implementers are more likely to put in effort when ordered 2. This encourages the decision maker to order 2.

Thus, the above condition simply states that the implementer and the decision maker cannot be too congruent. It is equivalent to:

$$\beta \leq \frac{\alpha F(\alpha \bar{b}) \underline{B} - (1-\alpha) F(\alpha \underline{b}) \bar{B}}{\left[F(\alpha \bar{b}) - F(\alpha \bar{b})\right] \left[(1-\alpha)\bar{B} + \alpha \underline{B}\right]} = \beta_2^\star \tag{1}$$

[6]There is also theoretically the possibility of an equilibrium where the decision maker always selects the project opposite to the signal she received: one can show that this actually cannot be an equilibrium provided that $\alpha > \frac{1}{2}$

When congruence β is high, it is costly not to follow the implementer's bias because he will put in little effort. This incentive to "pander" to the implementer's preferences will be too strong to allow the reactive equilibrium to emerge. Note that in some cases, in particular when α is large, $\beta_2^\star > 1$. When the signal is very informative, the decision maker is always ready to overcome her bias and the implementer's, because she knows that stubbornness will lead to failure. With a slight abuse of notation, we write hereafter $\beta_1^* \equiv \min\{1, \beta_1^*\}$.

The second incentive constraint is symmetrical to the first. When the signal indicates project 1, the decision maker must be selecting project 1. This condition is a priori easier to satisfy since both the signal and her own intrinsic preferences encourage the decision maker to order 1. However, when β is too low, the implementer dislikes project 1 so much that he is unlikely to put in effort. In such cases decision maker may be tempted to ignore both her signal and her own preferences to pander to her implementer's tastes. Formally, the second incentive constraint writes as a lower bound on β:

$$\beta \geq \frac{(1-\alpha)F(\alpha\bar{b})\underline{B} - \alpha F(\alpha\underline{b})\bar{B}}{\left[F(\alpha\bar{b}) - F(\alpha\underline{b})\right]\left[\alpha\bar{B} + (1-\alpha)\underline{B}\right]} = \beta_1^\star \leq \frac{1}{2} \tag{2}$$

For some parameter values, it may be that $\beta_1^* < 0$. In this case, the second incentive constraint is never binding: a decision maker observing 1 always orders 1, because the "pandering" effect is too small. With a slight abuse of notation, we write in the following $\beta_1^* \equiv \max\{0, \beta_1^*\}$. Summing up the results of this section:

Result 1 *The two thresholds $\beta_1^\star, \beta_2^\star$ are such that:*

$$\beta_1^\star < \beta_2^\star$$

When $\beta \in [\beta_1^\star; \beta_2^\star]$, the equilibrium is reactive: the project selected by the decision maker is always the one indicated by the signal.

Non-Reactive Equilibria

Our model features two different types of pooling equilibria: one where the decision maker always selects her preferred project, i.e. project 1, whatever her signal is; one where she always selects project 2. These equilibria are characterized by the absence of reactivity to the private signal.

We first consider in detail the equilibrium where the order is always 1. In this case, the order has no informational content, and the implementer's posterior belief on state of nature is $\mu_1 = \frac{1}{2}$. Out of equilibrium, were project 2 selected, we assume that the implementer would attribute a full informational content to this order (i.e. $\mu_2 = \alpha$).[7]

[7] This is a natural assumption: it is common knowledge that the decision maker is biased toward 1. Therefore, her ordering action 2 is very informative about the true signal. As will become apparent below, this assumption has the effect of making the "non reactive" equilibrium more difficult to sustain, but has no qualitative impact on our results.

As above, there are *a priori* two different incentives constraints that need to be satisfied: the decision maker must select project 1 whether her private signal is 1 or 2. As it turns out, as soon as the DM orders 1 when observing 2, she will always do so when she observes 1.[8] Thus, the only relevant incentive constraint is that the decision maker has incentive to select project 1 even when her private signal is 2. We find that this constraint is satisfied when β is large enough. Indeed, for low levels of β, the implement intrinsically prefers project 2 and puts little effort when order action 1. For this reason, and also because it is the right course of action, the decision maker prefers to order project 2 and deviates from the non reactive equilibrium. Formally, it is straightforward to show that there exists a threshold $\beta_2^{\star\star}$ above which this equilibrium exists:[9]

$$\beta \geq \beta_2^{\star\star} = \frac{\alpha F(\alpha \bar{b})\underline{B} - (1-\alpha)F(\frac{1}{2}\underline{b})\bar{B}}{[F(\frac{1}{2}\bar{b}) - F(\frac{1}{2}\underline{b})][(1-\alpha)\bar{B}] + [F(\alpha \bar{b}) - F(\alpha \underline{b})]\alpha \underline{B}]} \tag{3}$$

The second "non reactive" equilibrium can be characterized in a similar and symmetric fashion: there exists a threshold $\beta_1^{\star\star}$ *below* which the decision maker always orders action 2, even though she has intrinsic preferences toward 1. The intuition is the following: as β decreases, the implementer is more likely to exert effort when ordered 2. When β is low enough, these preferences are so strong that the decision maker is compelled to pander to the implementer's preferences. Formally, the threshold $\beta_1^{\star\star}$ under which this equilibrium exists is given by:[10]

$$\beta \leq \beta_1^{\star\star} = \frac{(1-\alpha)F(\frac{1}{2}\bar{b})\underline{B} - \alpha F(\alpha \underline{b})\bar{B}}{[F(\frac{1}{2}\bar{b}) - F(\frac{1}{2}\underline{b})][(1-\alpha)\underline{B}] + [F(\alpha \bar{b}) - F(\alpha \underline{b})](1-\alpha)\bar{B}]} \tag{4}$$

Summing up the above results, it is simple to show that:

Result 2 *The two thresholds $\beta_1^{\star\star}$ and $\beta_2^{\star\star}$ are such that:*

$$\beta_1^{\star\star} < \beta_1^{\star} \leq \beta_2^{\star} < \beta_2^{\star\star}$$

When $\beta \in [0; \beta_1^{\star\star}]$, the decision maker always orders action 2.
When $\beta \in [\beta_2^{\star\star}; 1]$, the decision maker always orders action 1.

The above analyses suggest that for some intermediate values of β (i.e. $\beta \in [\beta_1^{\star\star}; \beta_1^{\star}] \cup [\beta_2^{\star}; \beta_2^{\star\star}]$), neither a "reactive", nor a "non reactive" equilibrium exist.

[8]The intuition is the following: because the success of action 1 is more likely when the signal is 1, when the decision maker observes signal 1, she has even more incentives to order project 1 than when she observes signal 2.

[9]For some values of the parameters, β_2^{**} may be larger than 1 or smaller than 0. With a slight abuse of notation, we write $\beta_2^{**} \equiv \min\{1, \max\{\beta_2^{**}, 0\}\}$.

[10]For some values of the parameters, β_1^{**} may be smaller than 0. In those cases, the equilibrium where 2 is systematically ordered is never sustainable. With a slight abuse of notation, we write $\beta_1^{**} \equiv \max\{\beta_1^{**}, 0\}$.

The following section shows that, in these intermediate cases, equilibria feature partially informative orders, where the decision maker sometimes does not always base her order on the received signal..

