OPTIMAL DISSENT IN ORGANIZATIONS[*]

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Abstract

This paper models the costs and benefits of "passive resistance" in the chain of command. An organization consists of two employees: an informed decision maker in charge of selecting projects and an uninformed implementer in charge of their execution. Both have intrinsic preferences over projects. We show that some conflict in those preferences may be useful to (1) foster the use of information in decision making and (2) give credibility to the decision maker's choices. On the other hand, dissent can induce some "paralysis" in the chain of command. The decision maker's informational advantage increases the value of dissent. We solve for the optimal organization and consider three applications: (1) the role of outside directors in corporate governance, (2) the optimal degree of bureaucratic independence from political power and (3) the relation between product market uncertainty and corporate organization.

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1 Introduction

In organizations, a key function 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. Other times, they do not believe their boss is giving the right order. Such reluctance to implement orders may not manifest as an open conflict, but rather as a lack of enthusiasm or effort. 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 decision maker's choices. That there is an optimal level of dissent in organizations is more than just a theoretical speculation; it has, we argue, important practical implications, ranging from the political independence of government agencies to the current debate on corporate governance.

This paper is 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 economic literature. The novel intuition brought by our analysis is that the net effect of these conflicts may be an improvement in efficiency. The large body of literature on incentives in organizations generally takes it as a given that members of organizations would prefer to shirk or pursue pet projects rather than strive for the common good. This moral hazard constraint needs to 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 shirking (see, e.g., Calvo and Wellisz [1979]). 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], Marino, Matsusaka and Zabojnik [2006]). Other papers have searched for devices reducing such divergence in preferences (e.g., definition of a narrow strategy, as in Rotemberg and Saloner [1994], or of a clear managerial vision, as in Van Den Steen [2004]). However, this literature shares the view that disagreement is, almost by definition, harmful to organizations.

The role of dissent changes, however, once we start to acknowledge in organizations the division of labor among (1) those who make decisions and (2) those who have to implement them. Implementers may question decisions taken by managers; managers anticipate this and factor it into their choices. Thus, dissent acts as a disciplining device for managers and compels them to be less self-serving in their choice of projects, i.e., base decisions on objective information rather than pandering to their own preferences. Instead of leading to uninformative babbling, dissent helps to make the decision maker's orders credibly more objective. More credible orders, in turn, raise more effort from the employees implementing them.

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 (e.g. she goes to meetings, conferences, and 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 this set-up is that the Decision Maker has to anticipate the effort of the Implementer. 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 become less likely. Second, the Implementer is uncertain about what has driven the Decision Maker's choice: he ignores whether she selected a project because she was informed of its superior prospects or simply because of a personal preference. The Implementer therefore questions the choice's *legitimacy* and provides more effort the more he believes that the Decision Maker makes an informed decision rather than a self-serving one.

Dissent enhances the legitimacy of the decision maker's orders. Indeed, when the Implementer has different preferences, the Decision Maker becomes more inclined to pander to his preferences and less inclined to follow her own bias. As a result, dissent may prevent, in some cases, bad decisions from being taken and increases the credibility of orders.

The overall effect of dissent on incentives is, however, ambiguous. On the one hand, as the Decision Maker's orders are less biased, the chosen project is more likely to succeed, which leads the Implementer to put in more effort. On the other hand, dissent implies that the Decision Maker will sometimes have to select a project that the Implementer dislikes, so that he will put in low effort: 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.

In our model, dissent improves the ability to communicate, in contrast to Dessein's [2002] result. In his cheap-talk set-up, low congruence between a principal and her agent can compromise informative communication as both parties have too much incentive to lie. In Dessein's 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 have the same function: eliciting information on a project's prospects. In our model, the function of the agent is to implement ex post. When this ex post moral hazard constraint is relaxed with a more congruent agent, the decision maker becomes more prone to choose projects based on her own tastes rather than information and therefore becomes *less* credible. Our result is closer to Dewatripont and Tirole's [2005] model of communication. In their paper, a sender conveys a message and a receiver implements; both make effort at communicating. When both parties have similar preferences, they free ride on each other's communication effort, so that com-

munication may break down. This result, though similar to ours, emerges for very different reasons. While Dewatripont and Tirole focus on free riding in communication investments, we focus on the legitimacy of the project's choice, i.e., the perception by the Implementer of the order's true motivation–information vs. personal preferences.

In our model, dissent prevents talk from being totally cheap because the Decision Maker needs to elicit the Implementer's support. Our paper thus endogenizes the ability of the Decision Maker to talk credibly. In signaling models (e.g. Hermalin [1997] in the organization literature and Cukierman and Tomasi [1998] in political economy) and in the political economy, 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 shown to be easier when dissent is large. Prendergast [1993] shows that employees tend to conform to the opinion of their boss rather than expressing informative but potentially career damaging information. In our model, employees do not "resist" by explicitly challenging the choices of their boss but by providing little effort in implementing projects. The possibility for such "passive resistance" results from the implementation role of employees.

The insight that decision makers need to internalize the preferences of Implementers is well recognized in the practitioner management literature. Arguably, it is one of the key messages of Alfred Sloan's (1963) autobiography, "My Years with General Motors". In chapter 5, Sloan relates the story of the "copper-cooled engine," a project that raised the enthusiasm of GM's managers but failed to raise the support of the line-engineers in charge of implementing it. Their lack of motivation in implementing the innovation resulted in failure, at a very large cost for the company. Sloan quotes his own analysis of the situation in 1923, at the core of the crisis: "We feel that [...] forcing the divisions to take something they do not believe in [...] is not getting us anywhere. We have tried that and we have failed." The importance of implementers as a constraint to decision makers is much less recognized in the theory of organizations literature. One exception is Marino, Matsusaka and Zabojnik [2006], who explore the motive for delegation arising from the possibility that agents disobey orders. Through this disobedience channel, they relate the optimality of delegation to the quality of outside options of the agents on the labor market. A second exception is Blanes, Vidal and Möller's [2005] modeling approach. Though not directly interested in dissent, as we are, they explicitly account for the division of labor between giving orders and implementing them. As a result, the "implementation constraint" that the implementer imposes on the decision maker is also present in their model. They use this insight to study the effect of information sharing in the firm. They find that Decision Makers tend to rely too much on hard (yet inaccurate) information, instead of their own soft (but precise) information in order to loosen the

implementation constraint. This negative effect can be mitigated if the Decision Maker over-relies on soft information because, for instance, she is overconfident.

Finally, we discuss three applications of our theory. We first apply our analysis to the current debate on "corporate governance." This debate has, so far, mainly focused on the role of boards of directors in improving corporate decision making. Yet, financial economists have found very little empirical evidence that directors affect firm behavior. Our analysis suggests that dissent in the chain of command, i.e., *below* the firm's CEO, could be an effective way 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 more profitable acquisitions. These results are not a structural test of our theory [1], but they appear to be in accordance with the model's analysis.

As second application of our paper 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 political power (see, for instance, Horn [1995]). This recommendation is consistent with our model, where the politicians (the Decision Maker of our model) 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 theory suggests that when social demand is critical (e.g., field knowledge about the acceptance of reform), a neutral bureaucracy helps eliciting less biased reforms from the politicians. When politicians have low informational advantage over the bureaucracy (e.g., whether a terrorist attack is likely in the near future), then it is best for incentive purposes to politicize the agency.

Finally, we look at the effect of uncertainty in our model. This comparative static is motivated by the large managerial literature insisting on the vital need to organize firms for change. We investigate how the optimal strategy of a firm relates to the turbulence of its environment and whether change should come from the top or the bottom of the hierarchy. We do so by looking at an extension where one decision (the "status quo") is more likely to be the right one than the other ("change"). On the one hand, when firms operate in a low-uncertainty environment, the optimal organization is monolithic: it should not be reactive and should feature both pro- "status quo" Implementer and Decision Maker. On the other hand, when there is a certain degree of uncertainty as to when the "status quo" is the right decision, the optimal organization should be reactive. Moreover, the optimal way to implement reactivity is to have a pro-change Decision Maker in charge of giving orders to pro-"status quo" Implementers. Hence, our model

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[1]Another interpretation of our empirical results 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.

suggests a "fresh blood at the top" policy in turbulent environments. In such a context, a large rate of externally hired CEOs is optimal. When needed, these external hires can credibly impose change to status quo-biased implementers.

