Optimal Dissent in Organizations*

Augustin Landier†, David Sraer‡ and David Thesmar§

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Abstract

We model an organization as a two agents hierarchy: an informed decision maker in charge of selecting projects and an uninformed "implementer" in charge of their execution. Both have intrinsic preferences over projects. This paper models the costs and benefits of divergence between these preferences, i.e. dissent within the organization. Dissent is useful to (1) foster the use of objective (and sometimes private) information in decision making and (2) give credibility to the decision maker's choices. However, dissent comes at the cost of hurting the intrinsic motivation of "implementers", thereby impairing organizational efficiency. We derive the optimal organizational form in this context and relates it to the quality of information at the organization's disposal.

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†N.Y.U., Stern School of Business, alandier@stern.nyu.edu

‡University of California, Berkeley, sraer@berkeley.edu. Corresponding Author: University of California, Berkeley 549 Evans Hall # 3880 Berkeley, CA 94720-3880. Tel: (510)-809-7775

§H.E.C. School of Management and CEPR, thesmar@hec.fr

"*Workers do, and managers figure out what to do.*"
F. Knight [1921]

1 Introduction

A key role of managers in organizations is decision making. Yet, as pointed out by Knight [1921], a project is rarely implemented by the manager who has selected it. This "separation of implementation and control" is not innocuous for decision making. "Implementers" may have intrinsic distastes over selected projects or may simply not adhere to the manager's vision for the firm. Such "natural" reluctance to carry out selected projects may not manifest as an open conflict, but rather as an under-provision of implementation effort. This paper explores theoretically the existence of such "implementation constraints" and relates them to organizational efficiency.

The insight that decision makers need to internalize Implementers preferences 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."

Surprisingly, this role of "implementers" as a constraint to decision making has not been explored in the theory of organizations. Of course, the idea that managers and their subordinates may have conflicting preferences is certainly not new to the economic literature. An extensive body of research has focused on the role of moral hazard in organizations, analyzing situations where "implementers" have private information about the effort they provide to exert a specific task (Calvo and Wellisz [1979]). Another strand of the literature has dealt with decision making problems in a principal-agent setting where the agent has private information about the "right" decision to make (see Simon [1957] and more recently Aghion and Tirole [1997] or Dessein [2002]). Finally, a last part of the literature has been trying to design mechanisms aiming at directly reducing the divergence in preferences in such decision making situations (by, e.g. defining a narrow strategy, as in Rotemberg and Saloner [1994], or a clear managerial vision, as in Van Den Steen [2004]). Whether studying decision making or task implementing problems, this entire literature shares the view that preference heterogeneity within the principal-agent relationship is, almost by definition, harmful to organizational efficiency: an efficient organization should always be made of "clones" of the principal.

However, preference heterogeneity may prove useful once one starts to acknowledge the "division of labor" among (1) those who make decisions and (2) those who have to implement them. We thus consider an organization consisting of two employees with different functions: a Decision Maker (she) in charge of selecting a project, and an Implementer (he) in charge of its execution. Both individuals have intrinsic and possibly differing preferences over projects. Successful implementation requires that the Implementer exerts costly unobservable effort. Finally, the organization is endowed with some objective information about the "right" strategic decision. The key feature of this set-up is that the Decision Maker has to anticipate the effort the Implementer is willing to provide on each particular project. A dissenting Implementer (i.e. an implementer with intrinsic preferences unrelated to those of the decision maker) is more likely to be reluctant to work on the Decision Maker's preferred project. Anticipating this, the Decision Maker is led to use more of the "objective" information in her decision process and to take less account of her own preferences, which raises the organization's profitability. Thus, from the organization Owner's point of view, lack of congruence imposes an efficient "implementation constraint" that disciplines the decision making process.

This "implementation constraint" has in turn an important consequence on the Implementer's motivation. Because project's success matters for the Implementer, he is willing to provide more effort when the Decision Maker is taking an informed decision and not a self-serving one. A dissenting Implementer – by fostering the use of "objective" information in the decision making process – will thus hold stronger beliefs on the project's probability of success and as a consequence, will spend more effort on the project implementation.

Preferences' divergence along the chain of command comes, however, at a cost. Because dissent foster the use of objective information in decision making, dissent also leads the Decision Maker to select projects that are *intrinsically* disliked by these dissenting Implementers. Therefore, an independent Implementer is more often confronted with projects he does not have intrinsic preferences for, harming his motivation to execute the project. The trade-off we exhibit in this paper is therefore one between (1) more profitable, "objective", projects selected and (2) less intrinsically motivated agents. As we show, when the Decision Maker's private information is sufficiently precise, the optimal organization features dissenting Implementers to provide her with incentives to use this information in her decision process.

In our hierarchical setting, heterogeneity in preferences may therefore be beneficial to the organization, but for different reasons than in "horizontal" structures like committees or parliaments. In such structures, diversity might be desirable, as it allows individual biases to "cancel each others out". In the hierarchical organization we study, heterogeneity of preferences emerges as a natural mechanism to make the "implementation constraint" more binding, which, under certain condition, is beneficial to organizational efficiency. This interaction between decision making and implementation is at the heart of the trade-off we highlight and allows us to derive interesting comparative static properties that could not be obtained in a more "horizontal" model.

Our work is related to some recent literature on organizational design, our main innovation being the study of homogeneity of preferences in a "division of labor" framework. Zabojnik [2002] is the only paper to acknowledge the separation between decision making and implementation, but the organization he considers is composed with only extrinsically motivated agents and his focus is on the role of delegation of authority within the hierarchy. Dessein [2002] presents a model of communication between a principal and her agent in a pure decision making situation. As a result of this "task homogeneity", he obtains that communication is very inefficient, which stands in sharp contrast with our own results. Dewatripont and Tirole [2005] introduce a model of costly communication where homogeneity in preferences may be detrimental to organizational efficiency. While Dewatripont and Tirole focus, as we do, on the link between congruence and decision making, their theory relies on the potential free-riding issues that may appear between the sender and the receiver along the communication process.

One important extension of our model consists in assuming that the "objective" information is privately observed by the Decision Maker. This turns our simple decision making model into a signaling game where the project selected at equilibrium might convey part of the information observed by the Decision Maker. In this context, lack of congruence becomes an efficient way to make project selection *more credible*: because lack of congruence yields a strong "implementation constraint", a dissenting Implementer anticipates that the Decision Maker will use more objective information in her project selection, making it easier for the Decision Maker to credibly convey the information she initially received. This aspect of our model is related to traditional signaling models (e.g. Hermalin [1997] in the organization literature or Cukierman and Tomasi [1998] in political economy) where an informed principal often manages to send credible messages using some "money burning" devices. In our model, the ability to engage in credible message sending relies on the equilibrium organizational form: dissenting Implementers helps the Decision Maker to increase the informational content of her selection process, enhancing in turn her decision's credibility.

We end the paper with a discussion of the role of uncertainty in the model. This comparative static is motivated by the large managerial literature insisting on the vital need to organize firms for change. We investigate how a firm's optimal strategy relates to its environmental turbulence and whether change should come from the top or the bottom of the hierarchy. We do so by deriving an extension of the model where one of the project (the "status quo") is *a priori* more likely to be profitable than the other (the "change" project). In a low-uncertainty environment, we find that firms' optimal organization should be "monolithic", i.e. composed of both pro-"status quo" Implementer and pro-"status quo" Decision Maker. However, as firm-level uncertainty grows, the optimal organization should combine a pro-"status quo" Implementer with a pro-"change" Decision Maker.

The remainder of the paper is organized as follows. Section 2 exposes the most simple set-up of the model, discusses its different assumptions and solve for the equilibrium as well as for the optimal organizational design. Section 3 then extends the basic model by assuming that the Decision Maker has some private information about the "right" course of action. Section 4 then explores the implications of (1) the Decision Maker enjoying real authority over the hiring decisions and (2) letting the Implementer selects the organization he wants to work for. Section 5 explores the impact of product market turbulences on the optimal organizational design. Section 6 concludes with leads for further research.

2 The Costs and Benefits of Dissent: a First Pass

We consider an organization that belongs to an Owner seeking to maximize expected profits. This organization has two employees: a Decision Maker (she) and an Implementer (he). The Decision Maker selects a project to pursue and the Implementer is in charge of implementing it.

Project Structure

There are two projects, labeled 1 and 2. There are also two *equally likely* states of nature θ, also labeled for convenience 1 and 2. Projects either fail, in which case they deliver 0 to the firm's Owner, or succeed and deliver a profit R. We will say that project $i \in 1, 2$ is "adapted" to the state of nature θ when $\theta = i$.

The Decision Maker selects among the two potential projects the one to be completed. Once selected, a project is executed by the Implementer. There is moral hazard at the implementation stage: the Implementer has to choose an implementation effort $e \in \{0, 1\}$, which is assumed to be unobservable. Exerting high effort (i.e. $e = 1$) entails a private, non-transferable, cost $\tilde{c} \in \mathbb{R}^+$ to the Implementer. $\tilde{c}$ is random and is distributed according to a c.d.f. $F(.)$. F is defined on $\mathbb{R}^+$ and is supposed to be *strictly increasing and weakly concave.*[1] Moreover, as F is a c.d.f. function, $F(0) = 0$ and $\lim_{c \to \infty} F(c) = 1$. $F(.)$ is common knowledge within the organization.

We make the extreme assumption that project selection and Implementer's effort are perfect complements: to be successful, the Implementer's effort must be high ($e = 1$) *and* the project must be adapted to the state of nature (i.e. project i must be selected in state of nature $\theta = i$). What is important here is that selection and implementation effort are at least weak complements in the production function (see also Dewatripont and Tirole [2005] for a similar assumption).

Before selecting the project, the organization receives a binary signal $\sigma \in \{1, 2\}$ on the state of nature. This signal is informative in the sense that:

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

We begin the analysis with the assumption that this signal is observed by *both* the Decision Maker and the Implementer. This assumption is then relaxed in Section 3 where the signal becomes private information to the Decision Maker.