Semi-Reactive Equilibria

This section looks for the conditions of existence of "mixed strategy" equilibria, i.e. equilibria where the decision maker is allowed to randomize her order when she observes a signal she dislikes. More precisely, we are interested in equilibria where the decision maker strategy is to (1) always select project 1 when her signal is 1 and (2) select project 2 with probability $(1-\rho)$, project 1 with probability 1, when the signal is 2. Of course, ρ here is endogenous and will be determined by equilibrium conditions. In the terminology defined above, $\rho = 0$ corresponds to a reactive equilibrium. $\rho = 1$ to a non-reactive equilibrium.

In such an equilibrium, when order 1 has been given, the implementer updates his beliefs that 1 is the right course of action. A posteriori, order 1 may be given either because signal 1 has been observed, or because the decision maker chose to lie. Bayes' rule gives:[11]

$$\mu_1(\rho) = \frac{\alpha + \rho(1-\alpha)}{1+\rho}$$

When project 2 is ordered however, the only possibility is that the decision maker has observed signal 2:

$$\mu_2(\rho) = \alpha$$

The decision maker chooses randomly whether or not to follow signal 2. For mixed strategies to be optimal, she has to be indifferent between the two options:

$$\alpha\left(\beta F(\alpha\underline{b}) + (1-\beta)F(\alpha\bar{b})\right)\underline{B} = (1-\alpha)\left(\beta F(\mu_1(\rho)\bar{b}) + (1-\beta)F(\mu_2(\rho)\underline{b})\right)\bar{B} \quad (5)$$

which pins down the value of ρ as a function of the other parameters

It can be shown easily that, for each $\beta \in [\beta_2^\star, \beta_2^{\star\star}]$, equation (5) defines a unique $\rho(\beta) \in [0,1]$. When $\beta = \beta_2^{\star\star}$, $\rho = 1$: the decision maker never reacts to the signal, the equilibrium is non reactive, as shown above. When $\beta = \beta_2^\star$, $\rho = 0$. The decision maker always react to the signal, and the equilibrium is fully reactive, consistently with the above analysis.

A symmetric analysis can be performed for $\beta \in [\beta_1^{\star\star}, \beta_1^\star]$. For each value of β in this interval, there is an equilibrium where the decision maker (1) always orders 2 when the signal is 2 and (2) orders 1 with probability $1-\lambda$ when the signal is 1. For lower values of β in this interval, the decision maker becomes more likely to order 2, for all signal values.

[11] When project 2 is selected, there is no doubt that signal 2 was received by the decision maker

Result 3 *When $\beta \in [\beta_1^{\star *}, \beta_1^{\star}]$, the decision maker orders action 1 when the signal is 1 with probability $1 - \lambda(\beta)$. λ is decreasing in β. $\lambda(\beta_1^{**}) = 1$ and $\lambda(\beta_1^*) = 0$.*

When $\beta \in [\beta_2^*, \beta_2^{**\star}]$, the decision maker orders action 2 when the signal is 2 with probability $1 - \rho(\beta)$. ρ is increasing in β. $\rho(\beta_2^*) = 0$ and $\rho(\beta_2^{**}) = 1$.

3.3 Summary and Discussion

[Insert Figure 2 about here.]

The results of the above analysis are summarized in figure 2 **A unique perfect Bayesian equilibrium exists:** for low levels of β ($\beta \in [0; \beta_1^{\star\star}]$), the implementer's preferred project is always ordered. As β increases, the order progressively incorporates more and more informational content, as the decision maker reveals the signal more often (when $\beta \in [\beta_1^{\star *}, \beta_1^{\star}]$). For intermediate values of β ($\beta \in [\beta_1^{\star}; \beta_2^{\star}]$), the decision maker always follows the signal when giving her orders. Then, when β further increases ($\beta \in [\beta_2^*, \beta_2^{**\star}]$), the decision maker sometimes orders 1 even when the signal is 2. When finally $\beta \in [\beta_2^{\star *}; 1]$, order 1 is always given, whatever the value of the signal.

This suggests that reactivity is easier to obtain for intermediate levels of congruence, while non reactivity prevails when β is large or small. Put differently, uncertainty about the implementer's taste is key to achieve reactivity in such an organization. The reason is the following. The implementer's mere presence in the chain of command strongly limit the decision maker's options: because the decision maker is the first mover in our setting (she select the project before the implementer exert the implementation effort), she must internalize the incentive constraint of the implementer in her decision process. When congruence is extreme, i.e. β close either to 0 or 1, following the signal may not be such a good strategy for the decision maker, as she knows that the implementer is not likely to exert effort on the project he dislikes: these are the cases where the "implementation" constraint is binding. Selecting the project according to the signal becomes more valuable for the decision maker when congruence is intermediate, as the probability that the implementer exerts effort on both projects increases: the "implementation" constraint is loose for such cases. As a consequence, intermediate congruence emerges in our framework as an efficient tool to moderate the decision making process.[12]

[12]Note that this effect is independent from the "signalling" aspect of our model (the fact that orders may, or may not, be informative). Intermediate β would still help reactivity if the signal was common knowledge, instead of being private information to the decision maker.

3.4 Organizational Design

The above analysis suggest that intermediate levels of congruence fosters organizational reactivity. Reactivity, however, comes at a cost as a moderately aligned implementer is less likely to put in high effort on average. To study this tradeoff, this section looks for the optimal β from a shareholder (i.e. unbiased) perspective.

For intermediate levels of congruence (i.e. $\beta \in [\beta_1^\star, \beta_2^\star]$), the firm will always react to the signal. Therefore, it is easy to show that the firm's expected profit is given by:

$$V^R(\beta) = \alpha \left(\frac{F(\alpha\bar{b}) + F(\alpha\underline{b})}{2} \right) R \equiv V^R \tag{6}$$

It turns out that this value does not depend on β. Indeed, the *a priori* probability that the correct course of action will be ordered is α, because the decision maker follows the signal. Then, with probability 1/2 the order will correspond to what the implementer prefers: he will thus exert high effort with probability $F(\alpha\bar{b})$. With probability 1/2, the implementer will dislike the order, and exert effort with probability $F(\alpha\underline{b})$ only. Note that the implementer always expects the order to be correct with probability α, because in reactive equilibria, the order is informative.

For very high congruence ($\beta \in [\beta_2^{\star\star}, 1]$), the decision maker will always choose her preferred project. The expected profit of such an homogenous organization is given by:

$$V^H(\beta) = \frac{1}{2} \left(\beta F\left(\frac{\bar{b}}{2}\right) + (1-\beta) F\left(\frac{\underline{b}}{2}\right) \right) R \tag{7}$$

Action 1, the decision maker's preferred project, is *a priori* successful with probability 1/2. With probability β, action 1 is also the implementer's preferred project: in this case, he makes high effort with probability $F(\bar{b}/2)$. With probability $1-\beta$, the implementer prefers project 2 and makes low effort. In contrast to non reactive organizations, the order here never conveys any information. The posterior belief that the order is the correct course of action therefore remains equal to 1/2, which decreases implementation effort.

The value of an homogenous organization (7) is maximized for perfect congruence between the decision maker and the implementer (i.e. $\beta = 1$). Indeed, since the order is always equal to the DM's bias, what matters is to maximize the implementation effort. This is achieved with implementers who prefer 1 the most. This reasoning allows us to compute the optimal "homogenous" organization:

$$V^H = \frac{1}{2} F\left(\frac{\bar{b}}{2}\right) R \tag{8}$$

As it turns out, the value (8) is also the expected profit of firms with extremely low levels of congruence. The intuition is simple and similar to the perfectly homogenous (i.e. high β) case. When β is low, the order is always action 2, so the best is to have implementers who make maximum effort to implement action

2. This is achieved with $\beta = 0$. In this case, the prior probability of success is 1/2 times the probability of successful implementation $F(\bar{b}/2)$.