The remainder of the paper is organized as follows. Section 2 exposes the set-up of the model and discusses its different assumptions. Section 3 first explores the various equilibria of the decision making game and then turns to the question of optimal organization design. Section 4 highlights our key assumptions by doing various robustness checks on our hypotheses. Section 5 explores three applications of our theory in corporate governance, bureaucratic organization and product market turbulences. Section 6 concludes with leads for further research.

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 (she) and an Implementer (he). The Decision Maker selects a project and the Implementer implements it.

Project Structure

There are two projects, labeled 1 and 2.[2] 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 a profit R. The Implementer has to choose an implementation effort e, which is assumed to be unobservable and discrete: $e \in \{0, 1\}$. Exerting high effort (i.e., $e = 1$) 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.

We make the extreme assumption that project selection and the Implementer's effort are perfect complements: 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). This is done to clarify exposition without loss of generality so long as project selection and implementation 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

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[2]Our qualitative results do not depend on the number of possible projects. Anticipating our results below, we remark that, if there were more than 2 possible projects, it would still be the case that the Implementer and the Decision Maker may have dissenting preferences on the project's set. This discrepancy would still compel the Decision Maker to assign a smaller weight to her own preferences and more weight to objective information. Thus, dissent would still foster organizational reactivity.

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 (as in Aghion and Tirole [1997]). Thus, the Decision Maker and Implementer derive utility only from private benefits attached to the successful completion of a project. Discussion on monetary incentives is deferred 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 at all. 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.

Finally, we define a congruence parameter β as the ex ante probability that both Decision Maker and Implementer share the same preferred project. We interpret β as a measure of the organization homogeneity (or congruence of tastes). Organizational design by the organization's owner boils down to the choice of β. Throughout the paper, we assume that the Decision Maker doesn't know the Implementer's preferred project but only his congruence parameter β when she gives the order. This assumption is also made to clarify the exposition of the model and is by no means necessary for our results.

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, defined as the probability that the Implementer will prefer project 1, as the Decision Maker. β then becomes public information.

2. **Decision making**: The Decision Maker receives her private signal σ, with precision α, about the state of nature. She then selects a project. This

choice is assumed to be irreversible.[3] At the time of project selection, the Decision Maker knows β but 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 and private benefits are then equal to 0).

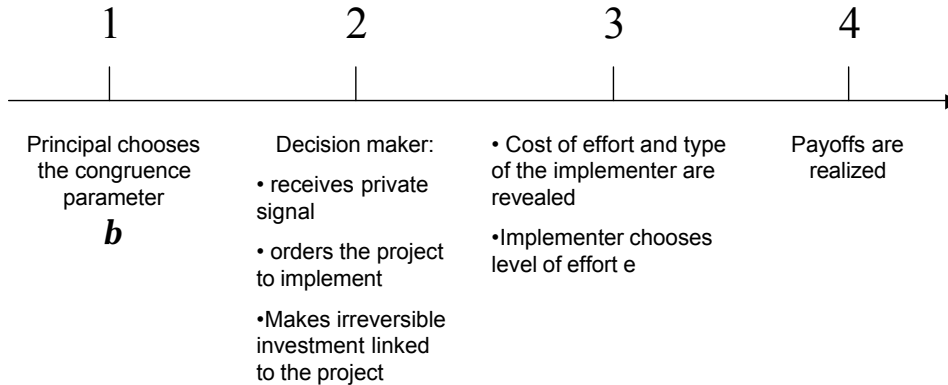The corresponding time line is drawn in Figure 1.

1	2	3	4
Principal chooses the congruence parameter **b**	Decision maker: • receives private signal • orders the project to implement •Makes irreversible investment linked to the project	• Cost of effort and type of the implementer are revealed •Implementer chooses level of effort e	Payoffs are realized

Figure 1: Timing of the model

2.2 Equilibrium Concept

An equilibrium of this game consists of two strategies. First, the *decision rule* for the Decision Maker, which maps signals into project choices; it captures the extent to which orders really reflect the private information of the Decision Maker. Second, the *Implementer's beliefs* about the informational content of the Decision Maker's choice; the Implementer decides his effort level using these beliefs.

We look for standard perfect Bayesian equilibria of this game, which imposes two natural constraints here. First, given the Implementer's beliefs, the Decision

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[3]Because, for instance, a large project-specific investment needs to be made at this point. This assumption prevents the Implementer from communicating his preferences to the Decision Maker. It can be shown that such communication weakens, but does not destroy, the role of dissent. We come back to this issue at the end of Section 3.3.

Maker's decision rule must be privately optimal for the Decision Maker. Second, given the Decision Maker's decision rule, the Implementer should form his expectations using Bayes' rule. Decision rules and beliefs that satisfy these two constraints define an equilibrium.

3 Organizational Homogeneity Affects Reactivity

We first fix the level of organizational homogeneity β and characterize equilibria. We begin with the Implementer's effort choice (section 3.1), given the Decision Maker's choice of project. We then solve for the Decision Maker's choice. Finally, we move to organizational design (section 3.4), which amounts to finding the level of congruence β that maximizes shareholder profits.

3.1 Implementer's Effort Choice

The Implementer must decide whether or not to exert effort. High effort costs c, but increases the probability of success. When project 1 (resp. 2) has been selected, μ_1 (resp. μ_2) is the Implementer's posterior belief that the real state of nature is 1 (resp 2). μ_i depends on his prior about the Decision Maker's decision rule.

To ease exposition, we only consider here the case where the Decision Maker selects project 1 (project 2's selection results in similar equations). If the Implementer's preferred project is project 1, he will put in high effort when:

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

However, if the Implementer's preferred project is project 2, he is less likely to put in high effort on project 1. Indeed, he only exerts the high level of effort on project 1 when:

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

Given that the Decision Maker has a bias toward 1, ex ante, the Implementer prefers project 1 with probability β. Thus, when the Decision Maker selects project 1, she can anticipate 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 on project 1 is more likely to be exerted when the Implementer (1) believes project 1 is the right course of action and (2) is more likely to prefer project 1 .

3.2 The Decision Maker's Project Choice

We now consider the Decision Maker's problem, conditional on her private signal. In some cases, a separating equilibrium emerges: the Decision Maker always bases her choice on the signal she observes. In these situations, the organization is said to be "reactive", because it uses all the available information. In other cases, the Decision Maker's choice only depends on her own preferences, without taking the signal into account. Such equilibria are said to be "non- reactive."Between these two classes of equilibria emerge "partially reactive" equilibria, where the Decision Maker only partially uses her private information for project choice. This section looks at the influence of the congruence parameter β on the existence of these various equilibria[4].

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 is based on the signal (as the order reveals the signal). We look for conditions for this equilibrium to be sustainable.

In this equilibrium, the Implementer's posterior beliefs are given by:

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

Furthermore, we assume that the Implementer "takes lies at face value": the above beliefs also hold true out of equilibrium (i.e., when the Decision Maker does not select the project indicated by the signal). We focus on such out-of-equilibrium beliefs, as they make it more difficult for the reactive equilibrium to exist (the Decision Maker has a bigger incentive to lie), and therefore give restrictive conditions on the emergence of reactivity. However, this choice does not affect our qualitative results.

These posterior beliefs are indeed rational when the Decision Maker *always* prefers to select the project indicated by the signal. Therefore, two incentive constraints have to be satisfied in this equilibrium. First, when the signal is 2, the Decision Maker must prefer to order 2:

$$\underbrace{\alpha}_{\text{Proba. of state 2}} \cdot \underbrace{\left(\beta F(\alpha \underline{b}) + (1-\beta) F(\alpha \bar{b}) \right)}_{\text{Proba. of effort with order 2}} \cdot \underbrace{B}_{\text{Low Decision Maker benefit}}$$

$$\geq \underbrace{(1-\alpha)}_{\text{Proba. of state 1}} \cdot \underbrace{\left(\beta F(\alpha \bar{b}) + (1-\beta) F(\alpha \underline{b}) \right)}_{\text{Proba. of effort with order 1}} \cdot \underbrace{\bar{B}}_{\text{High Decision Maker benefit}}$$

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[4]There is also the theoretical 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 $\alpha > \frac{1}{2}$

A priori, the Decision Maker's own preferences compel her to order 1 instead of 2 (as $\bar{B} > \underline{B}$). However, when the private signal indicates state of nature 2, project 2 becomes more likely to succeed, which influences her toward project 2 (as $\alpha > 1 - \alpha$). Finally, when β is superior to $1/2$, the Implementer is more likely to prefer 1, and therefore less likely to put in effort when ordered 2. As a result, the Decision Maker is more likely to order 1, the higher is β. Similarly, when $\beta < 1/2$, the Implementer is more likely to put in effort when ordered 2. This gives more incentives to the Decision Maker to select project 2. The Decision Maker always tends to under-react to information that is opposite to her bias, compared to what an unbiased shareholder would desire. indeed, the reaction condition that would determine the choice of the shareholder would be the same as above but with $\underline{B} = \bar{B} = R$, which holds more often.