Utility Functions and Organizational Design

The Owner is risk-neutral and maximizes expected profit. To simplify exposition, we first assume that monetary incentives cannot be offered, because, for instance, agents are infinitely risk averse on the monetary part of their utility (as in Aghion and Tirole [1997]). Thus, the Decision Maker and the Implementer derive utility only from private benefits attached to the successful completion of a project. Discussion on monetary incentives is deferred to Section 2.2.

More precisely, the Decision Maker obtains private benefit $\overline{B} > 0$ (resp. $\underline{B} > 0$) when her most (resp. least) preferred project is implemented and succeeds (with $\bar{B} > \underline{B} > 0$). When the project fails, *she receives no private benefit at all.* As a simple normalization, and 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 within the organization, it is public information that the Decision Maker prefers project 1.

[1] An alternative modeling choice would consist in assuming that the Implementer exerts a continuous level of effort $e \in \{0, 1\}$, which yields, when the appropriate project has been selected (i.e. project i in state i), a probability of success e at a cost $C(e)$, where $C()$ is a convex, strictly increasing function defined over $[0, 1]$. Both modeling choices are equivalent. In particular, the assumption that F is concave is equivalent to the assumption that $C'''() \geqslant 0$.

The Implementer obtains private benefit $\bar{b}$ (resp. $\underline{b} < \bar{b}$) when his most (resp. least) preferred project is selected and succeeds. In case of project failure, he has no private benefit.

Organizational design is simply the choice between:

1. an *homogeneous* organization where both the Decision Maker and the Implementer prefer project 1

2. an *heterogeneous* organization where they have dissenting preferences, i.e. the Decision Maker prefers project 1 whereas the Implementer prefers project 2.

To ease exposition and limit the potential equilibria of this model, we assume that the Decision Maker's is more intrinsically biased than the Implementer, in the sense that[2]:

$$\frac{\bar{B}}{\underline{B}} \geq \frac{F(\bar{b}/2)}{F(\underline{b}/2)} \tag{1}$$

Sequence of Events and Information Structure

The model has four stages:

1. **Organizational design**: The Owner of the firm selects the organizational form, i.e. either an *homogeneous* or an *heterogeneous* organization.

2. **Decision making**: The Decision Maker and the Implementer observe signal $\sigma \in \{0, 1\}$, with precision α, about the state of nature. The Decision Maker then selects one of the two projects.

3. **Implementation**: The implementation cost $\tilde{c} \in \mathbb{R}_+$ is revealed to the Implementer. He decides whether or not to exert effort on the project selected in stage 2.

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 timeline is drawn in Figure 1.

The relevant equilibrium concept to solve this game is the sub-game perfect Nash equilibrium. We first solve for the Implementer's provision of effort, conditional on the observed signal σ and on the project selected by the Decision Maker. We then find the Decision Maker's expected utility from selecting each of the project, conditional on the signal observed, so that we can derive her decision rule, i.e. the mapping between the received signal and the project selected. We finally turn to organizational design and find the organizational form (homogeneous vs. heterogeneous) that maximizes the Owner's expected utility in stage 1.

[2]Anticipating our result, this assumption simply excludes equilibria where the Implementer is so biased that the Decision Maker is compelled to systematically select his preferred project. Such equilibria are interesting and perfectly consistent with the overall mechanisms that we describe hereafter but they tend to make the exposition more cumbersome.

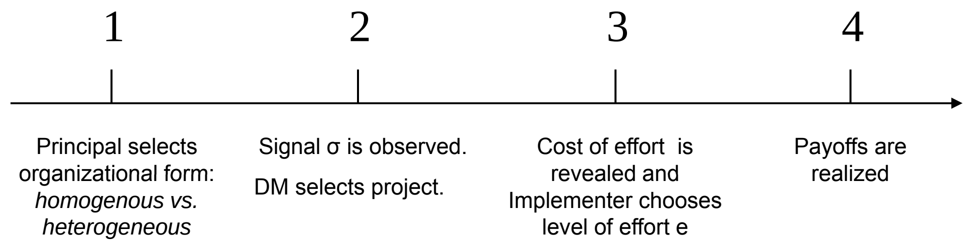

Figure 1: Timing of the model

2.1 Equilibrium Characterization

2.1.1 Main Result

The first step in solving the model is to determine the Implementer's effort. Assume that project $\mathcal{P} \in \{1, 2\}$ has been selected and that the public signal is $\sigma \in \{1, 2\}$. Note $b(\mathcal{P})$ the Implementer's private benefit from project $\mathcal{P}$ success. Because of the model's symmetry, irrespective of whether $\sigma = 1$ or 2, probability of success will be α when $\mathcal{P} = \sigma$ (the Decision Maker then "reacts to the signal"), and $1 - \alpha$ else. Thus, the Implementer provides the high level of effort if and only if:

$$\left(\alpha \mathbb{1}_{\mathcal{P}=\sigma} + (1-\alpha)\, \mathbb{1}_{\mathcal{P}\neq\sigma}\right) b\left(\mathcal{P}\right) - \tilde{c} \geq 0, \tag{2}$$

where $\tilde{c} \in \mathbb{R}_+$ is the Implementer private cost of effort.

At the decision making stage (stage 2), the Decision Maker can thus expect the Implementer to exert the high level of effort with probability:

$$\mathbb{P}[e = 1|\mathcal{P}, \sigma] = F\left(\left(\alpha \mathbb{1}_{\mathcal{P}=\sigma} + (1-\alpha)\, \mathbb{1}_{\mathcal{P}\neq\sigma}\right) b\left(\mathcal{P}\right)\right), \tag{3}$$

where F is $\tilde{c}$'s distribution function. Equation (3) quite intuitively reveals that the Implementer is more likely to exert effort on a project (1) he intrinsically likes and (2) which has a higher probability of success.

We now turn to the decision making process. First, we show that when the signal indicates project 1, the Decision Maker always selects project 1. Consider first the case of an homogeneous organization. If the signal indicates project 1, the Decision Maker selects project 1 if it provides him with a higher expected utility than project 2:

$$\begin{aligned} & \underbrace{\alpha}_{\text{Project 1 proba. of success}} \cdot \underbrace{F(\alpha\bar{b})}_{\text{I effort provision on 1}} \cdot \underbrace{\bar{B}}_{\text{DM private benefits on 1}} \\ \geq \; & \underbrace{(1-\alpha)}_{\text{Project 2 proba. of success}} \cdot \underbrace{F((1-\alpha)\,\underline{b})}_{\text{I effort provision on 2}} \cdot \underbrace{\underline{B}}_{\text{DM private benefits on 2}} \quad , \end{aligned} \tag{4}$$

which always holds since (1) project 1 is then the most likely to succeed and (2) in a homogeneous organization, both the Decision Maker and the Implementer have a strict preference for project 1.

Consider now the case of an heterogeneous organization. On the one hand, project 1 provides the Implementer with the lowest intrinsic motivation. On the other hand, because signal 1 is observed, project 1 is the project most likely to succeed. Additionally, project 1 provides the Decision Maker with the highest intrinsic motivation. Overall, assumption (1) ensures that the former gains from selecting project 1 outweigh the latter loss, i.e. that the following inequality is always verified:

$$\begin{aligned} & \underbrace{\alpha}_{\text{Project 1 proba. of success}} \cdot \underbrace{F(\alpha \underline{b})}_{\text{I effort provision on 1}} \cdot \underbrace{\bar{B}}_{\text{DM private benefits on 1}} \\ \geq \; & \underbrace{(1-\alpha)}_{\text{Project 2 proba. of success}} \cdot \underbrace{F((1-\alpha)\,\bar{b})}_{\text{I effort provision on 2}} \cdot \underbrace{\underline{B}}_{\text{DM private benefits on 2}} \end{aligned} \tag{5}$$

When the signal indicates project 2, the Decision Maker faces conflicting objectives: project 1 is her preferred project but leads to a lower objective probability of success. Consider first the case of an heterogeneous organization. The Decision Maker selects project 2 after observing signal 2 if and only if:

$$\alpha F(\alpha \bar{b})\underline{B} \geq (1-\alpha)\, F((1-\alpha)\,\underline{b})\bar{B} \Leftrightarrow \alpha \geq \alpha^{\text{het}} \in]1/2, 1[, \tag{6}$$

while, in an homogeneous organization, a Decision Maker selects project 2 if and only if:

$$\alpha F(\alpha \underline{b})\underline{B} \geq (1-\alpha)\, F((1-\alpha)\,\bar{b})\bar{B} \Leftrightarrow \alpha \geq \alpha^{\text{hom}} \in]1/2, 1[, \tag{7}$$

It is quite obvious from inequalities (6) and (7) that the Decision Maker's incentive for selecting project 2 after signal 2 is being observed is stronger in an heterogeneous organization, as the Implementer derives higher intrinsic utility from project 2 in this organization. Formally: $1/2 < \alpha^{\text{het}} < \alpha^{\text{hom}} < 1$.

These very intuitive results are summarized in the following proposition:

Proposition 2.1 *There exist α^{het} and α^{hom} such that $1/2 < \alpha^{het} < \alpha^{hom} < 1$ and:*

1. *For $\alpha \leq \alpha^{het}$, both organizations are "non-reactive", i.e the Decision Maker always selects project 1.*

2. *For $\alpha^{het} \leq \alpha \leq \alpha^{hom}$, the homogeneous organization remains "non-reactive", while the heterogeneous organization becomes "reactive", i.e. always selects the project indicated by the signal σ.*

3. *For $\alpha \geq \alpha^{hom}$, both organizations are "reactive".*

Proof See Appendix A.