Semi-reactive organizations arise are *never* optimal. The intuition is the following: start for instance with a value of β for which the decision-maker does not always order 2 when the signal is 2 ($\beta \in [\beta_2^\star, \beta_2^{\star\star}]$). In this interval, the decision-maker is, by definition, indifferent between following signal 2 or not. Given that the decision maker is biased towards 1, this means that, for these values of parameters, an un biased shareholder would strictly prefer project 2 to be undertaken. Thus, the shareholder can increase the firm's value by reducing β, which reduces the probability of no reactivity, ρ, and increases the chances that project 2 will be undertaken. In the end, the optimal β in this range is the extreme $\beta = \beta_2^*$, where the probability of no reactivity is zero, and the equilibrium fully reactive.[13]

To choose the optimal degree of homogeneity in the organization, the shareholder must therefore choose between fully reactive organizations (obtained with extreme congruence) and non reactive organizations (obtained with any intermediate $\beta \in [\beta_1^\star, \beta_2^\star]$). The net gain of reactivity ((6) - (8)) can be broken down into three terms that highlight the three effects at work in the model:

$$\frac{V^R}{V^{NR}} = \underbrace{2\alpha}_{\text{Reactivity gain}} \times \underbrace{\left(\frac{F(\alpha\bar{b}) + F(\alpha\underline{b})}{F(\bar{b}/2) + F(\underline{b}/2)}\right)}_{\text{Credibility gain}} \times \underbrace{\left(\frac{F(\bar{b}/2)/2 + F(\underline{b}/2)/2}{F(\bar{b}/2)}\right)}_{\text{Mismatch cost}} \tag{9}$$

Over non reactive organizations, reactive ones have two benefits, and one cost:

- *Reactivity gain*: This gain corresponds to the first term on the right hand side of (9). Because the implementer's preferences are uncertain, the decision maker has less incentive to pander to his tastes. She assigns more weight to the signal, and less weight to the implementer's preferences as well as her own. Therefore, reactive organisations make the right decision more often than non reactive ones, because they make use of all the information available ($\alpha > 1/2$). Note that this effect is totally independent of the signalling aspect of the game, and would also arise if, say, the decision maker's signal was public information.

[13]This intuition can be verified formally by writing down the expected shareholder of mixed reactivity:

$$\begin{aligned} V^{MR} &= \frac{1}{2}\alpha\,(1-\rho)\,.\left(\beta F(\alpha\underline{b}) + (1-\beta)F(\alpha\bar{b})\right) \\ &\quad + \frac{1}{2}\,(\alpha + (1-\alpha)\,\rho)\,.\left(\beta F(\mu(\alpha).\bar{b}) + (1-\beta)F(\mu(\alpha).\underline{b})\right) \end{aligned}$$

along with the indifference contraint (5), which defines ρ as a function of β. It then is straightforward to show that V^{MR} is a decreasing function of β.

- *Credibility gain*: The "implementation constraint" compels the decision maker to pay more attention to the signal. As a result, the order she gives is informative about the project's likelihood of success. As success is more likely, the implementer will put in more effort and the overall success probability will increase. Thus, the additional gain of intermediate congruence is that the orders gain "legitimacy": the implementer's motivation increases because he believes his boss. This effect is a by product of the signalling game, and would disappear if the DM's signal was not private information.

- *Cost of mismatch*: This cost of intermediate β corresponds to the last term of (9). In reactive organisations, the project that the implementer dislikes will be ordered with probability 1/2 (since both projects are ex ante equally probable). Thus, with probability 1/2, the order will have to be carried out with low effort on average. In non reactive organizations, this never happens as the decision maker always panders to the implementers preferences which are clearly defined ($\beta = 0$ or 1).

As is obvious from equation (9), both reactivity and credibility gains are increasing functions of α. When the signal is more informative, it becomes more profitable to follow it (reactivity gain increases). Also, the implementer makes more use of legitimate orders: he knows the decision maker makes very often the right choice, and therefore puts in more effort. As a result, net gains of reactivity $V^R - V^{NR}$ are an increasing function of α. Since reactivity is worthless when the signal is non informative ($\alpha = 1/2$) and clearly profitable when the signal is fully informative ($\alpha = 1$), we derive the following result:

Result 4 *Intermediate congruence is optimal when the signal is sufficiently precise. Else, extreme congruence is optimal.*

Put differently, there exists a threshold of precision α^0 such that, for all $\alpha > \alpha^0$ $\iff V^R > V^{NR}$

4 Robustness

This section investigates the robustness of our results in front of three specification changes, that we believe shed light on our mechanism. First (section 4.1), what happens if we allow the decision maker to hire her own implementer (i.e. choose β) ? Would she still choose some level of dissent ? How her choice of dissent relates to the organization's owner's one ? Secondly (section 4.2), does the shareholder really want authority to rest in the decision maker's hands ? Third (4.3), what is the level of contractual incompleteness on which our results hinge ? Is dissent still optimal if we can pay the decision maker and the executive for performance ?

4.1 What if the Decision-Maker Hires the Implementer Herself ?

In this section, we allow the decision maker to hire the implementer herself, and assume she can observe her preference prior to the hiring decision. This amounts to give the choice of β to the decision maker. The question we ask here is: how different is the degree of organizational homogeneity if we allow the decision maker to choose it, compare to the case where we let the shareholder design it ? To some extent, the normative implications of our model hinges on the answer to this question: in cases where the decision-maker does not choose ex-ante the optimal β, it is efficient to constrain her hiring decision. For example, in the corporate governance application, it suggests that the shareholders, instead of the CEO, should decide on who is the new CFO of the company.

The trade-off faced by the decision maker is the following: on the one hand she has the same goals as the firm's shareholders. She wants to increase the legitimacy of her order vis à vis the implementer ("credibility gain" above) and reduce mismatch so as to avoid disappointing him ("mismatch cost"). On the other hand, she is more biased toward project 1 than the shareholder: even when the signal points on action 2, given that it may be misleading ($\alpha < 1$), she is more willing to take a chance to order action 1. Thus, when the signal is not precise enough, the decision maker is more willing to design a monolithic ($\beta = 1$) organization. This incentive however disappears if α is accurate enough.

The above discussion suggests that the decision maker and the shareholder are likely to choose similar organizations when the signal is very precise or very imprecise. Yet, their choice will differ for intermediate values of α.

The formal analysis confirms this intuition. Conditional on choosing a reactive equilibrium (i.e. $\beta \in [\beta_1^\star, \beta_2^\star]$), the decision maker's utility is given by:

$$U^R(\beta) = \underbrace{\frac{\alpha}{2}[\beta.F(\alpha\bar{b}) + (1-\beta).F(\alpha\underline{b})]}_{\text{proba that order 1 succeeds}}.\bar{B} + \underbrace{\frac{\alpha}{2}\left[(1-\beta).F(\alpha\bar{b}) + \beta.F(\alpha\underline{b})\right]}_{\text{proba that order 2 succeeds}}.\underline{B}$$

which is increasing in β. Because she get higher payoffs when she orders action 1, the decision maker prefers implementers who are more motivated by project 1 since the effect of more motivation in action 1 dominates the decreasing motivation for action 2. These two effects would exactly offset each other for a neutral shareholder. As a result, conditionally on choosing to be reactive, the decision maker chooses the highest possible level of congruence: $\beta = \beta_2^\star$.