Thus, the above condition simply states that the Implementer and the Decision Maker should not be too congruent if this "reactive" equilibrium is to hold. This condition is equivalent to:

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

When congruence β is high, the Decision Maker finds it costly not to select project 1, as she anticipates that the Implementer is very likely to prefer this particular project. Such incentive to "pander" to the Implementer's preferences may be too strong to allow the reactive equilibrium to emerge (i.e., when $\beta \geq \beta_2^{\star}$). Note that in some cases, such as when α is large, $\beta_2^{\star} > 1$. When the signal is very informative, the Decision Maker is always ready to overcome her bias as well as the Implementer's, as she knows that stubbornness will very likely lead to failure. With a slight abuse of notation, we write hereafter $\beta_2^* \equiv \min\{1, \beta_2^*\}$.

The second incentive constraint is symmetrical to the first. When the signal indicates project 1, the Decision Maker must choose project 1. This condition is a priori easier to satisfy, since both the signal and the Decision Maker's own intrinsic preferences encourage her to select project 1. However, when β is very low, the Implementer dislikes project 1 so much that he becomes very unlikely to put in high effort. In such cases, the Decision Maker may be tempted to ignore both her signal and her own preferences to pander to the Implementer's tastes. Formally, the second incentive constraint is written 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 the case that $\beta_1^* < 0$. In such cases, this second incentive constraint never binds: a Decision Maker observing signal 1 always orders 1, because the "pandering" effect is too small, whether because the signal is too precise or because the Implementer's preferences (i.e., $\bar{b} - \underline{b}$) are not too extreme. With a slight abuse of notation, we note from now on $\beta_1^* \equiv \max\{0, \beta_1^*\}$. Summing up the results of this section:

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Proposition 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; the other where she always selects project 2. Both these equilibria are characterized by the absence of reactivity to the private signal.

We first consider in detail the equilibrium where the selected project is always project 1. In this case, the order has no informational content, and the Implementer's posterior belief on the state of nature is $\mu_1 = \frac{1}{2}$. Out of equilibrium, if project 2 were selected, we assume that the Implementer would attribute a full informational content to this order (i.e., $\mu_2 = \alpha$).[5]

As above, there are a priori two different incentive 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, if the Decision Maker selects project 1 even when observing signal 2, she also systematically orders project 1 when her signal is 1. Indeed, in this case, her preferred project is even more likely to succeed. Thus, the only relevant incentive constraint is the one stating that the Decision Maker should select project 1 even when receiving private signal 2. It is easy to show that this constraint is satisfied when β is large enough. For low levels of congruence β, the Implementer is more inclined toward project 2, so that he is more likely to put forth little effort when implementing project 1. For this reason, and also because project 2 is more likely to succeed, the Decision Maker prefers to order project 2 and therefore will deviate from the non-reactive equilibrium.

Formally, it is straightforward to show that there exists a threshold $\beta_2^{\star\star}$ above which this "non- reactive" equilibrium exists:[6]

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

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

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[5]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. This assumption has the effect of making the "non-reactive" equilibrium more difficult to sustain. Yet, as for the reactive equilibria, our qualitative results are unaffected by the choice of out-of-equilibrium beliefs.

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

always select project 2, even though she has intrinsic preferences toward project 1. The intuition is the following: As β decreases, the Implementer becomes more likely to exert effort on project 2. When β is very low, 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[7]:

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

Summing up the above results, we have the following proposition:

Proposition 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 analysis suggests 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. The following section shows that, in these intermediate cases, the equilibrium features a partially informative decision: the Decision Maker selects with a positive probability the project indicated by the signal.

Semi-Reactive Equilibria

This section is concerned with the conditions of existence of a mixed Strategy equilibrium where the Decision Maker is allowed to randomize her choice when she observes a signal she dislikes (i.e., signal 2). More precisely, we are interested in an equilibrium where the Decision Maker's strategy is to (1) always select project 1 when her signal is 1 and (2) select project 2 with probability $(1 - \rho)$ and project 1 with probability ρ when the signal is 2. Of course, ρ is endogenous and will be determined by equilibrium conditions. In the terminology defined above, $\rho = 0$ corresponds to a reactive equilibrium and $\rho = 1$ to a non-reactive equilibrium.

In such a "semi-reactive" equilibrium, when order 1 has been given, the Implementer updates his beliefs on the probability that signal 1 was received by the Decision Maker. Ex post, order 1 may have been given either because signal 1 was observed, or because the Decision Maker selected her preferred project. Bayes' rule allows us to derive this ex post belief:

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[7]For some values of the parameters, $\beta_1^{\star\star}$ 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 $\beta_1^{\star\star} \equiv \max\{\beta_1^{\star\star}, 0\}$.

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

Of course, when project 2 is ordered, the only possibility is that the Decision Maker observed signal 2, so that:

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

In our semi-reactive equilibrium, the Decision Maker randomizes her order when the private signal is 2. For such mixed strategies to be sustainable, the Decision Maker has to be indifferent between the two options:

$$\underbrace{\alpha \left(\beta F(\alpha \underline{b}) + (1-\beta)F(\alpha \bar{b}) \right) \underline{B}}_{\substack{\text{Decision Maker expected utility of ordering } 2 \\ \text{with signal } 2}} = \underbrace{(1-\alpha) \left(\beta F(\mu_1(\rho)\bar{b}) + (1-\beta)F(\mu_2(\rho)\underline{b}) \right) \bar{B}}_{\substack{\text{Decision Maker expected utility of ordering } 1 \\ \text{with signal } 2}}$$

(5)

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

It can be easily shown that, for each value of the congruence parameter $\beta \in [\beta_2^\star, \beta_2^{\star\star}]$, equation (5) defines a unique $\rho(\beta) \in [0,1]$. When $\beta = \beta_2^{\star\star}$, $\rho(\beta_2^{\star\star}) = 1$: the Decision Maker never reacts to the signal and the equilibrium is non- reactive, as shown above. When $\beta = \beta_2^\star$, $\rho(\beta_2^\star) = 0$. The Decision Maker always reacts to the signal, and the equilibrium is fully reactive, consistent 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 selects project 2 when the signal indicates 2 and (2) selects project 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 select project 2 when receiving signal 1. We sum up the result of this section if the following proposition:

Proposition 3 *The following semi-reactive equilibria emerge:*
1. When $\beta \in [\beta_1^{\star\star}, \beta_1^\star]$, the Decision Maker always selects project 2 when the signal indicates 2. When the signal is 1, the Decision Maker nevertheless selects project 2 with probability $\lambda(\beta)$ and project 1 with probability $1 - \lambda(\beta)$. λ is decreasing in β. $\lambda(\beta_1^{\star\star}) = 1$ and $\lambda(\beta_1^\star) = 0$.
2. When $\beta \in [\beta_2^\star, \beta_2^{\star\star}]$, the Decision Maker always selects project 1 when the signal indicates 1. When the signal is 2, the Decision Maker nevertheless selects project 1 with probability $\rho(\beta)$ and project 1 with probability $1 - \rho(\beta)$. ρ is increasing in β. $\rho(\beta_2^{\star\star}) = 1$ and $\rho(\beta_2^\star) = 0$.