2.1.2 On the Origin of Reactivity

Heterogeneous organizations are more reactive. In this model, this originates from the fact that a Decision Maker observing signal 2 faces two trade-offs. The first one balances following her bias on the one hand (and thus selecting project 1) with following the Implementer's bias on the other hand (and thus selecting project 2). This effect is present in our simple set-up because there are only two projects: one that the Decision Maker intrinsically likes, and another that the Implementer (possibly) prefers.

However, the higher reactivity of heterogeneous organizations does not depend on the assumption that there are only two projects. This is because the Decision Maker faces another trade-off which balances following her own bias and selecting the right project. Having a dissenting implementer reduce her incentive to follow her own bias and thus lead her to react to the signal more often. This particular trade-off does not depend on the number of potential projects.

To see why, it is useful to think of an extension of the above model with a third project. There are now 3 states of nature, and, for all $i \in \{1, 2, 3\}$, project i can only succeed in the state i. We assume that the signal indicates the true state of nature with probability α, but indicates wrongfully each one of the other 2 projects with probability $(1-\alpha)/2$. α, the signal precision, now goes from $1/3$ (uninformative signal) to 1 (fully informative signal).

The payoffs to the Implementer and Decision Maker are set in the same spirit as in the basic model. We assume, without loss of generality, that the Decision Maker is again intrinsically biased toward project 1: she enjoys private benefit $\overline{B}$ if project 1 is successfully implemented, while success of either project 2 or 3 only provides her with utility $\underline{B} < \overline{B}$. An homogeneous organization is now defined as an organization where the Implementer has intrinsic preferences similar to those of the Decision Maker: he gets $\overline{b}$ when project 1 succeeds but only $\underline{b} < \overline{b}$ when project 2 or 3 succeed. In an heterogeneous organization, the Implementer enjoys the high private benefit $\overline{b}$ only when project 2 is successful, while the other two projects' success only provide him with utility $\underline{b}$.[3] Last, we make an assumption similar to assumption (1) in this three projects context:

$$\frac{\overline{B}}{\underline{B}} > \frac{F(\overline{b}/3)}{F(\underline{b}/3)} \tag{8}$$

The following proposition describes the equilibria for both organizational forms:

Proposition 2.2 *There exists three thresholds α_1, α_2 and α_3, such that $1/3 < \alpha_1 < \alpha_2 < \alpha_3 < 1$ and*

1. *For $1/3 < \alpha < \alpha_1$, both organizations are "non-reactive", i.e. the Decision Maker always selects project 1.*

2. *For $\alpha_1 < \alpha < \alpha_2$, the homogeneous organization is "non-reactive". The heterogeneous organization selects project 1 when $\sigma = 1$ or 3, and selects project 2 when $\sigma = 2$*

3. *For $\alpha_2 < \alpha < \alpha_3$, the homogeneous organization is "non-reactive". The heterogeneous organization is "reactive": the Decision Maker always reacts to the signal.*

[3]The case where the Implementer has intrinsic preferences for project 3 is obviously identical.

4. For $\alpha_3 < \alpha < 1$, both organizations are reactive.

Proof See Appendix B.

Proposition 2.2 proves that the introduction of a third project modifies the scope for reactivity. On the one hand, in both types of organizations, reactivity is enhanced by having an additional project as, to the Decision Maker, the cost of not following the signal is larger: the probability of success when ignoring the signal goes from $(1-\alpha)$ in the 2 projects setting to $(1-\alpha)/2$. On the other hand, when the signal indicates project 3, both the Decision Maker and the Implementer have low intrinsic preferences for this project, and this even in an heterogeneous organization. This reduces the incentive for the Decision Maker to react to project 3, and thus impairs overall reactivity. Thus, a new equilibrium emerges where the Decision Maker reacts only to signal "1" and "2", but not to signal 3. In this equilibrium, reactivity to signal "2" is due to the fact that the Decision Maker avoids to select a project the Implementer dislikes, while non reactivity to signal "3" originates from the low incentives the Decision Maker has to follow a signal that both she and the Implementer dislike.

Nevertheless, in spite of this new equilibrium, this extension still suggests that, even when there are more than two projects, reactivity still emerges more easily in an heterogeneous organization than in an homogeneous one, i.e. $\alpha_3 > \alpha_2$.

2.2 Organizational Design

2.2.1 Main Result

We now turn to organizational design, i.e. the choice of the organizational form that optimizes firm value. To do this, we go back to the basic model of Section 2 with only 2 projects. When $\alpha > \alpha^{\text{hom}}$, both organizations are reactive, so that their expected value are the same:

$$V^{\text{het}} = V^{\text{hom}} = \frac{\alpha}{2}\left[F(\alpha\bar{b}) + F(\alpha\underline{b})\right].R$$

This comes from the model's built-in symmetry: in reactive organizations, both projects can be ex ante selected with probability of 1/2. Thus, the Decision Maker's bias does not affect value[4].

When $\alpha \in [\alpha^{\text{het}}, \alpha^{\text{hom}}]$, the heterogeneous organization is reactive while the homogeneous organization is non-reactive. We can then compute both organizations' expected profit:

$$\begin{aligned} V^{\text{hom}} &= \frac{1}{2}.\left[\alpha F(\alpha\bar{b}) + (1-\alpha).F((1-\alpha).\bar{b})\right].R \\ V^{\text{het}} &= \frac{\alpha}{2}.\left[F(\alpha\bar{b}) + F(\alpha\underline{b})\right].R \end{aligned}$$

In the homogeneous, non-reactive, organization, project 1 is always selected and it is a priori successful with probability $\frac{1}{2}$. However, in these states of nature where project 1 is the successful project, signal 1 will be observed with probability α, leading to an expected probability of high

[4]We break this symmetry in Section 5.

implementation effort $F\left(\alpha\bar{b}\right)$, while signal 2 will be observed with probability $1-\alpha$, leading to a lower expected implementation effort $F\left((1-\alpha).\bar{b}\right)$.

In the heterogeneous reactive organization, project 1 is selected and successful when the signal righteously indicates 1, which happens from an *ex ante* perspective with probability $\frac{\alpha}{2}$. Probability of effort is then $F\left(\alpha\underline{b}\right)$ as the Implementer has intrinsic preferences for project 2. Similarly, project 2 is selected *and* successful with probability $\frac{\alpha}{2}$ and then leads to a probability of effort $F\left(\alpha\bar{b}\right)$.

Overall, for $\alpha \in [\alpha^{\text{het}};\alpha^{\text{hom}}]$, the net benefit of heterogeneity vs. homogeneity can be decomposed into three terms:

$$V^{\text{het}} - V^{\text{hom}} = \underbrace{\left(\alpha - \frac{1}{2}\right).F(\alpha.\bar{b}).R}_{\text{reactivity gain}} + \underbrace{\frac{1}{2}\left(1-\alpha\right).\left[F(\alpha\bar{b}) - F\left((1-\alpha).\bar{b}\right)\right].R}_{\text{credibility gain}} \underbrace{-\frac{\alpha}{2}.\left(F\left(\alpha\bar{b}\right) - F\left(\alpha\underline{b}\right)\right).R}_{\text{cost of mismatch}} \tag{9}$$

The first expression is the "reactivity gain": since the signal is informative ($\alpha > \frac{1}{2}$), there are efficiency gains to using the signal in the decision making process. This reactivity gain is an increasing function of α, the signal's precision. The second term is the "credibility gain": whenever the signal indicates project 2, selecting project 1 results in the implementer's low expectation that project 1 can be successful at all. In other words, in a non-reactive organization, some decisions are perceived by the Implementer as less "legitimate", which leads to a decrease in expected profit. Finally, the third expression relates to the "cost of mismatch". A non-reactive homogeneous organizations always selects the project the Implementer prefers, thus maximizing the Implementer's *intrinsic* motivation. Conversely, an heterogeneous reactive organization selects project 1 with probability $\frac{1}{2}$,"compelling" the Implementer to implement with probability $\frac{1}{2}$ a project he intrinsically dislikes. We show in proposition 2.3 that the overall net benefit of heterogeneity relative to homogeneity is a strictly increasing function of α, the signal precision, and that there exists an interior threshold $\alpha^\star$ such that the heterogeneous reactive organization strictly dominates over $[\alpha^\star, \alpha^{\text{hom}}]$, while the homogeneous organization is optimal over $[\alpha^{het}, \alpha^\star]$.

Finally, when $\alpha < \alpha^{\text{het}}$, both organizations are non-reactive so that their value can be written as:

$$\begin{cases} V^{\text{hom}} = \dfrac{1}{2}.\left[\alpha F(\alpha\bar{b}) + (1-\alpha).F((1-\alpha).\bar{b})\right].R \\ V^{\text{het}} = \dfrac{1}{2}.\left[\alpha F(\alpha\underline{b}) + (1-\alpha).F((1-\alpha).\underline{b})\right].R \end{cases}$$

For these (low) values of α, both organizations always implement the same project (project 1). But, since the Implementer in the heterogeneous organization has low intrinsic motivation for project 1, the homogeneous organization systematically delivers higher expected profit. The following proposition 2.3 summarizes the analysis of this simple model:

Proposition 2.3 *There exists $\alpha^\star \in [\alpha^{het}, \alpha^{hom}]$, such that:*

1. *For $\alpha < \alpha^\star$, the homogeneous, non-reactive, organization is optimal.*

2. *For $\alpha^{hom} > \alpha > \alpha^\star$, the heterogeneous, reactive, organization is optimal.*

3. *For $\alpha \geq \alpha^{hom}$, both organizations yield the same expected profit.*

Proof See Appendix C.

Three "ingredients" crucially hinge behind the proposition 2.3. First, in an organization, decisions are often not purely driven by profit consideration, but also by intrinsic preferences, come they from private benefits or differences in beliefs as in Van den Steen [2005]. Second, an organization is often endowed with at least some objective, valuable information on the relative merits of all potential strategies. Finally, decision making and implementation are often not executed by the same individuals. If one acknowledges these three features of most organizations, then organizational design, i.e. the choice of alignment of intrinsic preferences within the organization, becomes crucial to organizational efficiency. The intuition is simple: dissent (i.e. heterogeneity of preferences) acts as a disciplining device for the Decision Maker. Because she knows the implementer has non-congruent preferences, she is reluctant to select her own pet strategy, lest the Implementer should fail to exert appropriate effort.