When opting for a non-reactive equilibrium, the decision maker knows she will pander to the implementer's preferences. Given that she herself prefers project 1, she strictly prefers to hire implementers biased towards 1. In this case, it is easy to see that she selects extremely biased implementers ($\beta = 1$):

$$U^{NR}=\frac{1}{2}F(\frac{\bar{b}}{2})\bar{B}$$

Therefore, if the decision maker has control over the organizational design, she will choose a non-congruent implementer (i.e. $\beta=\beta_2^\star$) if and only if:[14]

$$\frac{\alpha}{2}[\beta_2^\star.F(\alpha\bar{b})+(1-\beta_2^\star).F(\alpha\underline{b})].\bar{B}+\frac{\alpha}{2}\left[(1-\beta_2^\star).F(\alpha\bar{b})+\beta_2^\star.F(\alpha\underline{b})\right].\underline{B}\geq\frac{1}{2}F(\frac{\bar{b}}{2})\bar{B}$$

given that, by definition, β_2^* is the level of congruence for which the decision maker is indifferent between following a signal 2 and ordering 1, this condition rewrites:

$$\underbrace{\frac{1}{2}[\beta_2^\star.\left(F(\alpha\bar{b})-F\left(\frac{\bar{b}}{2}\right)\right)+(1-\beta_2^\star).\left(F(\alpha\underline{b})-F\left(\frac{\underline{b}}{2}\right)\right)].\bar{B}}_{\text{credibility gain from DM viewpoint}}$$
$$\geq\ \underbrace{\frac{1}{2}(1-\beta_2^*)\left[F\left(\frac{\bar{b}}{2}\right)-F\left(\frac{\underline{b}}{2}\right)\right].\bar{B}}_{\text{mismatch cost from DM viewpoint}}$$

This condition states that the decision maker compares the gains to be able to send credible orders (more motivated implementer), to the costs of possibly disappointing her subordinate (mismatch between the order and the implementer's preferences). As it turns out, the reactivity gain does not appear here because the DM is *ex post* indifferent between following, or not, signal 2. Thus, the only gain that matters to her is the ability of being *ex post* credible to the implementer. Put differently, organizational dissent has in her eyes the value of a commitment device.

As a result, it is feasible to show formally that, for sufficiently precise signals, the decision maker still chooses intermediate values of $\beta=\beta_2^*$. However, as reactivity per se is worthless to her, she will be less likely to hire dissenting implementers than the shareholder, for a given level of α:

Result 5 *There exists two thresholds $\frac{1}{2}<\underline{\alpha}<\overline{\alpha}<1$ such that:*

When the private information of the decision maker is very precise or very noisy (i.e. $\alpha>\overline{\alpha}$ or $\alpha<\underline{\alpha}$), the shareholder can delegate the task of organizational design to the decision maker.

For intermediate level of precision (i.e. $\underline{\alpha}<\alpha<\overline{\alpha}$), the decision maker prefers to have a perfectly aligned implementer ($\beta=1$), while the shareholder would prefer moderately dissenting subordinates ($\beta\in[\beta_1^\star;\beta_2^\star]$). In this case, organizational design should be a prerogative of the organization's owner.

[14]For exactly the same reasons as in the previous section, one can show that mixed equilibria are always dominated by the full reactivity equilibrium.

4.2 Delegating Authority to the Implementer

In our setting, the decision maker cannot delegate the selection of the project to the implementer, as some project-specific investment has to be made before the hiring of the implementer. This is clearly a specific characteristic of our model. As it turns out, relaxing this assumption does not modify our results, but brings some interesting insights.

We thus consider in this section the case where the implementer has final authority over project selection. However, the decision-maker can still send a (non-binding) message to the implementer indicating the nature of her private information. In such a framework, it is possible to show that two types of equilibria may arise.

First, for all values of parameters, there is the possibility of a "babbling" equilibrium, where the decision maker never speaks the truth about her signal. Given this, the implementer always chooses her preferred project (since $\bar{b}/2 > \underline{b}/2$). It is optimal for the decision maker to send a meaningless message confirming the implementer's bias (to foster his motivation). As it turns out, when the signal is too inaccurate ($\alpha < \bar{b}/(\bar{b}+\underline{b})$), the babbling equilibrium is the only equilibrium.[15] This babbling equilibrium yields the same payoff as a non reactive equilibrium, since the implementer always works on his preferred project, and does not obtain information about the signal.

Second, if the signal becomes sufficiently precise ($\alpha > \bar{b}/(\bar{b}+\underline{b})$), then there can also be a "truthful" equilibrium where the decision maker always sends a message equal to the signal and the implementer believes her. This equilibrium arises exactly when $\beta \in [\beta_1^\star; \beta_2^\star]$, because the conditions of existence of such a truthful equilibrium are formally identical to those of the above "reactive equilibrium".

Overall, this suggests that delegating authority to the implementer has two costs from the shareholder's viewpoint. First, there is *always the possibility* that the organization will be non reactive, whatever the congruence chosen. There is always an equilibrium such that the implementer distrusts the decision maker, and does not have to follow her orders. Second, it may be that, although reactivity would be desirable ($\alpha_0 < \alpha$), it cannot be achieved *at all* because the babbling equilibrium is the unique equilibrium $\alpha < \bar{b}/(\bar{b}+\underline{b})$. This occurs for all values of $[\alpha_0, \bar{b}/(\bar{b}+\underline{b})]$ when this interval is non empty.

Result 6 *Delegation of authority to the implementer reduces the feasibility of reactivity.*

[15]The proof goes as follows: if the decision maker was telling the truth about her signal, the implementer would still choose his preferred project. Indeed, when the signal is not informative enough, the gain from implementing a likely successful, yet disliked, project ($\alpha\underline{b}$) is dominated by the gain of implementing a less successful, yet preferred, project ($\alpha\bar{b}$). Given this behavioral rigidity, the decision maker has strong incentives to confirm the implementer's bias and the message cannot be informative.

4.3 Contracting on wages

Our analysis has shown that organizational design mattered for the quality of decision making, as some level of dissent appeared as an efficient mechanism to make the decision making more sensitive to private information. We have so far neglected the impact of monetary compensation on the decision making process, although monetary rewards are widely used among organizations. This section tackles this issue and looks at the impact of the use of wages on the optimal level of congruence.

We thus enlarge our model to allow for monetary compensation and look for the joint optimal level of compensation and congruence. We assume that success of the project is observable and verifiable, so that contracts can be written contingent on success. As a consequence, the organization's owner should offer a reward to the implementer or the decision maker only when the project is successful, as giving something in case of failure can only be bad for incentives. We also assume that wages cannot be designed contingent on an agent's preferred project and we defer the discussion on complete contracting to the end of this section. Therefore, let's call w the wage of the implementer in case of success of the project, and z that of the decision maker.