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Implemented Project by a 1- decision maker

Signal 1	Project 2	$\begin{cases} \boldsymbol{x} : \text{Project2} \\ 1\text{-}\boldsymbol{x} : \text{Project1} \end{cases}$	Project 1	Project 1	Project 1
Signal 2	Project 2	Project 2	Project 2	$\begin{cases} \boldsymbol{r} : \text{Project 1} \\ 1\text{-}\boldsymbol{r} : \text{Project2} \end{cases}$	Project 1

$$0 \qquad \boldsymbol{b}_1^{**} \qquad \boldsymbol{b}_1^{*} \qquad \boldsymbol{b}_2^{*} \qquad \boldsymbol{b}_2^{**} \qquad 1$$
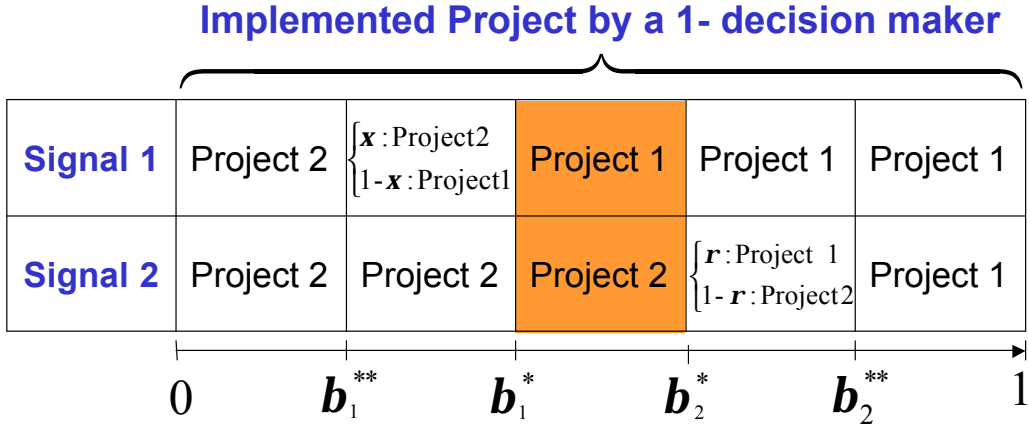
Figure 2: Implemented Project of a 1 Decision Maker according to the Signal

3.3 Summary and Discussion

The results of the above analysis are summarized in Figure 2. For each level of dissent, **there exists a unique perfect Bayesian equilibrium:** For low levels of the congruence parameter β ($\beta \in [0; \beta_1^{\star\star}]$), the Implementer's preferred project is always selected. As β increases, the order progressively entails more and more informational content, as the Decision Maker reveals the signal more often (when $\beta \in [\beta_1^{\star\star}, \beta_1^{\star}]$). For intermediate values of β ($\beta \in [\beta_1^{\star}; \beta_2^{\star}]$), the Decision Maker always selects the project indicated by the signal. Then, when β further increases ($\beta \in [\beta_2^{*}, \beta_2^{\star\star}]$), the Decision Maker sometimes chooses project 1, even though the signal indicates 2. Finally, when $\beta \in [\beta_2^{\star\star}; 1]$, project 1 is always selected, whatever the value of the signal may be.

This suggests that reactivity is easier to obtain for intermediate levels of congruence, while non-reactivity prevails for large or small values of congruence β. Put differently, uncertainty about the Implementer's taste is key to achieving reactivity in our organization. The reason is the following. The Implementer's mere presence in the chain of command strongly limits the Decision Maker's options: because the Decision Maker is the first mover in our setting (she selects the project before the Implementer implements), she must internalize the incentive constraint of the Implementer in her decision process. When congruence is extreme (i.e., β close 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 a project he dislikes. These are the cases where the "implementation" constraint is binding. The Decision Maker caters to her implementer's preferences. Selecting the project according to the signal becomes more valuable for

the Decision Maker when congruence is intermediate: as the probability that the Implementer likes the same project as she does decreases, following her own taste becomes less attractive for the Decision Maker. As a consequence, intermediate congruence ensures that the order is informative.[8]

What happens if the Implementer can reveal his preferences to the Decision Maker before the order is given? Such a possibility was assumed away in the sequence of events described in Section 2.1. This assumption helps reactivity to emerge, but is not key. The intuition is that communication–assuming it is feasible and credible in equilibrium– reduces uncertainty over the Implementer's type and therefore harms reactivity. If the Implementer can communicate his preferences credibly, β suddenly moves to 0 or 1 and the Decision Maker is most tempted to pander to her executive's view. Looking at figure Figure 2, it is easy to see when this is the case. For instance, if $0 > \beta_1^{**}$ and $\beta_2^{**} < 1$, an equilibrium can arise where the Implementer reveals his type and the Decision Maker believes him and panders to his preferences.[9] Such an equilibrium exhibits no reactivity to the signal. This is, however, not the end of the story. First, aside from this "pandering" equilibrium, there is always another equilibrium without communication: the implementer babbles and the Decision Maker does not believe him. In this case, from the Decision Makers' perspective, dissent remains equal to β and, provided $\beta \in [\beta_1^\star; \beta_2^\star]$, reactivity remains. Secondly, when the signal is informative enough and/or biases are small, we have that $\beta_1^* > 0 > 1 > \beta_2^*$. In such cases, the pandering equilibrium disappears altogether, while the reactive equilibrium remains, even though the Implementer is still allowed to declare his type.

3.4 Organizational Design

The above analysis suggests that intermediate levels of congruence foster organizational reactivity. Reactivity, however, comes at a cost, as a partially dissenting Implementer is less likely to put in high effort on average. To study this tradeoff, this section looks for the optimal β from the owner's perspective. For intermediate levels of congruence (i.e., $\beta \in [\beta_1^\star, \beta_2^\star]$), we know that the Decision Maker always reacts to the signal. We can therefore write the expected profit of such an organization as:

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

---

[8]Note that this effect is independent from the "signaling" 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.

[9]It is easy to see why this is an equilibrium. Assuming he is to be believed, it is in the Implementer's interest to be sincere about his type. Otherwise, the project he dislikes will be ordered. On the other hand, the fact that $0 > \beta_1^{**}$ and $\beta_2^{**} < 1$ ensures that, faced with a truthful revelation, the DM always prefers to pander to her executive's declared preferences.

This value does not depend on β[10]. In this organization, the *ex ante* probability that the profitable project will be selected is simply α, as the Decision Maker always chooses the project indicated by the signal. From an *ex ante* perspective, and whatever the level of congruence chosen, the Implementer and the Decision Maker have no systematic bias: they are as likely to prefer project 1 as they are to prefer project 2. Therefore, with probability $1/2$, the implemented project will correspond to the one the Implementer prefers. He thus exerts 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, as, in the reactive equilibria, he knows the Decision Maker has followed her private signal in giving the order.

For very high congruence ($\beta \in [\beta_2^{\star\star}, 1]$), the Decision Maker will always choose her preferred project. The expected profit in such a non-reactive organization is given by:

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

Action 1, the Decision Maker's preferred project, is *ex ante* 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 high effort with probability $F(\underline{b}/2)$ only. In contrast to reactive organizations, the order here never conveys any information. From the implementer's viewpoint, the posterior belief that the ordered project (always 1) is the successful one therefore remains equal to $1/2$.

The value of an non-reactive organization (7) is maximized for perfect congruence between the Decision Maker and the Implementer (i.e., $\beta = 1$). As the organization always implements the same project, it is best to ensure maximal implementation effort in this case.

Thus, the optimal "non-reactive" organization is worth:

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

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 reactive (i.e., high β) case: When β is low, project 2 is always selected, so organization value is maximized when Implementers always put in high effort to implement action 2. This is achieved with hiring totally dissenting Implementers, i.e., $\beta = 0$. In this case, the prior probability of success is $1/2$ times the probability of successful implementation, i.e., $F(\bar{b}/2)$; profit of such an organization is thus also given by equation (8).

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[10]Note that, if α is close to 1, reactivity can be implemented even with a fully congruent Implementer, as $\beta_2^{\star}$ becomes equal to 1.