The above analysis does not rest on the absence of monetary incentives. Indeed, a possible concern with our basic model is that we did not allow the Owner of the firm to write compensation contracts for the Implementer and the Decision Maker that are contingent on the final outcome. When such contracts can be written, it is probable that the Owner will seek to force the Decision Maker to react, and the implementer to put in high effort. In such a case, one may wonder if organizational design, i.e. the alignment of intrinsic preferences within the organization is still relevant.

We show that this is, in general, the case, provided that the Implementer and the Decision Maker are both subject to limited liable. To prove this point, we reason by contradiction. First, we assume that the owner can design "very complete" monetary contracts: compensation is not only contingent on the outcome, but also on the selected project *and* on the signal received by the Decision Maker. Solving the optimal contracting stage in general is beyond the scope of this paper, but we show in Appendix D that when F is the uniform distribution function, heterogeneity remains the optimal organizational form for a non-zero interval of signal's precision.

The robust intuition behind this result is that heterogeneity delivers reactivity at zero monetary cost. Assume that α is such that the Owner is aiming for a reactive organization. One possibility is to provide the Decision Maker with a reward when she reacts to the signal, and nothing if she does not. This is ex ante costly because negative payments are prevented by limited liability. Alternatively, the Owner can choose an heterogeneous organization. As we have seen above, for some values of α, such organizations are reactive, even when the Decision Maker receives zero monetary payment. In Appendix D, we show formally that, when F is the uniform distribution, there exists a non empty interval of α for which (1) reactivity is profit maximizing (2) the heterogeneous organization is optimal and (3) the optimal compensation of the Decision Maker is zero.

2.3 Reactivity in Large Organizations

This Section focuses on the case of large organizations, and addresses the issue of optimal firm composition. We extend our basic model by assuming that there is a continuum of Implementers of mass 1 and a single Decision Maker. Each Implementer is in charge of one project and derives private benefits from his project's success only. The Decision Maker's utility is the sum of all private benefits derived from all projects' successes. The rest of the model is very similar to the basic model. The Decision Maker can only select one project, i.e. all the Implementers have to work on the same project. Each Implementer draws a private cost of effort $\widetilde{c}_i$ (these draws are i.i.d. from the same distribution F) and then decides, depending on his own private benefits and the objective probability of success, whether to exert high effort or not. Before the order is given, all Implementers and the Decision Maker observe an informative signal of precision α.

In such a large organization, there is a fraction β of Implementers who prefer project 1. The organization is now reactive to signal 2 if and only if:

$$\begin{aligned}&\alpha\underline{B}.\left[\beta.F\left(\alpha\overline{b}\right)+(1-\beta).F\left(\alpha\underline{b}\right)\right]>\\&(1-\alpha)\overline{B}.\left[\beta.F\left((1-\alpha)\underline{b}\right)+(1-\beta).F\left((1-\alpha)\overline{b}\right)\right]\end{aligned} \tag{10}$$

This equation simply guarantees that, when the signal is 2, the Decision Maker is better off when selecting project 2 than following her own bias. Given Assumption (1), it is straightforward to show that the Decision Maker always selects project 1 after observing signal 1. A bit of algebra shows that the above equation (10) is equivalent to $\alpha > A(\beta)$, where A is an increasing function of β. This condition is similar to that of proposition 2.1. In homogeneous organizations, $\beta = 1$, and the firm is reactive only when the signal is sufficiently precise. In organizations where all the Implementers share their intrinsic preference for project 2 (i.e. $\beta = 0$), reactivity emerges for for lower values of α. In between, as the fraction of dissenting Implementers increase (i.e. as β decreases), organizational reactivity increases.

This set-up is formally equivalent to the case where there is a unique Implementer, whose intrinsic preferences are unknown to both the Decision Maker and the Owner. β then stands for the Decision Maker's prior that the Implementer prefers project 1. The extension then suggests that this uncertainty about the Implementer's intrinsic preference does not prevent the organization from being reactive: the Decision Maker still trades-off following both her and the Implementer intrinsic preferences with reacting to the signal σ. Being uncertain about the Implementer's preferences tilts this trade-off toward more reactivity.

The optimal organization choice in this context is analyzed in the following proposition:

Proposition 2.4 *There exist a function $B(\alpha)$ non-decreasing in α such that*

1. *For $\alpha < \alpha^\star$ (where $\alpha^\star$) is defined in proposition 2.3), the optimal organization entails only fully congruent Implementers (i.e. $\beta = 1$) and is not reactive.*

2. *For $\alpha^{hom} > \alpha > \alpha^\star$, the optimal organization is such that $\beta \in [0, B(\alpha)]$ and is reactive.*

3. *For $\alpha \geq \alpha^{hom}$, the organization is reactive for all level of congruence $\beta \in [0, 1]$ and thus deliver the same expected profit irrespective of the level of β.*

Proof See Appendix E.

The above proposition states that the results of proposition 2.3 extend easily to the case of a large organization. In particular, the optimal optimal organization can always be selected among one of the two organizations where all Implementers share the same preferences (i.e. $\beta = 0$ or 1). To foster reactivity, however, it is important that Implementers disagree at least to some extent ($\beta < B(\alpha)$) with the Decision Maker, but this "required" disagreement decreases as the signal becomes more informative.

2.4 Dissent and the Extent of Intrinsic Biases

In this section, we investigate how the choice of the optimal organizational form is affected when either the Decision Maker or the Implementer becomes more "biased", in the sense that $\bar{B} - \underline{B}$ (resp. $\bar{b} - \underline{b}$) increases, holding $\bar{B} + \underline{B}$ (resp. $\bar{b} + \underline{b}$) constant. In other words, we ask if more biased agents makes dissent more, or less, attractive.

First, it is straightforward to show that an increase in $\bar{B} - \underline{B}$ reduces the Decision Maker's incentive to follow the signal, and makes all types of organizations less reactive. An increase in $\bar{b} - \underline{b}$ has a more ambiguous effect. In homogeneous organizations, when the Implementer becomes more biased, the Decision Maker's incentives to react to signal 2 are reduced. In heterogeneous organizations however, the Decision Maker incentive to react to signal 2 are fostered by an increase in the Implementer's bias, as the Implementer's intrinsic motivation on project 2 has increased. These comparative statics on equilibrium reactivity are summarized in the following Lemma.

Lemma 2.5 *An increase in the Decision Maker's intrinsic bias reduces reactivity in both organizational forms: α^{het} and α^{hom} are increasing functions of $\bar{B} - \underline{B}$ holding $\bar{B} + \underline{B}$ constant.*

An increase in the Implementer's intrinsic bias reduces the reactivity of homogeneous organization, while it enhances the reactivity of heterogeneous ones: α^{het} is decreasing in $\bar{b} - \underline{b}$, and α^{hom} is increasing in $\bar{b} - \underline{b}$, holding $\bar{b} + \underline{b}$ constant.

Proof Direct from definitions (6) and (7).

We now turn to the effect of an increase in intrinsic biases on the optimal organizational design. As a result from the above Lemma, it is easy to see that a more biased Decision Maker tends to make homogeneous organizations more attractive. An increase in $\bar{B} - \underline{B}$ reduces the incentive to react to the signal, and thus makes all types of organizations less reactive. We know that, in the absence of reactivity, the homogeneous organization always dominates: since project 1 will always be selected, it is better to have an Implementer that indeed prefers project 1. Thus, when the Decision Maker is more biased, the comparative advantage of homogeneous organizations increases. The Decision Maker's intrinsic bias and dissent (i.e. the choice of the heterogeneous organizational form) are thus substitute from the Owner's perspective.

The impact of an increase in the Implementer's intrinsic bias on the optimal organizational form is ambiguous. On the one hand, as shown in Lemma 2.5, an increase in $\bar{b} - \underline{b}$ foster the emergence of reactivity only in the heterogeneous organization. On the other hand, reactivity *per se* becomes less attractive to the Owner for two reasons. First, when the firm is reactive, an increase in the Implementer's bias increases implementation effort with probability $\frac{1}{2}$, but also reduces it with probability $\frac{1}{2}$. Because F is concave, this reduces the overall probability of high implementation effort of reactive organizations. Second, non reactivity becomes more efficient as the Implementer is always more motivated (his preferred project being always selected). All in all, an increase in the Implementer's bias has an ambiguous impact on the relative gain from heterogeneity: it increases the relative efficiency of non-reactivity, but reduces the reactivity of homogeneous organizations.

Which effect dominates ultimately depends on the curvature of F and the preference parameters. In the case where $F(x) = x$, it is possible to show that as long as:

$$\frac{\overline{B}}{\underline{B}} > \left(\frac{\bar{b}}{\underline{b}}\right)^2 \tag{11}$$

an increase in the Implementer's intrinsic bias $\bar{b} - \underline{b}$ makes the heterogeneous organization more attractive to the Owner[5]. We thus obtain the surprising result that for some parameters, instead of inducing paralysis in the chain of command (i.e. non reactivity and the choice of homogeneity), Implementer intrinsic bias may be a complement to organizational heterogeneity.

3 When the Signal is Private Information

The model of Section 2 assumes perfect information. Thus, the Implementer knows if the Decision Maker has followed the signal or not. However, in many situations, the Decision Maker might have access to private, soft, unverifiable information (by going to meetings, reading confidential memos etc...). When this is the case, it might be less likely that reactivity emerges as the optimal organization response, as the Decision Maker has strong incentives to mis-report her private signal and select her own preferred project. This Section therefore assumes that the signal σ is private information to the Decision Maker and shows how our results carry through in this new context.