Our model is similar to previously except that all private benefit have been translated by an amount z for the decision maker and w for the implementer, i.e. with $\bar{b}' = \bar{b} + w$ and $\underline{b}' = \underline{b} + w$. As a consequence, organization's values are given by [16]:

$$\begin{cases} V(\beta \in [\beta_2^{\star\star}(w,z),1]) = \dfrac{1}{2}\left(\beta F(\dfrac{\bar{b}+w}{2}) + (1-\beta)F(\dfrac{\underline{b}+w}{2})\right)(R-w-z) \\ V(\beta \in [\beta_1^{\star}(w,z),\beta_2^{\star}](w,z)) = \alpha\left(\dfrac{F(\alpha(\bar{b}+w)) + F(\alpha(\underline{b}+w))}{2}\right)(R-w-z) \end{cases}$$

For a non-reactive equilibrium, the optimal compensation structure is easily determined. First, there is no need to give anything to the decision maker as her order will not be informative anyway. Therefore, it should be optimal in such a case to set: $z = 0$. Second, the organization value in such an equilibrium is increasing in β, independently of wages. The optimal level of congruence is still given by $\beta = 1$. Finally, the optimal wage of the implementer should be determined by:

$$\hat{w} = argmax_w \frac{1}{2}F(\frac{\bar{b}+w}{2})(R-w)$$

[16]We have shown that for every range of private benefits, the semi-reactive equilibria were dominated by the reactivity equilibrium. This still holds true with wages.

For a reactive equilibrium, the program the principal has to solve is given by:

$$\left| \begin{array}{l} \max_{w,z,\beta} \alpha \left(\frac{F(\alpha(\bar{b}+w)) + F(\alpha(\underline{b}+w))}{2} \right) (R - w - z) \\ \beta \geq \beta_1^\star(w,z) \\ \beta \leq \beta_2^\star](w,z) \end{array} \right.$$

under the condition that the reactive equilibrium exists, i.e. $\beta_2^* > 0$, or:

$$\alpha F(\alpha(\bar{b}+w))\underline{B} > (1-\alpha)F(\alpha(\underline{b}+w))\bar{B}$$

As we show in appendix 6, the optimal contract provides no extra wage for the decision maker, i.e. $z = 0$. As wages cannot be made contingent on the decision maker's type, it is not possible to moderate her bias with monetary compensation, which should be set equal to 0. The intuition is direct: consider that the optimal wage is such that $z > 0$ and the equilibrium is reactive: then, by decreasing slightly the congruence level and the decision maker's wage, the equilibrium is still reactive but the organization's profit has strictly increased. Therefore, the optimal contract must have $z = 0$.

The wage given to the implementer should only be determined in order to maximize his incentives to effort:

$$\left| \begin{array}{l} w^\star = argmax_w \frac{\alpha}{2} \left(F(\alpha(b \bar{+} w)) + F(\alpha(\underline{b}+w)) \right) (R - w), \\ s.t.\ \alpha F(\alpha(\bar{b}+w))\underline{B} > (1-\alpha)F(\alpha(\underline{b}+w))\bar{B} \end{array} \right.$$

Interestingly, too strong monetary incentives are detrimental to reactivity when the signal is not too informative, as they make the reactive equilibrium disappear: for a high enough w, $(1-\alpha)F(\alpha(\bar{b}+w))\underline{B} > \alpha F(\alpha(\underline{b}+w))\bar{B}$ cannot hold if $\alpha\underline{B} < (1-\alpha)\bar{B}$. The reason is that an agent saturated with monetary payoffs becomes quite insensitive to his own biases and therefore constitutes a weak source of bottom-up governance. Finally, for a range of values of the model's parameters, we can show that: $\beta_2^\star(w^\star, 0) < 1$ and that implementing the reactive organization under monetary incentives dominates.

The optimal organization depends once again on the precision of the decision maker's private information: there is a threshold α_2 above which the reactive organization will dominate. Therefore, the existence of wages still leaves an important role for organizational design: wages contingent on success are useless to moderate the selection process of the decision maker, they are only useful to provide higher incentives to the implementer to exert effort.

A question though remains unanswered in this analysis: if the principal was allowed to use wages contingent on the preferred project of the decision maker and the implementer, would organizational design still be relevant at equilibrium ? The answer is no. With such a complete contracting environment, the principal could always go for a reactive equilibrium as long as he would pay enough the decision maker for a successful project 2 (remember that the decision maker is naturally biased toward project 1). Therefore, in such a framework, dissent may no longer be required at the optimum.

5 Applications

5.1 Bottom-up corporate governance

The first and perhaps most straightforward application of our theory is related to corporate governance. Both practitioners and academics have framed the corporate governance question as a top-down one: how can the board efficiently monitor the CEO? What charter provisions, what incentive package,s can give a CEO appropriate incentives to maximize shareholder value. By contrast, our theory suggests that bottom-up corporate governance, might be an important margin in that debate: on a daily basis, the CEO might be more constrained by his subordinates than board-members. The mechanism underlying this bottom-up pressure might not only be the "whistle-blowing" effect emphasized by the popular press: After all, cases of fraud are the exception and certainly a minor phenomenon in aggregate compared to poor but legal decisions. Our model suggests that the channel of this bottom-up pressure might be the passive resistance of subordinates to orders that they disapprove. Subordinates may disagree with their CEOs and as a result may cut down effort. Such a need to obtain the top executives' agreement acts as a disciplining device on the CEO and prevent him from undertaking very controversial actions. Hence, effective monitoring from disagreeing subordinates may arise from below the CEO, rather than above.

In a companion paper, we provide empirical evidence supporting strong performance effects of internal governance. On a panel of US listed corporations, we define an index of internal governance as the fraction of top ranking executives who joined the firm before the current CEO was appointed. Our identifying assumption is that in most cases, top-executives hired under a CEO's tenure are more likely to be congruent with him either because they were hired by him, either because their loyalty feelings increase their responsiveness to the CEO's orders. First of all, we find this index to be robustly and strongly correlated with various profitability measures (return on assets, on equity, market to book value of assets). Secondly, consistently with the corporate governance role of subordinates, we find managerial slack, as proxied through cash holdings, M&A activity, executive compensation or CEO turnover, to be lower in organizations where executives joined the firm before the CEO was appointed. Also, we find that internal corporate governance is more strongly correlated with performance for firms evolving in uncertain environments, where the information asymmetry between the CEO and the shareholders is likely to be the largest. Third, these findings are not affected when we control for traditional, "external" corporate governance measures (based on board independence or the takeover-related corporate governance index built by Gompers, Ishii and Metrick [2003]).Fourth, consistent with the model, the bottom-up governance performance effect is more pronounced in "opaque" sectors, where the informational advantage of the CEO is likely to be higher.

The normative implication of this application of the model is the following: A crucial role of the board of directors is to design the degree of subordinates' independence from the CEO, rather than to engaging in hyperactive direct monitoring. That implies that the human resource job of the board should not be restricted to CEO succession as is usually the case. Instead the board should be involved in the hiring of the key top-executives. If this decision is left to the CEO, he will unsurprisingly hire subordinates congruent with his own preferences, de facto eliminating the counter power of subordinate dissent. An interesting example of this phenomenon is the testimony of Jean-Marie Messier [1999], former CEO of Vivendi, in an autobiography written in 1999, about three years before the burst of the bubble would lead to his fall by revealing the disastrous burden of expensive acquisitions on the media conglomerate's financial health. Messier was well aware of the role of top-executives as counter-powers : "The danger of my job is isolation: if nobody criticizes you, you end-up doing errors. I want top-executives that affirm their convictions, not people who say "yes" to get a promotion…But it's difficult to keep contestation alive." But a few paragraphs later, he also reveals his taste for alignment when it comes to hire executives: "All the top executives of Vivendi except two have been hired by myself. I chose them because I feel good with them at a personal level. Before nominating them, I check that we share the same vision, the same values".