Semi-reactive organizations are *never* optimal from the owner's perspective. The intuition is the following: Consider, for instance, a value of β for which the Decision Maker does not always select project 2 when the signal indicates 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 intrinsically prefers project 1, this must imply that, for such values of congruence β, the *ex ante* unbiased owner would strictly prefer project 2 to be undertaken. Thus, the shareholder can increase the organization's value by reducing β, which reduces the probability of no reactivity, ρ, and therefore increases the chances that project 2 will be undertaken. Finally, the optimal β in this range is the extreme $\beta = \beta_2^*$, where the probability of no reactivity is zero and the equilibrium becomes fully reactive.[11]

To determine the optimal level of dissent in the organization, the owner thus has to choose between a non-reactive organization (obtained with extreme congruence β equal to 0 or 1) and fully reactive organizations (obtained with any intermediate $\beta \in [\beta_1^\star, \beta_2^\star]$). The net gain of reactivity over non- reactivity((6) - (8)) can be broken down into three terms, highlighting the model's trade-off:

$$\frac{V^R}{V^{NR}} = \underbrace{2\alpha}_{\text{Reactivity gain, } >1} \times \underbrace{\left(\frac{F(\alpha\bar{b}) + F(\alpha\underline{b})}{F(\bar{b}/2) + F(\underline{b}/2)} \right)}_{\text{Credibility gain, } >1} \times \underbrace{\left(\frac{F(\bar{b}/2)/2 + F(\underline{b}/2)/2}{F(\bar{b}/2)} \right)}_{\text{cost of mismatch, } <1} \quad (9)$$

Choosing a fully reactive organization over a non-reactive one implies the following trade-off:

- *Reactivity gain*: This gain corresponds to the first term on the right hand side of (9). Because it is less likely that the Implementer's preferences are aligned, the Decision Maker has less incentive to make a self-serving choice. In her decision making process, she assigns more weight to the signal, and less weight to her own preferences. Therefore, reactive organizations make the right decision more often than non-reactive ones, as they make use of all the available information (and $\alpha > 1/2$). This effect is independent of the signaling aspect of the game, and would also arise if the Decision Maker's signal were public information.

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[11]This intuition can be formally verified by writing down the expected profit of the owner of a mixed reactivity organization:

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

Using the indifference constraint (5), which defines ρ as a function of β, it is straightforward to prove that this value V^{MR} is a decreasing function of β, which yields the announced result.

- *Credibility gain*: The "implementation constraint" detailed above 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 becomes more likely, the Implementer puts in more effort and the overall success probability increases. Thus, the additional gain of intermediate congruence (i.e., of reactivity) is that the Decision Maker's choices gain "legitimacy": the Implementer's motivation increases, as he believes in the impartiality of his boss's decision. This effect is a byproduct of the signaling game, and would disappear if the Decision Maker's signal were not private, but rather public information.

- *Cost of mismatch*: This cost of intermediate β corresponds to the last term of (9). In reactive organizations, the project that the Implementer dislikes will be chosen with probability $1/2$ (since both projects are ex ante as likely). Thus, with probability $1/2$, the selected project will be implemented by an agent disliking this project. In non-reactive organizations, this can never happen, as the Decision Maker always panders to the Implementer's 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). The Implementer's motivation also increases as he expects the selected project to have a higher probability of success. Consequently, the net gain of reactivity V^R/V^{NR} is an increasing function of α. Since reactivity is worthless when the signal is non-informative ($\alpha = 1/2$) and profitable when the signal is fully informative ($\alpha = 1$), we can state the following proposition:

Proposition 4 *Intermediate congruence weakly dominates full congruence when the signal is sufficiently precise. Otherwise, extreme congruence is optimal.*

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

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), we allow the Decision Maker to directly hire the Implementer (i.e., choose β) . Second (section 4.2), we make the allocation of authority between the Implementer and the Decision Maker endogenous. Third (section 4.3), we investigate whether dissent remains useful once we allow the owner to provide monetary incentives to the Decision Maker

4.1 Delegation of Organizational Design to the Decision Maker

In this section, we allow the Decision Maker to hire the Implementer, and assume that she knows her own preferences prior to this hiring decision. This amounts to delegating organizational design (i.e., the choice of congruence β) to the Decision Maker. In this case, would the Decision Maker choose an optimal organization from the owner's perspective? To some extent, the normative implications of our model hinge on the answer to this question, as in cases where the Decision Maker does not choose *ex ante* the optimal congruence level β and it becomes efficient to constrain her hiring decision. In the corporate governance application we will explore later on, this result would suggest cases where the shareholders, instead of the CEO, should hire the new CFO of the company.

The Decision Maker faces the following trade-off: on the one hand, she shares the same goals as the organization's owner. She wants to increase the legitimacy of her order vis à vis the Implementer ("credibility gain" above) and reduce mismatch so as to avoid a unmotivated Implementer ("mismatch cost"). On the other hand, conditional on success, she has intrinsic preferences toward project 1, whereas the owner is indifferent. Therefore, even when the signal indicates project 2, given that this signal is imperfect ($\alpha < 1$), she is more willing to try project 1 than the owner would be. Thus, for a given level of signal precision, the Decision Maker is more willing to design a non-reactive ($\beta = 1$) organization than is the owner.

The above discussion suggests that the Decision Maker and the owner are likely to choose similar organizations when the signal is either very precise or very imprecise. Yet, their choice may differ for intermediate values of α.

The formal analysis confirms this intuition. Consider first the case of a reactive equilibrium (i.e., $\beta \in [\beta_1^\star, \beta_2^\star]$). The Decision Maker's utility is then given by:

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

which is increasing in β. Because she gets higher payoffs when she orders action 1, the Decision Maker prefers Implementers who are more motivated by project 1. The positive effect of increased motivation on action 1 dominates the negative effect of decreased motivation on action 2. These two effects would exactly offset each other from the owner's perspective. As a result, conditional on choosing to be reactive, the Decision Maker prefers the highest possible level of congruence, $\beta = \beta_2^\star$, whereas the owner would be indifferent between all level of congruence β in $[\beta_1^\star, \beta_2^\star]$.

When opting for a non-reactive equilibrium, the Decision Maker anticipates that she will always select project 1. She thus strictly prefers to hire Implementers

also biased towards this project (i.e., $\beta = 1$):

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

Therefore, when the Decision Maker has control over the organizational design, she will decide to hire a non-congruent Implementer (i.e., $\beta = \beta_2^\star$) if and only if[12]:

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

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 as:

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

$$\geq \underbrace{\frac{1}{2}(1 - \beta_2^*)\left[F\left(\frac{\bar{b}}{2}\right) - F\left(\frac{b}{2}\right)\right].\bar{B}}_{\text{mismatch cost from Decision Maker viewpoint}}$$

The Decision Maker thus compares the gains from credible choices (i.e., motivated Implementer) to the costs of potential mismatch (i.e., the possibility that the Implementer dislikes the selected project). The reactivity gain does not appear in this trade-off, as the Decision Maker is *ex post* indifferent between following and not following signal 2. The reason is that, within the set of reactive equilibria, she prefers organizations with the most congruent Implementer possible. In such an organization, she is given signal 2, indifferent between ordering 1 or 2. Put otherwise, she does not value reactivity per se; however, she values the credibility that reactivity brings, because the Implementer will put in more effort at implementing her preferred project. From the Decision Maker's perspective, organizational dissent has the value of a commitment device.

As the gain from credible choices increases with the signal's precision, the Decision Maker will be more willing to hire a dissenting Implementer (i.e., chooses a level of congruence $\beta = \beta_2^*$) for high levels of signal precision. However, as reactivity, per se, is worthless to her, the signal needs to be more precise for her to hire a dissenting Implementer than it needs to be for the owner:

Proposition 5 *There are two thresholds $\frac{1}{2} < \alpha_0 < \bar{\alpha} < 1$ such that:*

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

When the private information of the Decision Maker is precise or noisy (i.e., $\alpha > \overline{\alpha}$ or $\alpha < \alpha_0$), the owner can delegate the task of organizational design to the Decision Maker.

For intermediate levels of precision (i.e., $\alpha_0 < \alpha < \overline{\alpha}$), the Decision Maker prefers to have a perfectly aligned Implementer ($\beta = 1$), whereas the owner would prefer a moderately dissenting Implementer ($\beta \in [\beta_1^\star; \beta_2^\star]$). In this case, efficiency requires organizational design to be a prerogative of the organization's owner.

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 specific to our model. 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 sends a meaningless message to the Implementer. Given this noisy message of the Decision Maker, the Implementer always chooses his preferred project (since $\overline{b}/2 > \underline{b}/2$) or none if $\widetilde{c} > \overline{b}/2$. Given that the Implementer always selects his preferred project, the Decision Maker is indifferent between the messages she may send, and therefore sends a meaningless message. As it turns out, when the signal is too inaccurate (i.e., $\alpha < \frac{\overline{b}}{\overline{b}+\underline{b}}$), this babbling equilibrium is the only equilibrium[13]. This babbling equilibrium yields the same payoff as a non-reactive equilibrium, since the Implementer always selects his preferred project and never obtains information on the true value of the signal.