3.1 Equilibrium concept

We assume here that the signal σ is not observable to the Implementer, but only to the Decision Maker. Therefore, our model becomes a standard signaling game where the Implementer has to draw inference about the signal σ from the informed Decision Maker's project choice.

An equilibrium is defined by two strategies $(\mathcal{P}, \mu)$. $\mathcal{P}$ is the **Decision Maker's selection process**, i.e. a function that maps the Decision Maker's private signal $\sigma \in \{1, 2\}$ into the project space $\{1, 2\}$:

$$\mathcal{P} : \sigma \in \{1; 2\} \mapsto \{1; 2\}$$

$\mu()$ is the **Implementer's posterior belief**, i.e. a function that maps the project selected by the Decision Maker into a probability that 1 is the state of nature:

$$\mu : \mathcal{P} \in \{1; 2\} \mapsto \mathbb{P}(\theta = 1|\mathcal{P}) \in [0, 1]$$

A perfect Bayesian equilibrium of the game is a couple $(\mathcal{P}, \mu)$ that verifies:

[5] Intuitively, when condition (11) is satisfied, $\alpha^\star = \alpha^{\text{het}}$. This means that the heterogeneous organization is optimal as soon as it is reactive. But we know that an increase in the Implementer intrinsic bias increases the scope for reactivity for heterogeneous organizations: α^{het} decreases, thus $\alpha^\star$ decreases.

1. **Individual rationality:** Given the Implementer's posterior belief $\mu(.)$, $\mathcal{P}(\sigma)$ maximizes the Decision Maker's expected utility for each $\sigma \in \{1, 2\}$.

2. **Bayesian updating:** The posterior $\mathbb{P}(\theta = \mathcal{P}|\mathcal{P})$ is obtained using the selection process $\mathcal{P}(.)$, the Implementer's prior about state θ and Bayes' law.

As already stressed, our model is similar to a standard signaling game (see, e.g., Spence [1973]), with an informed principal (the Decision Maker who knows the true value of the signal) and an uninformed agent (the Implementer who does not observe this signal). As with most signaling games, there are many equilibria in our model if we do not impose any restrictions on the Implementer's out-of-equilibrium beliefs. The standard refinement of beliefs in the signaling literature is the notion of strategic stability, introduced by Kohlberg and Mertens [1986]. We will use in this paper a weaker refinement, known as D1 (Cho and Sobel [1990]), which is sufficient for a unique equilibrium to emerge in our basic model. Intuitively, the D1 refinement makes the following restriction: when the Implementer observes an out-of-equilibrium "order", he believes it comes from the Decision Maker whose signal makes her "most eager" to make the deviation from equilibrium. This means that, in a non reactive organization, if the Decision Maker selects project 2 (this never happens in equilibrium), the Implementer would infer that she has observed $\sigma = 2$, not $\sigma = 1$. This comes from the fact that, all things equal, $\sigma = 2$ makes the Decision Maker "more eager" to select project 2 than $\sigma = 1$.

3.2 Equilibrium characterization

To solve the model, we proceed as in section 2. The following proposition summarizes and describes the equilibria for both types of organizations:

Proposition 3.1 *Let $j \in \{het, hom\}$. For both types of organization, there exists two thresholds $\frac{1}{2} < \alpha^j_{NR} < \alpha^j_R < 1$ such that:*

1. *For $\alpha < \alpha^j_{NR}$, organization j is non-reactive.*

2. *For $\alpha^j_{NR} \leq \alpha \leq \alpha^j_R$, organization j is "semi-reactive": after observing signal 2, the Decision Maker selects project 1 with probability $\rho^j(\alpha)$.*

   $\rho^j(\alpha)$ is a decreasing and continuous function of α. $\rho^j(\alpha^j_{NR}) = 1$ and $\rho^j(\alpha^j_R) = 0$

3. *For $\alpha > \alpha^j_R$, the organization is fully reactive.*

Proof See Appendix F.

In contrast to the basic model of section 2.1, the analysis does not end with the characterization of pure reactive and non-reactive equilibria. This comes from the fact that the signal is now private information to the Decision Maker. When α is large enough, or low enough, there is no ambiguity from the Implementer's viewpoint, and the intuitions of the basic model carry through in the presence of asymmetric information. But for intermediate values of α, "semi-reactive" equilibria emerge where the Decision Maker, after observing signal 2, is indifferent between selecting project 1 and selecting project 2, and therefore randomizes between the two projects.

For $j \in \{\text{het,hom}\}$, we note ρ_j be the probability that the Decision Maker selects project 1 after observing signal 2. ρ_j thus measures the "inertia" of organization j, or equivalently, $1-\rho_j$ measures organizational reactivity. The following Lemma shows how reactivity evolves (1) with the signal precision α and (2) with the organizational form:

Lemma 3.2 *For $j \in \{het,hom\}$, let $\rho_j(\alpha)$ the probability that the Decision Maker j selects project 1 when the signal $\sigma = 2$. Then:*

1. *$\rho_j(\alpha)$ is a decreasing function of α*
2. *$\rho^{het}(\alpha) < \rho^{hom}(\alpha)$ for all $\alpha \in [1/2; 1]$*

Proof See appendix G.

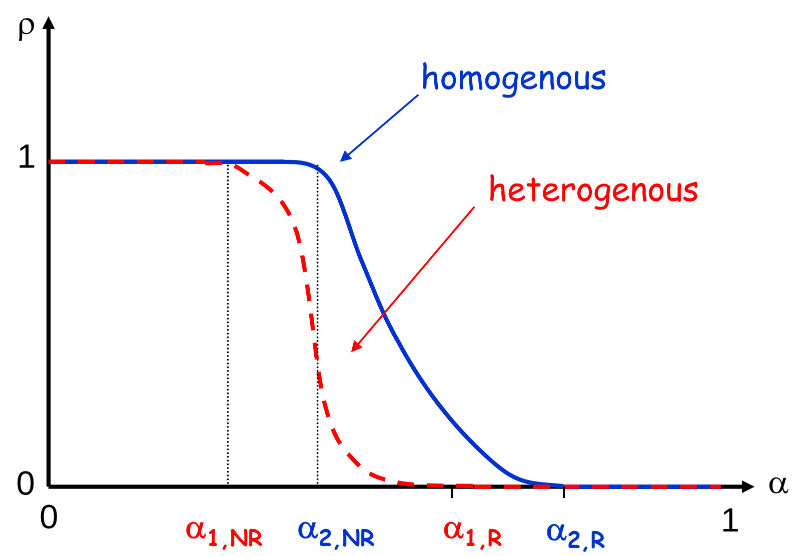

Figure 2: "Non-reactivity" in both organizations.

The above results are depicted in Figure 3.2, in the particular case where $\alpha_R^{\text{hom}} < \alpha_{NR}^{\text{het}}$. The inertia in homogeneous organizations (in blue) is always larger than in heterogeneous ones (in red). The next lemma shows that information asymmetries impair reactivity in both types of organization:

Lemma 3.3

$$\textit{For } j \in \{het, hom\}\textit{: } \alpha^j < \alpha_{NR}^j < \alpha_R^j$$

Proof See appendix H.

This Lemma proves that, for $\alpha \in [\alpha^j, \alpha^j_{NR}]$, asymmetric information makes organization j non reactive while it is reactive in the perfect information setting of section 2.1. This is because when the signal is observed by the Implementer, the cost of not reacting to signal 2 are severe, as the Implementer then has very low expectation on project 1 probability of success (i.e. $1-\alpha$). Once the signal becomes private information to the Decision Maker, the cost from not reacting to signal 2 decreases as the Implementer belief on project 1 being the successful project is now at least $\frac{1}{2}$. Thus, introducing private information reduces the scope for reactivity.

3.3 Organizational Design

The search for the optimal organizational form is similar to the one we performed in section 2.2, except there are now three different types of equilibrium. Nevertheless, the characterization of the optimal organization resembles greatly the one in proposition 2.3:

Proposition 3.4 *There exists a unique $\alpha^{\star\star} \in [\alpha^{het}_{NR}, \alpha^{hom}_{NR}]$ such that:*

1. *For $\alpha < \alpha^{\star\star}$, the homogeneous, non-reactive, organization has the highest expected profit.*
2. *For $\alpha^{\star} < \alpha < \alpha^{hom}_{R}$, the heterogeneous, semi-reactive or reactive, organization maximizes expected profit.*
3. *For $\alpha > \alpha^{hom}_{R}$, both organizations generate the same expected profit.*

Proof See Appendix I.

As in the preliminary model of section 2.1, the net gain of heterogeneity can be broken down into three different expressions: a reactivity gain, a credibility gain and a cost of mismatch. The most striking difference with the basic model comes from the reactivity gain. In section 2.1, the credibility gain originated from the observability of the signal σ: selecting the project indicated by the signal clearly strengthened the Implementer's belief about the success probability of the project he had to implement. In the context where σ is private information to the Decision Maker, the heterogeneous organizational form now allows the Implementer to draw a more precise inference from the project selected at equilibrium than what is possible in an homogeneous organization. In other words, when the signal is private information, the heterogeneous organization increases the Decision Maker's credibility by limiting its incentive not to react to the signal.

3.4 Dissent and Transparency

In this Section, we let the Owner reduce informational asymmetries by making the signal public information. We thus ask if organizational heterogeneity is complement or substitute to making the firm more "transparent". For simplicity, we focus here on the case where the signal can credibly be made public information *at no cost*[6].

[6]This extreme case is in a way the strongest robustness check we can think of: any positive cost to make the signal hard information will make transparency less attractive to the Owner and will therefore bring us back to the initial equilibrium of section 3.3.