Not only should the board be involved in recruiting top-executives: an implication of the theory is that it might be optimal to shield some key-executives from being fired by the CEO. For example, having a CFO that could be fired only with consent of the board seems a likely improvement. Indeed, this executive is likely to be the most effective counter-powers to value-destroying acquisitions.

5.2 Public Administration and Ideological Bias

In most western democracies, a main organizational issue in government is the divide of power between elected party politicians and professional state bureaucrats. Elected office holders choose reform goals according to their partisan orientation and their understanding of the political feasibility of reforms, while administrators carry the reforms to reality. If they do not actively cooperate, the reforms will fail.

Our model applies quite literally to this context: When the bureaucrats share the partisan preferences of the current policy-maker, they are more likely to put effort in implementing the attempted reforms. However, a non-partisan bureaucracy might give politicians efficient incentives to adjust policy reforms to the context, even when such reforms go against their political bias. This mitigating effect of bureaucracy on reform choices might be welfare improving, particularly so when fitness to the informational context is valuable. When politicians have inside information on the feasibility or the suitability of reforms, a non-partisan administration will make them more reactive to information going against their bias. For example, a politician prone to reform social security will be more reactive to private signals suggesting the project is quite unpopular if the social security administration is a non-partisan body. When reactivity to information by the politician is of no importance, it is preferable to have an implementer aligned with the decision-maker.

If politicians can choose bureaucrats once elected, they tend to choose people aligned with their own ideological bias. This in turn eliminates the "bottom-up" pressure of the bureaucracy. Therefore our model sheds light on a controversial political topic: To what extent should elected politicians be allowed to fire and hire top-administrators. The efficiency gains from partly shielding bureaucratic careers from political power is stated by Horn [1995], "civil service rules exist to constrain the ability of elected legislators to hire and fire appointed administrators". Such a constraint is valuable to filter decisions from extreme partisan bias and make it more fit to the political demand: "The need to elicit the cooperation of their subordinates creates a strong pressure on Bureau heads to act in a non-partisan way, even when they know their term won't outlast the current administration". The rules establishing employment conditions in the civil service are therefore crucial. The history of the US administration is marked by a concern to that topic. Roughly speaking the US has switched from a "patronage system" where elected politicians could hire, fire, promote "administrators" as their own private employees, to a "merit system" that restricts their ability to interfere with the administrative career process, including compensation (the Pendleton Act of 1883).

A second feature of governmental organization is in line with our model: Using a large survey on European governments, Aberpach,Putnam and Rockman [1981] report a significant preference polarization of politicians vs. bureaucrats. Bureaucrats exhibit a strong ideological conservatism, they "resist to change", while politicians are attracted by more radical reforms. The idea that administrative conservatism acts as a useful constraint on political reformism is explicitly stated by these scholars: " Bureaucratic centrists provide ballast and stability but they cannot provide direction and innovation". " The merit democracy operates like a brake; it discourages excessive swings of the pendulum" (Morstein-Marx). This feature is one of the predictions arising when the reactivity equilibrium is optimal: the choice of a subordinate with "independent" preferences is then optimal.

5.3 Hierarchy and Product Market Uncertainty

The last application of our theory relates to the well documented relationship between firm organizations and their environment. Until the late 1950s, the Tayloristic view was dominant among sociologists of organizations. There was "one best way" to organize the corporation, based on the scientific division of labor: such a carefully planned breakdown of actions into elementary tasks allowed the corporation to reap the gains from specialization, both at the shop floor and in the administration (Taylor [1919], Weber [1968]). Division of labor was also viewed as a key to improve information processing: the goal was to produce some sort of "super rationality" with a team of individually boundedly rational agents (Simon [1957]). Among both academic and practitioners, the ruling wisdom at the time was therefore that all firms could and should be organized along such principles. Organizational improvement only meant deeper and deeper labor division.

This view was challenged in the early 1960s: Looking closely at the British industry, Woodward [1958] first noticed that, in some industries, "pre tayloristic" firms remained prevalent and thriving, and were far from being anachronistic leftovers from pre industrial times. Woodward classified firms into three groups, ranked by their levels of "technical complexity" - a notion that has little to do with technology in the common sense. Firms with high level of "technical complexity" were involved in mass production, continuous process production, or continuous flow production. Firms with low level of "technical complexity" produced single pieces to customers' orders, technically complex units one by one, or pieces in very small batches. The product markets addressed by these firms was therefore very different than the large, standardized, markets of mass producing firms. Such markets were by nature more turbulent and demanded more adaptability from the firm. As a result, Joan Woodward found that firms operating in these unstable markets had in general very non Tayloristic organizations. They had few management levels. Supervisors had a much larger span of control, which meant that their job was much more to coordinate, than to monitor workers. Workers were much more skilled, polyvalent and autonomous.

The Theory of Contingency was born: To be commercially successful, a firm does not have to stick with "classical" (at the time, i.e. Tayloristic) management techniques. The optimal organizational structure depends on the firm's product market and production technology. When uncertainty is high, it is best emphasize worker autonomy and reduce management control. This view was then taken up by other scholars such as Burns and Stalker [1961]. It also served as the keystone of Piore and Sabel's prophecy of a "second industrial divide" [1984]. Because of globalization, technology and the saturation of customers' needs for standardized products, the environment of firms was to become more unstable and uncertain. Once the pride of the post war economy, Tayloristic mammoths such as GM or IBM would not have the flexibility required to cope with increased product market turbulence. As a result, firms had to become smaller, more decentralized and delegate more autonomy to the lowest levels of the hierarchy.

The Tayloristic view left very little room for bottom-up governance: tasks were scientifically assigned to employees and were simple enough to be performed, or not. In the Simonian view, orders received from above were an outcome of the information collected and processed by the "supra-rational" bureaucracy. There was little an isolated, "boundedly rational", individual could hope to add to such knowledge. In contrast, the Theory of Contingency left plenty of space for bottom-up governance: Each customer's order is specific, and workers often know more about the feasibility of each order. As it turns out, the sociological literature has documented that in flexible firms, relations with the hierarchy tends to be more informal, with workers being able to challenge, or at least bend, their boss's orders (see e.g. Piore and Sabel [1984]). This is a reason why Piore and Sabel viewed the move away from Taylorism as a chance for workers' emancipation.

This short literature review suggests that there is a relation between product market uncertainty and the optimal degree of bottom-up governance. To see what our model predicts, we need to amend it to parameterize the degree of uncertainty. In this section, we thus assume away symmetry of the state of nature: State 1 occurs with probability $\theta > 1/2$, and state 2 now occurs with probability $1-\theta < 1/2$. We label state 1 the "statu quo": the larger θ, the lower the uncertainty. In other words, a large θ means that the statu quo decision is on average a better decision than flipping a coin. Furthermore, we make here the technical assumption that $F(x) = x$ (the distribution of effort costs is uniform). As above, the probability that the implementer is biased in favor of the statu quo is β.