Second, when the signal becomes sufficiently precise ($\alpha > \overline{b}/(\overline{b} + \underline{b})$), there can also be a "truthful" equilibrium, where the Decision Maker always sends a message equal to the signal she received 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.

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[13]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 ($(1-\alpha).\overline{b}$). Given this behavioral rigidity, the Decision Maker has strong incentives to confirm the Implementer's bias, and the message cannot be informative.

Overall, this suggests that delegating authority to the Implementer has two costs from the owner's viewpoint. First, there is *always* the possibility that the organization will be non-reactive, whatever the level of congruence chosen. There is always an equilibrium such that the Implementer distrusts the Decision Maker, and implements his preferred project. 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 of the cheap talk game (i.e., $\alpha < \bar{b}/(\bar{b} + \underline{b})$). This occurs for all values of signal precision α in $[\alpha_0, \bar{b}/(\bar{b} + \underline{b})]$, provided this interval is non-empty.

Proposition 6 *Delegation of authority to the Implementer reduces the feasibility of reactivity and therefore decreases the expected profits of the organization.*

4.3   Contracting on Wages

Our analysis has shown that organizational design matters for the quality of decision making, as some level of dissent is 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 within organizations. One might be worried that a role for dissent in organization design might disappear once sufficiently complete monetary contracts are allowed. We establish in this section that this is not the case. We show that dissent is still valuable to the organization even when "very complete" contracts are used, i.e., wages that are contingent on success or failure and also on preferences of both the I and the Decision Maker˙Thus, the organization owner still wants to maintain, in some cases, a certain level of dissent within the organization.

The intuition for this result is quite simple: in the presence of limited liability, the incentive constraint from dissent comes "for free," whereas monetary incentives do not. A sketch of the proof (fully written in appendix) goes as follows: It is always the case that for sufficiently high precision of the signal, α, the owner wants to put in place a reactive organization. Then, assume that the optimal organization is such that the Decision Maker gets a strictly positive monetary reward for selecting action 2 and that congruence is perfect, i.e., $\beta = 1$. This clearly then cannot be optimal: the owner would be better off by decreasing both the Decision Maker's wage and the congruence. Indeed, decreasing the congruence allows the incentive constraint of the Decision Maker to be verified with a smaller Decision Maker's compensation. Therefore, this modification of the optimal contract would decrease the wage bill of the organization. Moreover, it would not affect the Implementer's motivation, as costs from mismatch are constant in a fully reactive organization. Therefore, the only fact to establish is the existence of a set of parameters for which (1) reactivity is optimal and (2) the incentive

constraint of the Decision Maker is binding at $\beta = 1$. This is the analysis we make in appendix A. The results are briefly summarized in the following proposition:

Proposition 7 *Assume the organization's owner can write monetary contracts with both the Decision Maker and the Implementer, with payments contingent on success or failure, as well as on their preferences. In this case, there still exists a range of precision level $[\hat{\alpha}_1, \hat{\alpha}_2]$, such that when signal precision belongs to this interval, the owner should hire a strictly dissenting Implementer (i.e., should optimally set $\beta^\star \in]0, 1[$)*

Proof. See appendix A ∎

5 Applications

5.1 Bottom-Up Corporate Governance

A first application of our theory is related to corporate governance. Both practitioners and academics have framed the issue of corporate governance as a top-down problem: How can the board efficiently monitor the CEO of a public corporation? What charter provisions and what incentive packages can give a CEO appropriate incentives to maximize shareholder value? By contrast, our theory suggests that bottom-up corporate governance (i.e., dissent within the executive chain of command) might be an important margin to consider in this debate: on a daily basis, the CEO might be more constrained by his executives (and their willingness to implement his choices) than by board members. The mechanism underlying this bottom-up pressure might not only be the "whistle-blowing" effect emphasized by the popular press.[14] After all, cases of fraud are the exception and certainly a minor phenomenon in the aggregate compared to inefficient, 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. Such a need to elicit the top executives' support acts as a disciplining device on the CEO and prevents her from undertaking controversial actions.

In a companion paper (Landier, Sraer and Thesmar [2005]), we provide empirical evidence supporting strong performance effects of such a bottom-up governance mechanism. From 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 (this is the case where $\alpha \in [\underline{\alpha}, \bar{\alpha}]$ in the model), or due to behavioral reasons such as loyalty feelings.

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[14]For a rigorous formalization, see Friebel and Guriev [2005].

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First of all, we find our index to be robustly and strongly correlated with various profitability measures, such as return on assets, return on equity or market-to-book value of assets. These findings are not affected when we control for traditional, "external" corporate governance measures (based on board independence or takeover defenses). Secondly, it seems that CEOs with "dissenting" executives make better acquisitions: the long-run stock returns of acquiring firms with high levels of dissent are larger than those of homogeneous firms.

This suggests that a crucial role for boards of directors is to design the degree of executives' independence from the CEO, rather than simply engaging in active direct monitoring. Our theory suggests that this design of internal dissent is relevant when the extent of private information at the top of the company (α) is high. From a human resource perspective, efficient boards of directors should not only focus on CEO successions issues, as is traditionally the case, but should also be involved in the hiring decisions of top executives. As shown in Section 4.1, when this decision is left to the CEO, there is an important risk that he will hire executives congruent with his own preferences, de facto eliminating the counter power of executive dissent.

An interesting example of such a phenomenon is the testimony of Jean-Marie Messier [1999], former CEO the French Utility/Telecom/Media Conglomerate Vivendi, written in his [1999] autobiography. This was about three years before the burst of the tech bubble would lead to his fall by revealing the disastrous burden on the firm's financial health of expensive acquisitions. 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 making 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." A few paragraphs later he also reveals his taste for alignment when it comes to hiring 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 instance, making the CFO of a company accountable to the board of directors and not the CEO when private information at the top of the company is high would be a normative prescription of our theory.

5.2   Public Administration and Ideological Bias

In most democracies, a key constitutional issue is the division of power between elected party politicians and professional 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.[15]

Our model applies quite directly to this context: when the bureaucrats share the partisan preferences of the current policy maker, they are more likely to put forth 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 the informational context is relevant. When politicians have private 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 (i.e., a bureaucracy) aligned with the Decision Maker (i.e., the political power).

According to our model, if politicians can choose bureaucrats once elected, they tend to choose too often people aligned with their own ideological bias. This may, in some cases, eliminate 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 to make it more suited to 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" (Horn [1995]). The rules establishing employment conditions in the civil service are therefore crucial. Over the course of the XIXth century, the US bureaucracy evolved to incorporate more and more dissent with elected politicians. Roughly speaking, the US has switched from a "patronage system" where elected politicians could hire, fire, and 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).

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[15]Albeit with a different model, Persson, Roland and Tabellini [1997] apply a similar insight to the study of the balances of powers in western democracies. In their model, dissent between sources of power increases discipline–they have no proper decision making stage. Discipline arises from a mechanism similar to our "implementation constraint."In their model, the parliament and the executive are the two powers. Some decisions require the approval of both powers, but both powers have conflicting interests because they fight over rents. As a result, the rent extraction of each power is kept in check by the other. This is akin to the constraint the Implementer's effort choice imposes on the Decision Maker's order, except that it goes in both direction. But in the end, the result is a mere improvement of discipline, not better decision making.

A second feature of governmental organization is in line with our model: Using a large survey on European governments, Aberbach, Putnam and Rockman [1981] report a significant preference polarization of politicians vs. bureaucrats. Bureaucrats exhibit a strong ideological conservatism–they "resist change"–while politicians are attracted by more radical reforms. The idea that administrative conservatism acts as a useful constraint on the political will to reform 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 [1959]). This feature is one of the predictions arising when the reactivity equilibrium is optimal: the choice of an implementation body with "independent" preferences is then optimal.

5.3 Organizing for Change

Both the recent practitioner-based literature (e.g., Intel's ex-CEO A. Grove [1999]) and the academic management literature (e.g., Utterback [1994], Christensen [1997]) insist on the vital need for companies to organize for innovation and fight inertia. In the face of increased competition and increased volatility (see e.g., Comin and Philippon [2005]), the ability to perform radical innovations and "reinvent" the company is put forth as a crucial purpose of organization design. Scholars such as J. March and C. Argyris warn against a natural tendency of organizations to produce resistance to change. In the trade-off between exploration and exploitation staged in March [2001], such resistance to change can be optimally mitigated by the regular hiring of new members coming from outside the organization. This comes at the cost of lower short-term productivity, as the new hires lack experience. But, should this "injection of fresh blood" occur at the top or at the bottom of the organization?