In this extended setting, the Owner decides whether the signal should be made public information in stage 1, i.e. at the organizational design stage, in particular before the signal is revealed. This decision boils down to comparing the expected payoffs in both the basic model of Section 2.1 and in the model of section 3 where σ is private information. This comparison brings the following results:

Proposition 3.5 *For each $j \in \{het, hom\}$, there exists a unique $\widehat{\alpha}^j \in [\alpha^j, \alpha^j_{NR}]$ such that:*

1. *For $\alpha < \widehat{\alpha}^j$, "opacity", i.e. the signal σ remaining private information to the Decision Maker, maximizes the Owner's expected profit.*
2. *For $\widehat{\alpha}^j < \alpha < \alpha^j_R$, "transparency", i.e. making the signal σ public information, maximizes the Owner's expected profit.*
3. *For $\alpha > \alpha^j_R$, the organization expected profit is independent of whether the signal is public or private information.*

Proof See Appendix J.

For each organizational form, there is a threshold $\widehat{\alpha}^j$, such that the Owner will choose to let the signal private information to the Decision Maker if and only if the signal precision is below this threshold. There are two countervailing effects that explain this result. On the one hand, because F is concave, the Owner exhibits a preference for having Implementer's effort spread out evenly across states of nature. . Therefore, "transparency" decreases expected profit by makes the Implementer's belief, and thus his effort provision, more extreme: in a non reactive equilibrium, the Implementer's belief on the probability of success of the selected project goes from $\left(\frac{1}{2}, \frac{1}{2}\right)$ to $(\alpha, 1-\alpha)$. On the other hand, "opacity" decreases expected profit as it impairs reactivity, as we showed in Lemma 3.3. Overall, "transparency" appears as a complement to reactivity: the threshold $\widehat{\alpha}^j$ belongs to $[\alpha^j, \alpha^j_{NR}]$. As soon as the organization under asymmetric information is at least semi reactive ($\alpha > \alpha^j_{NR}$), the Owner systematically wants it to become "transparent", so as to make the equilibrium fully reactive.

We now move on to organizational design and how the choice of transparency interacts with the organizational form (i.e. homogeneity vs. heterogeneity). As reactivity increases the returns to transparency, and reactivity is more easily reached within the heterogeneous organization, we expect heterogeneity and transparency to be strategic complements for the Decision Maker. This is, however, not always the case, as we show in the following Lemma:

Lemma 3.6 *When the Owner enjoys real authority over the decision to make the signal public information:*

1. *For $\alpha < \min(\alpha^\star, \alpha^{\star\star})$, the optimal organization is homogeneous and "opaque", i.e. the signal σ remains private information to the Decision Maker.*
2. *For $\alpha > \max(\alpha^\star, \alpha^{\star\star})$, the optimal organization is heterogeneous and "transparent", i.e the signal becomes public information.*

Proof See Appendix K.

Assuming that the Owner is in a position to make the signal σ public information is not innocuous. It may often turns out to be difficult to force the Decision Maker to reveal the content of its private information. For instance, if the Decision Maker obtains the signal σ at some private cost, she might then enjoy some real authority over the decision to make it public information. We thus consider the case where the Decision Maker, and not the Owner, has the choice of making the signal public. We first assume that she can credibly commit *ex ante* (i.e. in stage 1, before the signal is revealed to her) to reveal the signal σ once she observes it, in particular before the Implementer decides on effort decision. We solve for the optimal "transparency" decision under such an assumption in Appendix J. In a nutshell, the results we report are conceptually very close to those of proposition 3.5: for each organizational form $j \in \{\text{het,hom}\}$, there exists a unique $\widetilde{\alpha}^j \in [\alpha^j, \alpha^j_{NR}]$ such that, for $\alpha > \widetilde{\alpha}^j$, "transparency" is weakly preferred by the Decision Maker, while "opacity is preferred for $\alpha < \widetilde{\alpha}^j$. As a result, the Decision Maker also has incentives to implement transparency, provided the signal is sufficiently precise. Even though she is intrinsically biased, the Decision Maker is also interested in the project's probability of success and hence in implementation effort. Since transparency tends to make project selection more credible, it naturally increases the Implementer effort provision, which leads the Decision Maker to favor transparency provided reactivity is valuable, i.e. provided that α is large enough. Nevertheless, because she is biased toward project 1, the Decision Maker's willingness to make the signal public remains weaker than that of the Owner's, i.e. $\widetilde{\alpha}^j > \widehat{\alpha}^j$.

Going back to organizational design, we show in the following Lemma that the choice of the optimal organizational form remains unaffected, provided that the signal's precision is high or low enough:

Lemma 3.7 *When the Decision Maker enjoys real authority over the decision to make the signal public information:*

1. *For $\alpha < \min(\alpha^\star, \alpha^{\star\star})$, the Owner selects the homogeneous organization and the Decision Maker keeps the signal private information.*

2. *For $\alpha > \max(\alpha^\star, \alpha^{\star\star})$, the Owner selects the heterogeneous organization and the Decision Maker makes the signal public information.*

Proof See Appendix L.

What happens if the Decision Maker cannot commit *ex ante* to make the signal public information? If the signal σ can be certified *ex post* at zero cost, we can easily show that, in equilibrium, the signal is always fully revealed[7]. Consider for instance the case of an organization which is non reactive when the signal is private information. In such a case, when the Decision Maker receives signal 1, she wants to maximize the Implementer's ex post belief that project 1 is the "right" one, and will thus certify her signal. The Decision Maker receiving signal 2 is thus identified as such as she either certifies her signal (which reveals signal 2) or does not certify the signal, which reveals she did not receive signal 1. Thus, ex post certification in this model breaks the pooling equilibrium and turn the model with private information into the simple model of Section 2.1 where the signal is publicly observed. This outcome is not efficient as, as we proved in lemma 3.6, when $\alpha < \min(\alpha^\star, \alpha^{\star\star})$, the optimal organization entails both homogeneity and private information.

[7]A formal proof is available from the authors upon request

4 Organizational Dynamics

The models we have studied so far are inherently static. However, it can be argued that, as the organization evolves, the Decision Maker might gain some real authority over the hiring decision and thus shape the organizational form. Additionally, dissatisfied workers might leave the organization. In this section, we show how the choice of the optimal organizational form is affected once these dynamic considerations are incorporated in our basic model.

4.1 Optimal Organizational Design from the Decision Maker's perspective

In this section, we assume that the Decision Maker has gained over time the real authority over the hiring decision: the Decision Maker thus selects between the heterogeneous and the homogeneous organizations. How does this affect the equilibrium organizational structure?

Consider first the simple setup of section 2.1, where the signal received by the Decision Maker is public information. When selecting the optimal organizational form, the qualitative nature of the trade-off faced by the Decision Maker is similar to that of the Owner: because she is interested in the probability of success, she values both reactivity and effort provision by the Implementer. However, the Decision Maker is also intrinsically biased toward project 1. She thus values more implementation effort when it is directed toward the completion of project 1. Note that this is contrary to the Owner who is *ex ante* indifferent between effort provision on project 1 or on project 2. As a result, the Decision Maker selects the homogeneous organization *more often* than what the Owner would. As it turns out, in this model without information asymmetries, the Decision Maker always selects the homogeneous organization: the gain from having the Implementer more intrinsically motivated on project 1 when the signal is 1 always outweighs the cost from having an Implementer with low belief in project 1 when the signal is 2 (part 1 of proposition 4.1).

This extreme behavior of the Decision Maker is no longer present in the augmented model of section 3 where the signal σ is private information. Of course, the qualitative nature of the trade-off faced by the Decision Maker when selecting the optimal organizational form is left unchanged. However, the quantitative gain from the homogeneous organization, namely that the Implementer is more intrinsically motivated on project 1 when the signal is 1, is now strongly reduced as the Implementer, who does not observe the signal, does not believe anymore in the likelihood of project 1 succeeding (at least in the range where the homogeneous organization is non-reactive/semi-reactive, i.e. in the relevant range). Therefore, the Decision Maker might now opt for an heterogeneous organization in order to benefit from the increased "credibility" that this organizational form brings to its decision. We summarize the entire analysis of this issue in the following proposition:

Proposition 4.1 *Assume the Decision Maker has the real authority over organizational design. Then:*

1. *If the signal σ is commonly observed, she will always select an homogeneous organization.*

2. *If the signal σ is private information, there exists two levels of signal precision $(\breve{\alpha}_1, \breve{\alpha}_2) \in [\alpha^{\star\star}, \alpha_R^{hom}]$ such that the Decision Maker hires a dissenting implementer (i.e. opts for an homogeneous organization) only when $\alpha \in [\breve{\alpha}_1, \breve{\alpha}_2]$*

Proof See Appendix M.

The Decision Maker and the Owner are never fully aligned (unless $\underline{B} = \bar{B}$ which is ruled out by assumption 1) in their organizational choice: when $\alpha \in [\alpha^{\star\star}, \breve{\alpha}_1]$, the credibility gain brought by the heterogeneous organization is too low to overcome the Decision Maker own bias toward project 1 and therefore toward the homogeneous organization; when $\alpha \in [\breve{\alpha}_2, \alpha_R^{hom}]$, the homogeneous organization becomes sufficiently reactive to make the reactivity gain from the heterogeneous organization relatively too small to overcome the Decision Maker bias. However, it is noteworthy that, in the context of the private information model of section 3, heterogeneity remains an equilibrium organizational form even when the biased Decision Maker has real authority over organizational design.

4.2 Dissent in a Labor Market Equilibrium

In a reactive organization, the Implementer does not necessarily work on his preferred project and might thus prefer, all things equal, to work for an homogeneous organization. However, when the heterogeneous organization brings the highest expected profit, it might be possible to retain the Implementer in the organization by granting him a stronger share of this higher surplus. We show in this Section that the latter effect can dominate the former, and therefore, that heterogeneous organizations can survive when taking into consideration the equilibrium on the labor market.