The various equilibria (reactive, non-reactive and semi-reactive) should now be analyzed in two different cases: (1) when the decision maker is biased in favor of the statu-quo and (2) when the decision maker is biased in favor of change. The zones of β for which the various equilibria are sustainable are given in the following proposition:

Result 7 *When the decision maker is biased towards the"status quo":*

1. A non reactive equilibrium, where the order is always the "status quo" occurs for all $\beta \in [\beta_2^{**}(\theta); 1]$.

2. A reactive equilibrium, where the order reflects the true signal, occurs for all $\beta \in [\beta_1^*(\theta); \beta_2^*(\theta)]$*, with* $\beta_2^*(\theta) < \beta_2^{**}(\theta)$

When the decision maker is biased towards "change":

1. A non reactive equilibrium, where the order is always the "status quo" occurs for all $\beta \in [b_2^{**}(\theta); 1]$.

2. A reactive equilibrium, where the order reflects the true signal, occurs for all $\beta \in [b_1^*(\theta); b_2^*](\theta)$*, with* $b_2^*(\theta) < b_2^{**}(\theta)$.

When β *is not too low, reactivity is easier to obtain with a pro "change"* *decision maker, i. e.:*

$$\beta_2^{**}(\theta) < b_2^{**}(\theta), \beta_2^*(\theta) < b_2^*(\theta) \text{ and } \beta_1^*(\theta) < b_1^*(\theta)$$

When θ increases, reactivity becomes more difficult to sustain for a given, not too high, β, i.e.:

$$\beta_2^{**}(\theta),\ b_2^{**}(\theta),\ \beta_2^*(\theta),\ b_2^*(\theta),\ \beta_1^*(\theta) \text{ and } b_1^*(\theta) \searrow \theta$$

Consistently with the analysis of section 3, we find that (1) for intermediate values of β, the reactive equilibrium is feasible and (2), for extreme values of β, the non reactive equilibrium is feasible. In between, we have the semi-reactive equilibrium where the decision maker sometimes lies about the signal, and the implementer takes it into account. We omit here the analysis pertaining to very low βs, where the decision maker always follows the decision maker's bias as (1) such organizations are never optimal (similar to section 3.4) and (2) for broad values of parameters, such equilibria are not even feasible. We also omit the analysis of semi reactive equilibria, because (1) it is similar to part 3 and (2) such arrangement are never optimal from the shareholder's perspective.

The novelty of this extension is that, for a given β that is not too low, it is easier to implement reactive organizations with a pro "change" decision maker than with a pro "status quo" one. The intuition for this is obvious: when the decision maker is biased toward change, he is less likely to listen to pro status quo inclined implementers, and more inclined to follow his own bias. As a result, a non reactive equilibrium where the order is always the status quo is less likely to be sustainable. Provided β is not below $b_2^*(\theta)$, a reactive equilibrium is more likely to occur, because the decision maker's aversion for statu quo makes him more credible in ordering it.[17]

We now turn to the organizational design problem. Whatever the decision maker's bias, the value of a reactive organization is given by:

$$\begin{aligned} V^R(\beta,\theta) &= \theta\alpha.\left[\frac{\theta\alpha}{\theta\alpha+(1-\theta).(1-\alpha)}.\left(\beta\bar{b}+(1-\beta)\underline{b}\right)\right] \\ &\quad +(1-\theta).\alpha.\left[\frac{(1-\theta).\alpha}{\theta(1-\alpha)+(1-\theta).\alpha}.\left(\beta\underline{b}+(1-\beta)\bar{b}\right)\right] \end{aligned}$$

which is an increasing function of β, for two reasons. The first one is that, as the status quo is more likely to be the right decision ($\theta > 1/2$), it is natural to hire implementers, who are most motivated when ordered to follow it. .The second

[17] Notice that, for extreme values of θ (close to one), all the boundaries are shifted to the left and the reactive and semi reactive zones disappear ($\beta_2^{**}(\theta) < 0$). So there exists $\overline{\theta} < 1$ such that, for all βs, the only feasible equilibrium is non-reactive. This comes from the fact that the statu quo is then the optimal decision with near certainty: the decision maker then does not care any more about the implementer's preferences or understanding of her orders.

reason is less robust and related to our assumption on the concavity of F: In the reactive equilibrium, the order is meaningful, and therefore allows implementers to reinforce their beliefs in the state of nature. This effect is larger when the status quo is optimal, so that, to benefit from it, it is best to have status quo prone implementers.[18]

As we have seen above, reactivity can be sustained for higher levels of β when the DM is pro change. As V^R is an increasing function of β, the optimal reactive organization therefore sets $\beta = b_2^{**}(\theta)$ with a pro change DM.

The value of non reactive organizations are given, depending on the DM's bias:

$$V^{NR}(\beta,\theta) = \begin{cases} \theta.\left(\beta.F(\theta\bar{b}) + (1-\beta).F(\theta\underline{b})\right) & \text{if DM pro "status quo"} \\ (1-\theta).(\beta.F((1-\theta).\underline{b}) + (1-\beta).F((1-\theta).\bar{b})) & \text{if DM pro "change"} \end{cases}$$

where it is obvious that a pro status quo decision maker, with perfectly aligned implementer ($\beta = 1$) strictly dominates. The intuition is, again, that as the status quo is likely to be the optimal decision, it is best to hire implementers who like it.

The stage is set to compare the values of a reactive and non reactive organizations. After some manipulation (see appendix), we find that:

Result 8 *1. The optimal non-reactive organizations is monolithic. It has (1) a "status quo" biased decision maker, and (2) fully "status quo" biased implementers ($\beta = 1$).*

2. .The optimal reactive organization has (1) a pro "change" decision maker, and (2) moderately "status quo" biased implementers ($\beta = b_2^{**}(\theta)$).

3. The net advantage of reactive organizations, $V^R(b_2^{**}(\theta),\theta) - V^{NR}(1,\theta)$, increases as θ decreases to $1/2$. Non reactive organizations are always optimal in the neighborhood of $\theta = 1$. Reactive organizations are optimal in the neighborhood of $\theta = 1/2$ as soon as $\alpha > \sqrt{\bar{b}/\left[2.(\underline{b}+\bar{b})\right]}$

Hence, our model predicts that firms operating in high uncertainty environment (θ close to $1/2$) tend to have (1) a pro change decision maker, and (2) high levels of dissent. Firms operating in relatively safe environments (θ closer to 1) have pro statu quo decision makers and implementers, and very low levels of dissent. Point 2 in the above set of results relates to some pieces of the informal management literature, which argues that it is best to hire an outsider management to implement change. An outsider is less likely to share exactly the same view as her subordinates. Our model suggests that this is good as it allows the two parties to communicate more effectively.

[18]This effect would be reversed were F concave.

6 Conclusion

This paper has shown that there is a non-trivial role for organizational design in decision making. Because decision makers must internalize the enthusiasm of the implementers, dissent measured as the congruence of preferences may act as a moderating device in her selection process. This moderating mechanism is different from whistle-blowing or explicit opposition: the mere presence of a potentially dissenting implementer forces the decision maker to pay more attention to objective signals on the profitability of the project.

As we view it, the mechanism exposed in this paper is very general and has many implications on every-day organizations. In the corporate governance area, we showed in a companion paper that dissenting executives can (1) increase overall profit and (2) increase the quality of strategic decisions such as takeovers. This has important normative implications for the role of boards of directors. But optimal dissent can also serve as an interesting frame to understand the long standing debate on the divide of power between elected party politicians and professional state bureaucrats.