Our model sheds some new light on this issue. Without assuming that exogenous status quo biases fatally have to arise, we show that in order to implement reactivity within organizations, it is optimal to choose a pro-change decision maker and pro-status quo implementers. There are two main reasons for this result. First, as change is by definition the exception and not the rule, it is valuable for the company to have implementers who "enjoy" the status quo project, which is the most likely choice of the organization (even a reactive one). Second, pro-status quo implementers discipline the bias of the decision maker towards change. If she were not constrained by the resistance of implementers, a pro-change CEO might be tempted to implement change even when it is not optimal. This "change for the sake of change" trap is avoided by the bottom-up pressure of status quo-biased implementers.

Our model therefore suggests that (1) reactivity becomes optimal when instability increases and that (2) reactivity should be implemented through a "fresh blood at the top" policy rather than a "fresh blood at the bottom" policy. This

double result fits quite well with the large increase in the hiring of outside CEOs documented by Murphy and Zabojnik [2003]. They find that the fraction of CEOs hired from outside has almost doubled between the 1970s and the 1990s. This trend is parallel to the rise in volatility faced by firms. For example, Comin and Philippon [2005] establish that idiosyncratic volatility (measured as sales volatility or market leader turnover) has also doubled during that period. The management literature explicitly links the hire of outside CEOs to the need to implement change. Khurana [2002] shows (with a critical message) that the mission assigned to externally hired CEOs is often to be the "corporate saviors" reinventing the company by adapting its strategy to a new market context. Schein [1992] also emphasizes the role of leaders in implementing radical changes against the prevailing corporate culture. In his view, organizational change comes from the top against the will of the bottom layers of the hierarchy, as our model predicts.

To formally derive those results, we need to augment our base model to allow for various degrees of uncertainty in the optimality of projects. In this section, we will thus go back to the model and assume away symmetry of the state of nature: state 1 occurs with probability $\theta > 1/2$ and state 2 will now occur with probability $1-\theta < 1/2$ only. State 1 is the "status quo" situation: a large θ means low uncertainty and a higher probability of success from the status quo decision.

To ease the exposition, we will here assume that the effort cost is distributed according to a uniform distribution, i.e., $F(x) = x$. 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 status quo and (2) when the Decision Maker is biased in favor of change. We look for the optimal Decision Makers̀ preferences and the congruence parameter β with the status quo that are optimal. We show in appendix how the results of section 2 can be generalized to this extension in the model. The crucial insight brought by this generalized proposition is that, for a given level of congruence β that is not too low, reactive organizations are easier to design with a pro-change Decision Maker than with a pro-status quo one. The intuition 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 signal. As a result, a non-reactive equilibrium where the order is always the status quo is less likely to be sustainable.

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

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

which is an increasing function of β. The principal source of this monotonicity is the following: as the status quo is more likely to be the optimal decision

$(\theta > 1/2)$, it is more efficient to hire an Implementer who is intrinsically motivated by implementing the status quo. This effect was not present in our benchmark model where both states were equally likely to be optimal. A second source of the monotonicity is that the effort gain from alignment between the order and the Implementer's preferences is higher for the status quo project[16], simply because the ex post prior for this state is higher. A third effect is absent here because we assumed F is linear. It is a "saturation effect" that counteracts the first two effects. It is dominated as long as F is not too concave or if θ is large enough.[17]

Reactivity can be sustained for higher levels of β when the Decision Maker is pro-change, as her incentive constraint is slacker than for a pro-status quo Decision Maker (the formal proof is in appendix). As the value V^R of a reactive organization is an increasing function of β, the optimal reactive organization therefore sets the highest sustainable β, $\beta = \beta_2^{**}(\theta)$, with a pro-change Decision Maker.

The value of non-reactive organizations depends on the Decision Maker's bias:

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

where it is obvious that a pro-status quo Decision Maker with perfectly aligned Implementer ($\beta = 1$) strictly dominates. The intuition is, again, that when the status quo becomes more likely to be the optimal decision, it becomes more efficient to hire Implementers favoring this status quo project.

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

Proposition 8 *1. The optimal non-reactive organization 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 ($\beta = \beta_2^{**}(\theta)$).

3. The net advantage of reactive organizations, $V^R(\beta_2^{**}(\theta), \theta) - V^{NR}(1, \theta)$, 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 $\alpha > \sqrt{\bar{b}/[2.(\underline{b} + \bar{b})]}$

Hence, our model predicts that firms operating in high-uncertainty environments (θ close to $1/2$) tend to have (1) a pro-change Decision Maker and (2)

---

[16] $\frac{\theta\alpha}{\theta\alpha + (1-\theta)(1-\alpha)} (\bar{b} - \underline{b})$ vs. $\frac{(1-\theta)\alpha}{\theta(1-\alpha) + (1-\theta)\alpha} (\underline{b} - \bar{b})$

[17] F concave means that the returns to private benefits of already enthusiastic Implementers is lower than for non-enthusiastic ones. As a result, increasing congruence has a large negative impact on "unpopular" decisions (unenthusiastic Implementers cut down effort a lot), and a small positive impact on popular decisions (enthusiastic Implementers already give all they can). As a result, congruence may destroy value.

This effect is dominated by the first two as long as F is not too concave or if θ is large enough.

high levels of dissent. Firms operating in relatively safe environments (θ closer to 1) have (1) pro-status quo Decision Makers and Implementers and (2) very low levels of dissent. Result 2 in the above set of results relates to some pieces of the informal management literature that argue that it is best to hire an outsider to implement change. For example, Lou Gerstner (quoted from Khurana [2002], p.65), IBM's retired CEO states in the following terms the rationale for btinging in an outsider to implement change: "You don't seee many examples of internal candidates getting to the top of the system and then laying waste to the existing culture". 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.

6   Conclusion

This paper has shown that dissent may enhance the quality of corporate decision making. Because Decision Makers must internalize the motivation of the Implementers, dissent, measured as the congruence of preferences, may act as a moderating device in the decision making process. This moderating mechanism is different from whistle-blowing or explicit opposition: the mere presence of a potentially dissenting Implementer compels the Decision Maker to paying more attention to objective signals of the profitability of the project. This mechanism is robust: even when monetary contracts can be signed or when authority can be delegated, dissent is always part of the efficient organization.

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

Finally, our theoretical analysis may be extended in several directions. First, we believe that our organizational setting can bring new insight on the understanding of collusion within hierarchies. Indeed, what happens if the Implementer can bribe the Decision Maker into pandering to his own preferences? Second, we have explicitly assumed that Implementers cannot leave a dissenting firm to join an homogeneous one. But obviously, they may prefer to work for a fully congruent manager. An interesting theoretical question that arises in this case is whether dissenting organizations, even though optimal, can persist in a labor market equilibrium.

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A   Contracting on Wages

Consider the following augmented version of our model. The organization's owner is allowed to design contracts contingent on (1) the Decision Maker's preferred project,[18] (2) the Implementer's preferred project and (3) success of the projects. All other informational assumptions made before remain valid, in particular, that, at the time of project choice, the Decision Maker ignores the Implementer's preferred project and simply knows the congruence of their respective preferences.

We note $w_{i,j}$, the Decision Maker's wage when project i is successful and the Implementer happens to prefer project j. We also note $z_{i,j}$, the Implementer's wage when project i is implemented and successful and the Implementer's preferred project is project j.