To clarify this discussion, we assume that Decision Makers are exogenously and randomly assigned to firms: we will briefly come back to this issue below. We assume that there is a continuum of organizations with mass 1, indexed by i. For firms $i \in [0, 0.5]$, the Decision Maker is intrinsically biased toward project 1. For firms $i \in [0.5, 1]$, the Decision Maker has intrinsic preferences for project 2. Symmetrically, there is a continuum of potential Implementers of mass 1, half of them ($j \in [0, 0.5]$) with intrinsic preferences for project 1, the remaining half ($j \in [0.5; 1]$) intrinsically motivated by project 2.

We investigate the case where Owners have real authority over the hiring decision. The labor market equilibrium is thus an assignment of Implementers to firms. It can be represented as a one to one mapping $m(.)$, that, to all implementer j, assigns a firm i. This is thus a problem of bilateral (frictionless) matching. To characterize it, we now make the simplifying assumption that the Implementers' utilities and the firms' expected profits are transferable. This will amount to assuming that Owners can pay different wages to Implementers depending on the design of their organization:

Definition A matching function $m(.)$ is an equilibrium if it maximizes the sum of organizations' expected profits and Implementers' expected utilities. Hence:

$$m(.) \in \arg\max \left\{ \int_0^1 \left(\pi_{m(j)} + U_j^I \right) dj \right\}$$

where U_j^I is the expected utility of the implementer j, while $\pi_{m(j)}$ is the expected profit of the organization that employs j in equilibrium.

We introduce this labor market equilibrium consideration within the simple model of section 2.1, where the signal σ is publicly observed and where assumption 1 holds, i.e. the Decision Makers are more intrinsically biased than the Implementers.

Proposition 4.2 *There exists $\widehat{R} > 0$ such that, for all $R > \widehat{R}$, there is a $\hat{\alpha} \in [\alpha^{\star}, \alpha^{hom}]$:*

1. *For $\alpha \in [\alpha^{het}; \hat{\alpha}]$, there are only homogeneous organizations in equilibrium, i.e. $m(i) = i$ is an equilibrium, but $m(i) = 1 - i$ is not.*
2. *For $\alpha \in [\hat{\alpha}; \alpha^{hom}]$, there are only heterogeneous organizations in equilibrium, i.e. $m(i) = 1 - i$ is an equilibrium, but $m(i) = i$ is not.*

Proof See Appendix N.

In words, for $\alpha \in [\hat{\alpha}; \alpha^{hom}]$, heterogeneous organizations deliver the highest expected profit and are the only ones that exist in equilibrium. This subset of α is non empty ($\hat{\alpha} < \alpha^{hom}$) when profits are large enough compared to the magnitude of private benefits. Then, heterogeneous organizations generate enough financial profits to compensate dissenting Implementers for not working for Decision Makers with similar intrinsic preferences. When $\alpha \in [\alpha^{\star}, \widehat{\alpha}]$, the signal is not informative enough: profits of reactivity are too small to allow Owners to compensate Implementers for working with antagonistic Decision Makers. Notice however that the matching equilibrium, as defined in Definition 4.2, is always - by construction - Pareto optimal (if we exclude Decision Makers from this criterion).

The above bilateral matching problem excludes the Decision Maker from the process. We can also look at the equilibrium matching of Owners to Decision Makers, assuming that Implementers are already assigned to firms. In this case, the equilibrium matching process is the one that maximises the sum of Decision Makers and Owner's utilities, in a way analogous to Definition 4.2. In this context, we can derive a proposition similar to proposition 4.2: when monetary profits are large enough, the Owners can come up with enough surplus to compensate Decision Makers for working with dissenting Implementers. This result contrasts with the case of proposition 4.1 where the Decision Maker enjoyed real authority over the hiring decision: at the core of this result is the Owner's ability to subsidize with profit the heterogeneous organization, while they were not allowed to do so in Section 4.1.

5 An Application: 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 organizational design. Scholars such as J. March [1991] and C. Argyris [1990] 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. 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 an organization, it is optimal to hire a pro-change Decision Maker *and* having her collaborate with pro-status quo Implementers. A first motivation for such a result is that change is, almost by definition, the exception and not the rule: it is therefore valuable for the company to have implementers who "enjoy" the status quo project, as it is the project most likely to be selected (even in a "reactive" organization). Moreover, a pro-status quo Implementer disciplines the bias of the Decision Maker toward change. If she was not constrained by the Implementer's intrinsic utility, a pro-change Decision Maker might be tempted to implement change "too often", i.e. even when it is not efficient from a profit perspective. This "change for the sake of change" trap is avoided by the bottom-up pressure imposed by status quo-biased Implementers.

Our model leads to a pair of important empirical predictions: (1) reactivity becomes optimal as firm-level uncertainty[8] increases and (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 formalize these intuitions, we build on the simple model of Section 2.1 where the signal σ is publicly observed, but we now assume that one state of nature is more likely than the other: state 1 occurs with probability $\theta > 1/2$. This state of nature corresponds to "business as usual", i.e. when change does not have to be implemented and the status-quo is the best option. This new assumption breaks the model's symmetry, and, as a result, makes the model's resolution more complicated: there are now four (and not only two) organizational forms to consider, status-quo biased and change-biased heterogeneous organization and status-quo biased and change-biased homogeneous organizations.

To simplify our analysis, we make the following assumption:

$$\forall x \in \mathbb{R}_+,\ xf(x) \text{ is increasing in } x \tag{12}$$

Assumption (12) guarantees that F is not "too" concave: in particular, it ensures that a reactive organization is more profitable when the most-likely project (i.e. the status-quo project)

[8]Firm-level uncertainty is defined as the ex ante probability that "change" is the successful project.

is the Implementer's preferred project, an intuitive property that can be violated if F is indeed too "concave"[9]. This assumption allows us to characterize the optimal organizational form in a very simple way:

Proposition 5.1 *For each $\theta \in [1/2, 1]$. There exists $1/2 < \alpha^{het}(\theta) < \alpha^{hom}(\theta) < 1$ such that $\alpha^{het}(\theta)$ and $\alpha^{hom}(\theta)$ are increasing in θ and:*

1. *If $1/2 < \alpha < \alpha^{het}(\theta)$, the optimal organization is homogeneous and has a status-quo biased Decision Maker and a status-quo biased Implementer.*

2. *If $\alpha^{het}(\theta) < \alpha < \alpha^{hom}(\theta)$, the optimal organization is heterogeneous: it has a status-quo biased Implementer but a change biased Decision Maker.*

3. *If $\alpha > \alpha^{hom}(\theta)$, both above organizations deliver the optimum expected profit.*

Proof See Appendix O.

The first result from proposition 5.1 shows that among the four possible types of organization, only those with a status-quo biased Implementer can be optimal. This is simply because status-quo is *ex ante* more likely to be the successful course of action ($\theta > 1/2$). It is thus optimal to hire an implementer that has a strong intrinsic motivation for not changing. The second result of proposition 5.1 states that a lower precision α makes non-reactive, homogeneous, organizations more attractive. This is the same result as in the baseline model where $\theta = 1/2$. Finally, proposition 5.1 shows that the thresholds in α increase with θ. A rise in uncertainty can be seen as a decrease in the ex ante probability that the status-quo decision is the successful project (i.e. as a decrease in θ). Such an increase in firm-level uncertainty makes the reactive heterogeneous organization with a change biased Decision Maker more profitable. Therefore, in an environment where strategic decisions becomes less persistent, the organization Owner might find it optimal to replace a status-quo biased Decision Maker with a change biased Decision Maker, i.e. to hire a "corporate savior".

6 Conclusion

This paper has shown that dissent may enhance corporate decision making quality. Because Decision Makers must internalize the motivation of intrinsically motivated Implementers, heterogeneity of preferences may act as a moderating device in the decision making process. This moderating mechanism is different from whistle-blowing or explicit opposition, and relies explicitly on the "separation of implementation and control" that is casually observed in organizations: the mere presence of a potentially independent Implementer along the chain of command compels the Decision Maker to use more private, "objective" information in her selection process. This mechanism is robust: even when monetary contracts are allowed or when organizational design is delegated to the Decision Maker, preference heterogeneity can always be part of an efficient organization.

[9]If F is highly concave, it is better to "evenly" distribute the probability of success across the two projects and thus to have the Implementer intrinsically like the project less likely to succeed.

As we view it, the mechanism highlighted in this paper is very general and has many implications to every-day organizations. In the area of corporate governance, we believe this has an important normative implications for the role of boards of directors, who should optimally configure the preferences of the executive suite. 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, one could try to derive the consequences of allowing the Implementer to bribe the Decision Maker in order to convince him to stick to his preferred project. Another topics of interest would be to understand how repeated interactions, and in particular the building by the Decision Maker of a reputation for reactivity, would interact with the optimal organizational design. This question is left for future research.

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A Proof of Proposition 2.1

Consider first an homogeneous organization. When $\sigma = 1$, the DM will always select $\mathcal{P} = 1$ as:

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

When $\sigma = 2$, the DM selects project 2 if and only if:

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

Call $\psi(\alpha) = \alpha F(\alpha \underline{b})\underline{B} - (1-\alpha)F((1-\alpha)\bar{b})\bar{B}$. ψ is a strictly increasing function of α and $\psi(1/2) < 0$ while $\psi(1) > 0$. Therefore, there is a unique $\alpha^{hom} \in]1/2, 1[$ so that the DM selects project 2 when the signal is 2 if and only if $\alpha \geq \alpha^{hom}$.

Using the same approach, we show that an heterogeeous organization is reactive (i.e. selects project 2 when $\sigma = 2$) if and only if $\alpha > \alpha^{\text{het}}$ where:

$$\alpha^{\text{het}}.F\left(\alpha^{\text{het}}.\bar{b}\right).\underline{B} = \left(1-\alpha^{\text{het}}\right).F\left((1-\alpha^{\text{het}}).\underline{b}\right).\overline{B}$$

There is more scope for reactivity in an heterogeneous organization. Indeed, let $\alpha \geq \alpha^{hom}$, then $\alpha F(\alpha \underline{b})\underline{B} \geq (1-\alpha)F((1-\alpha)\bar{b})\bar{B}$. Because $\bar{b} > \underline{b}$, this trivially implies that $\alpha F(\alpha \bar{b})\underline{B} > (1-\alpha)F((1-\alpha)\underline{b})\bar{B}$, i.e. that $\alpha > \alpha^{het}$, so that $\alpha^{hom} > \alpha^{het}$. This completes the proof of proposition 2.1.