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Optimal Wages

Write the program:

$$\max_{\beta,w,z} \alpha \left(\frac{F(\alpha(\bar{b}+w)) + F(\alpha(\underline{b}+w))}{2} \right) (R-z-w) + \lambda\left(\beta - \beta_1^\star(w,z)\right) + \mu(\beta_2^\star - \beta)$$

Take the derivative in β: $\lambda = \mu$ Then: Assume one of the constraint is binding, then both constraint are binding as $\lambda = \mu$.

Therefore: $\beta_1^\star(w,z) = \beta_2^\star(w,z))$. This implies that $\alpha = (1-\alpha)$ (take the expression and compute) which is not possible ($\alpha > 1/2$).

Thus, none of the constraint is binding: $\lambda = \mu = 0$. Thus, trivially, $z = 0$.

And finally:

$$w^\star = argmax_w \frac{\alpha}{2} \left(F(\alpha(b \bar{+} w)) + F(\alpha(\underline{b}+w)) \right) (R-w)$$

Note that most of the time, β is strictly interior to $[0,1]$.

A Net Gains of Reactive Organizations

The net gain of a reactive organization is given by:

$$\Delta(\theta) = V^R(\theta, b_2^{**}(\theta)) - V^R(\theta)$$

where:

$$\begin{aligned} V^R(\theta,\beta) &= \theta\alpha. \left[\frac{\theta\alpha}{\theta\alpha + (1-\theta).(1-\alpha)}.\left(\beta\bar{b} + (1-\beta)\underline{b}\right)\right] \\ &\quad +(1-\theta).\alpha.\left[\frac{(1-\theta).\alpha}{\theta(1-\alpha)+(1-\theta).\alpha}.\left(\beta\underline{b} + (1-\beta)\bar{b}\right)\right] \end{aligned}$$

and:

$$V^R(\theta) = \theta^2.\bar{b}$$

The marginal effect of an increase in θ writes:

$$\frac{d\Delta}{d\theta} = \underbrace{\frac{\partial V}{\partial \beta}}_{>0}.\underbrace{\frac{db_2^{**}}{d\theta}}_{<0} + \underbrace{\frac{\partial}{\partial\theta}\left(V^R - V^{NR}\right)}_{<0}$$

The negativity of the first term is obvious. We show the negativity of the second term: We note:

$$\begin{aligned} f(\theta) &= \theta\alpha.\frac{\theta\alpha}{\theta\alpha + (1-\theta).(1-\alpha)} \\ &= -\frac{\alpha^2(1-\alpha)}{(2\alpha-1)^2} + \frac{\alpha^2}{(2\alpha-1)}.\theta + \frac{\alpha^2.(1-\alpha)^2}{(2\alpha-1)^3}.\frac{1}{\theta + \frac{1-\alpha}{2\alpha-1}} \end{aligned}$$

so that the gain of reactivity rewrites:

$$\begin{aligned} G(\beta,\theta) &= \frac{\partial}{\partial\theta}\left(V^R - V^{NR}\right) \\ &= \left(\beta\bar{b} + (1-\beta)\underline{b}\right).f'(\theta) - \left(\beta\underline{b} + (1-\beta)\bar{b}\right).f'(1-\theta) - 2\theta.\bar{b} \end{aligned}$$

where β is considered fixed. As it turns out:

$$\frac{\partial^2 G}{\partial\theta^2} = \left(\beta\bar{b} + (1-\beta)\underline{b}\right).f'''(\theta) - \left(\beta\underline{b} + (1-\beta)\bar{b}\right).f'''(1-\theta)$$

however, $f''' > 0$, and $\theta > 1/2$. As a result, this second derivative is positive. Thus, $\partial G/\partial\theta$ is an increasing function of θ. And:

$$\frac{\partial G}{\partial\theta}(\beta,1) = 16\alpha^2.(1-\alpha)^2.(\bar{b}+\underline{b}) - 2\bar{b} < -\bar{b} + \underline{b} < 0$$

thus, $\partial G/\partial\theta$ is negative, and G is decreasing. But:

$$G\left(\beta,\frac{1}{2}\right) = 2\beta.\left(\bar{b}-\underline{b}\right)\alpha^2.(3-2\alpha) - \bar{b} < -\underline{b} < 0$$

so $G < 0$ for all $\theta > 1/2$. ■

B Figures

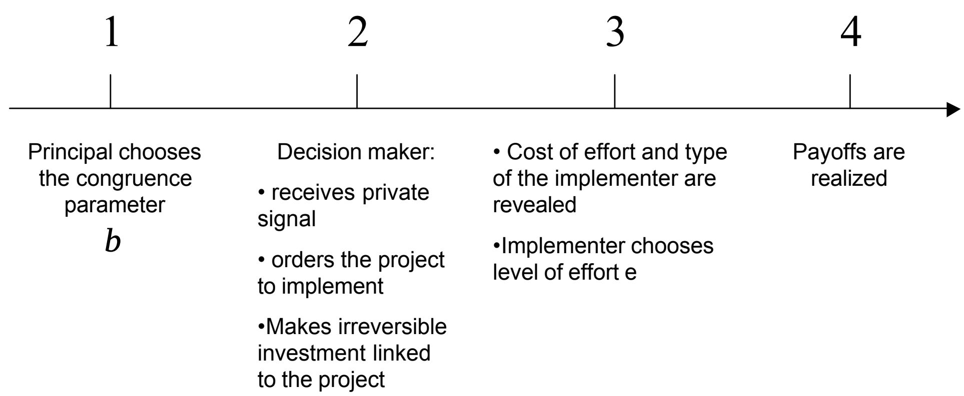

Figure 1: Timing of the model

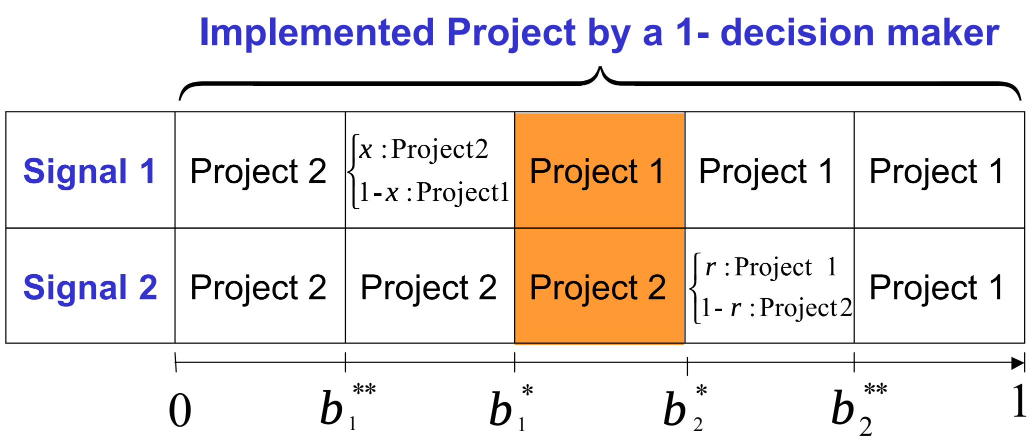

Figure 2: Implemented Project of a 1 Decision Maker according to the Signal