Finally, we also make the assumption that the distribution function F verifies the decreasing hazard rate property, i.e.:

$$\frac{f}{F}(x) \searrow x$$

When the organization is designed to be reactive, the owner's program can be written as:

$$
\left|
\begin{aligned}
&\max_{w_{i,j}, z_{i,j}, \beta} \left\{ \frac{\alpha}{2} \left(\beta F(\alpha(\bar{b} + z_{11})) \left(R - z_{11} - w_{11} \right) + (1 - \beta) F(\alpha(\underline{b} + z_{12})) \left(R - z_{12} - w_{12} \right) \right) \right. \\
&\qquad\qquad \left. + \frac{\alpha}{2} \left(\beta F(\alpha(\underline{b} + z_{21})) \left(R - z_{21} - w_{21} \right) + (1 - \beta) F(\alpha(\bar{b} + z_{22})) \left(R - z_{22} - w_{22} \right) \right) \right\} \\
&\alpha \left(\beta F(\alpha(\bar{b} + z_{11})) \left(\bar{B} + w_{11} \right) + (1 - \beta) F(\alpha(\bar{B} + z_{12})) \left(\bar{B} + w_{12} \right) \right) \geq (1 - \alpha) \left(\beta F(\alpha(\bar{b} + z_{22})) \left(\underline{B} + w_{22} \right) + (1 - \beta) F(\alpha(\underline{b} + z_{21})) \left(\underline{B} + w_{12} \right) \right) \\
&\alpha \left(\beta F(\alpha(\bar{b} + z_{22})) \left(\underline{B} + w_{22} \right) + (1 - \beta) F(\alpha(\underline{b} + z_{21})) \left(\underline{B} + w_{12} \right) \right) \geq (1 - \alpha) \left(\beta F(\alpha(\bar{b} + z_{11})) \left(\bar{B} + w_{11} \right) + (1 - \beta) F(\alpha(\bar{B} + z_{12})) \left(R - z_{12} - w_{12} \right) \right)
\end{aligned}
\right.
$$

First of all, let us omit the two constraints. Then, the solution of the previous problem clearly features $w_{i,j} = 0$, i.e., there is no need to give any rent to the Decision Maker. Solving for the optimal $z_{i,j}^\star$ is then very easy and independent from the chosen β. Thanks to the decreasing hazard rate property, the problem in $z_{i,j}$ is concave and therefore provides a unique solution given by the first-order conditions. It can directly be seen that $z_{11}^\star = z_{22}^\star = z_a^\star$ and that $z_{12}^\star = z_{21}^\star = z_b^\star$ and that these wages are given by:

$$
\begin{cases}
\alpha f(\alpha(\bar{b} + z_a^\star)) = F(\alpha(\bar{b} + z_a^\star)) \\
\alpha f(\alpha(\underline{b} + z_b^\star)) = F(\alpha(\underline{b} + z_b^\star))
\end{cases}
$$

To ease the proof, without loss of generality, let us switch to the uniform case. We can then rewrite:

$$
\begin{cases}
z_a^\star = \dfrac{R}{2} - \dfrac{\bar{b}}{2} \\
z_b^\star = \dfrac{R}{2} - \dfrac{\underline{b}}{2}
\end{cases}
$$

In this case, the organization profit can be rewritten as:

---

[18]We will look for optimal contracts contingent on a Decision Maker preferring project 1. This is only to ease exposition.

$$\pi^R = \frac{\alpha^2}{2}\left(\frac{R}{2}+\frac{\bar{b}}{2}\right)^2 + \frac{\alpha^2}{2}\left(\frac{R}{2}+\frac{b}{2}\right)^2$$

Note first that this profit is independent of β: because the organization is reactive, mismatch happens half of the time, independently of the chosen level of congruence. Second, note that this (unconstrained) profit is, if feasible, clearly the solution to the owner's problem. To be feasible, we must check that the Decision Maker's incentive constraints are verified. These incentive constraints can be rewritten as:

$$\begin{cases} \beta \leq \dfrac{\alpha\left(\frac{R}{2}+\frac{\bar{b}}{2}\right)\underline{B}-(1-\alpha)\left(\frac{R}{2}+\frac{b}{2}\right)\bar{B}}{\left(\frac{\bar{b}}{2}-\frac{b}{2}\right)(\alpha\underline{B}+(1-\alpha)\bar{B})}=\beta_2^\star \\[4mm] \beta \geq \dfrac{(1-\alpha)\left(\frac{R}{2}+\frac{\bar{b}}{2}\right)\underline{B}-\alpha\left(\frac{R}{2}+\frac{b}{2}\right)\bar{B}}{\left(\frac{\bar{b}}{2}-\frac{b}{2}\right)(\alpha\bar{B}+(1-\alpha)\underline{B})}=\beta_1^\star \end{cases}$$

Therefore, the optimal level of congruence, $\beta^\star$ lies strictly within the interval $]0,1[$ as soon as:

$$\hat{\alpha_2}=\frac{\bar{B}\left(\frac{R}{2}+\frac{b}{2}\right)}{\bar{B}\left(\frac{R}{2}+\frac{b}{2}\right)+\underline{B}\left(\frac{R}{2}+\frac{\bar{b}}{2}\right)} < \alpha < \frac{\bar{B}\left(\frac{R}{2}+\frac{\bar{b}}{2}\right)}{\bar{B}\left(\frac{R}{2}+\frac{\bar{b}}{2}\right)+\underline{B}\left(\frac{R}{2}+\frac{b}{2}\right)}=\hat{\alpha_1}$$

The remaining question is the following: can a reactive organization be optimal for such a level of signal precision α ?

To answer this question, we look at the maximum profit of a non-reactive organization. Such an organization always features a maximum level of congruence ($\beta = 1$). Omitting the incentive constraints of the decision maker in this non-reactive equilibrium, the profit maximizing program can be written as:

$$\max_z \pi^{NR} = \frac{1}{2}F\left(\frac{\bar{b}+z}{2}\right)(R-z)$$

With the uniform distribution function, the optimal profit is directly given by:

$$\pi^{NR} = \frac{1}{4}\left(\frac{R}{2}+\frac{\bar{b}}{2}\right)^2$$

Therefore, the optimal reactive organization with a positive level of dissent always dominates the non-reactive organization when:

$$\alpha^2 > \frac{\frac{1}{2}\left(\frac{R}{2}+\frac{\bar{b}}{2}\right)^2}{\left(\frac{R}{2}+\frac{\bar{b}}{2}\right)^2+\left(\frac{R}{2}+\frac{b}{2}\right)^2}=\hat{\alpha_3}^2$$

Because $\bar{B} > \underline{B}$, a little computation gives:

$$\hat{\alpha_1}^2 > \hat{\alpha_3}$$

Therefore, for all $\alpha \in [\hat{\alpha_3}, \hat{\alpha_1}]$, the optimal organization features an optimal level of dissent, i.e., $\beta^\star < 1$. Thus, complete contracting is not a limit to the use of dissent in organizations. Q.E.D.

B   Net Gains of Reactive Organizations with Uncertainty

Proposition 9 *When the Decision Maker intrinsically prefers the "status quo" project:*

1. A non-reactive equilibrium where the "status quo" is always selected occurs for all $\beta \in [\xi_2^{**}(\theta); 1]$.

2. A reactive equilibrium where the Decision Maker chooses the project indicated by her private signal occurs for all $\beta \in [\xi_1^*(\theta); \xi_2^*(\theta)]$, with $\xi_2^*(\theta) < \xi_2^{**}(\theta)$

When the Decision Maker intrinsically prefers the "change" project:

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

2. A reactive equilibrium where the Decision Maker selects the project indicated by the signal occurs for all $\beta \in [\beta_1^*(\theta), \beta_2^*](\theta)$, with $\beta_2^*(\theta) < \beta_2^{**}(\theta)$.

Provided that β is not "too low," a reactive equilibrium is easier to obtain with a pro-"change" Decision Maker, i.e.:

$$\xi_2^{**}(\theta) < \beta_2^{**}(\theta), \xi_2^*(\theta) < \beta_2^*(\theta) \text{ and } \xi_1^*(\theta) < \beta_1^*(\theta)$$

When θ increases (i.e., uncertainty decreases), reactivity becomes more difficult to sustain for a given level of congruence, β, provided this congruence is not too high, i.e.:

$$\xi_2^{**}(\theta),\ \beta_2^{**}(\theta),\ \xi_2^*(\theta),\ \beta_2^*(\theta),\ \xi_1^*(\theta) \text{ and } \beta_1^*(\theta)\ \searrow\ \theta$$

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, there are semi-reactive equilibria where the Decision Maker only partially reacts to the signal. We omit here the analysis pertaining to very low βs, where the Decision Maker always follows the Implementer's bias, as, for a broad range 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 arrangements are never optimal from the owner's perspective.

The net gain of a reactive organization is given by:

$$\Delta(\theta) = V^R(\theta, \beta_2^{**}(\theta)) - V^R(\theta)$$

where:

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

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

The marginal effect of an increase in θ is written as:

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

The negativity of the first term is obvious. Here, 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 to:

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

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 $\theta > 1/2$. ∎