B Proof of proposition 2.2

1. We start with the case of an homogeneous organization. It is easy to see that this organization is fully reactive if and only if:

$$\alpha F\left(\alpha \underline{b}\right).\underline{B} > \frac{1-\alpha}{2}.F\left(\frac{1-\alpha}{2}.\bar{b}\right).\overline{B} \Longleftrightarrow \alpha > \alpha_3 \tag{13}$$

This condition simply states that the Decision Maker prefers to select project 3 after observing signal 3 (or project 2 after observing signal 3) over selecting project 1. If this condition is verified, the Decision Maker will select project 3 after observing signal 3 as project 2 would deliver a lower utility than project 1 and also always select project 2 after observing signal 2 as again, project 3 would then deliver a lower utility than project 1. Finally, when the signal indicates project 1, the Decision Maker will always select 1, as it is project most likely to succeed, and both she and the Implementer have intrinsic preferences over project 1.

When equation (13) is violated, the Decision Maker always prefers to select project 1. The organization is then non-reactive. It is clear from inequality (13) that $\alpha_3 \in]1/3; 1[$.

2. The case of the heterogeneous organization is slightly more involved. When the signal is 1, the Implementer will select project 1 if and only if:

$$\alpha F\left(\alpha \underline{b}\right).\overline{B} > \frac{1-\alpha}{2}.F\left(\frac{1-\alpha}{2}.\bar{b}\right).\underline{B}$$

which, given assumption (8), always holds as long as $\alpha > 1/3$.

When the signal is 2, the Decision Maker always prefers selecting project 1over project3: both projects have the same (low) probability of success, but the Decision Maker receives higher utility from project 1 while the Implementer is indifferent between the two projects in term of intrinsic utility. Thus, the Decision Maker's choice then boils down to project 1 or project 2. She will select project 2, as indicated by the signal if and only if:

$$\alpha F\left(\alpha \bar{b}\right).\underline{B} > \frac{1-\alpha}{2}.F\left(\frac{1-\alpha}{2}.\underline{b}\right).\overline{B} \Longleftrightarrow \alpha > \alpha_1 \tag{14}$$

From assumption (8), it is easy to show that $\alpha_1 > 1/3$. $\alpha_1 < 1$ is also straightforward.

When the signal is 3, project 3 is selected whenever it provides the Decision Maker with a higher utility than selecting project 1 (inequality (15) or selecting project 3 (inequality (16):

$$\alpha F\left(\alpha \underline{b}\right).\underline{B} \quad > \quad \frac{1-\alpha}{2}.F\left(\frac{1-\alpha}{2}.\underline{b}\right).\overline{B} \Longleftrightarrow \alpha > \alpha_2^{\star} \tag{15}$$

$$\alpha F\left(\alpha \underline{b}\right).\underline{B} \quad > \quad \frac{1-\alpha}{2}.F\left(\frac{1-\alpha}{2}.\bar{b}\right).\underline{B} \Longleftrightarrow \alpha > \alpha_2^{\star\star} \tag{16}$$

Let $\alpha_2 = \max[\alpha_2^\star; \alpha_2^{\star\star}]$: after observing signal 2, the Decision Maker selects project 2if and only if $\alpha > \alpha_2$. Else, she selects either project 1 or 2. $\alpha_2 \in]1/3; 1[$is straightforward.

3. Last, we prove that $1/3 < \alpha_1 < \alpha_2 < \alpha_3 < 1$. It is straightforward to show that, if α satisfies inequality (15), it also satisfies (14). Also, if α satisfies (13), it also satisfies both (15) and (16). This completes the proof of proposition 2.2.

C Proof of Proposition 2.3

We now move on to proposition 2.3 and investigate organization value. The value of an homogeneous, reactive organization (i.e. for $\alpha \geq \alpha^{hom}$) is given by:

$$V^{hom}(\alpha \geq \alpha^{hom}) = \frac{\alpha}{2}\left(F(\alpha\bar{b}) + F(\alpha\underline{b}\right)$$

Let us briefly explain this last expression. With probability 1/2, the state of nature is 1. Because the organization is reactive, the DM will select the successful project, i.e. project 1, with probability α, i.e. as soon as she receives signal 1. The Implementer will then make expected effort $F(\alpha\bar{b})$, as project 1 is his preferred project. With probability 1/2, the true state of nature is 2. With probability α, the DM will righteously select project 2 (i.e. as soon as it is indicated by the signal), leading the Implementer to an expected probability of high effort $F(\alpha\underline{b})$.

The value of a non-reactive homogeneous organization (i.e. for $\alpha < \alpha^{hom}$) is given by:

$$V^{hom}(\alpha) = \frac{1}{2}\left(\alpha F(\alpha\bar{b}) + (1-\alpha)F((1-\alpha)\bar{b}\right) \text{ if } \alpha < \alpha^{\text{hom}}$$

Such an organization always implement project 1. Project 1 happens to be the successful project only with probability 1/2. However, with probability α (resp. $1-\alpha$), the public signal will indicate project 1 (resp. project 2), leading to an expected implementation effort of $F(\alpha\bar{b})$ (resp. $F((1-\alpha)\bar{b})$).

The value of an heterogeneous organization is computed in a similar fashion:

$$\begin{cases} V^{het}(\alpha \geq \alpha^{het}) = \frac{\alpha}{2}\left(F(\alpha\bar{b}) + F(\alpha\underline{b})\right) \\ V^{het}(\alpha < \alpha^{het}) = \frac{1}{2}\left(\alpha F(\alpha\underline{b}) + (1-\alpha)F((1-\alpha)\underline{b})\right) \end{cases}$$

Note that the value of the homogeneous, reactive, organization is similar to that of the heterogeneous, reactive, organization.

We can now easily turn to the comparison of firm value. For $\alpha \geq \alpha^{hom}$, both organizations are reactive and thus lead to the same profit. For $\alpha \in [\alpha^{het}, \alpha^{hom}]$, the homogeneous organization is non-reactive while the heterogeneous one is reactive. The difference in value between the heterogeneous and the homogeneous organization is given by:

$$\Delta(\alpha) = V^{het}(\alpha) - V^{hom}(\alpha) = \frac{1}{2}\left(\alpha F(\alpha\underline{b}) - (1-\alpha)F((1-\alpha)\bar{b})\right) R$$

Note that Δ is a strictly increasing function of α. By definition of α^{hom}, we know that:

$$\begin{aligned} \alpha^{hom}F(\alpha^{hom}\underline{b}) &= (1-\alpha^{hom})F((1-\alpha^{hom})\bar{b})\frac{\bar{B}}{\underline{B}} \\ &> (1-\alpha^{hom})F((1-\alpha^{hom})\bar{b}) \end{aligned}$$

So that $\Delta(\alpha^{hom}) > 0$. By definition of α^{het}, we know that:

$$
\begin{aligned}
\alpha^{het} F(\alpha^{het}\bar{b}) &= (1-\alpha^{het})F((1-\alpha^{het})\underline{b})\frac{\bar{B}}{\underline{B}} \\
&< (1-\alpha^{het})F((1-\alpha^{het})\underline{b}) \\
&< (1-\alpha^{het})F((1-\alpha^{het})\bar{b})
\end{aligned}
$$

Using $\bar{b} > \underline{b}$, this shows that: $\alpha^{het} F(\alpha^{het}\underline{b}) < (1-\alpha^{het})F((1-\alpha^{het})\bar{b})$, i.e. $\Delta(\alpha^{het}) < 0$. Because Δ is strictly increasing and continuous, using the intermediate value theorem, this implies that there is a unique $\alpha^\star \in]\alpha^{het}, \alpha^{hom}[$ such that for $\alpha \in [\alpha^{het}, \alpha^\star]$, the homogeneous, non-reactive organization has the highest value while for $\alpha \in [\alpha^\star, \alpha^{hom}]$, the heterogeneous, reactive organization delivers the highest value.

Finally, for $\alpha < \alpha^{het}$, the difference between the two non-reactive organizations is simply given by:

$$
\delta(\alpha) = V^{het}(\alpha) - V^{hom}(\alpha) = \frac{1}{2}\left(\alpha\left(F(\alpha\underline{b}) - F(\alpha\bar{b})\right) + (1-\alpha)\left(F((1-\alpha)\underline{b}) - F((1-\alpha)\bar{b})\right)\right) < 0,
$$

so that the homogeneous organization is strictly more profitable that the heterogeneous one. While both organizations are non reactive over this range of signal's precision, the homogeneous organization has a more intrinsically motivated Implementer. QED.

D Example with Contingent Wages

This Appendix shows that financial contracting is not a perfect substitute for organizational design.

Proposition D.1 *Start from the simple model of dissent considered in section 2.1 where the signal received by the Decision Maker is public information. Consider the special case where F is uniform over some range* $[0, 1]$. *Assume that the Owner can provide both the Implementer and the Decision Maker with compensation contingent (1) on the signal (2) on their preferred project and (3) on success of the project. Then there is a non-empty interval $[\hat{\alpha}^\star; \hat{\alpha}^{hom}]$ such that for each $\alpha \in [\hat{\alpha}^\star; \hat{\alpha}^{hom}]$, the heterogeneous organization strictly dominates the homogeneous one.*

$F(x) = x$. We first look for optimal compensation schemes that give *no compensation* to the Decision Maker, and then show that they are optimal over some range in α. In this case, call:

$$
\begin{cases}
z_1 = \operatorname*{argmax}_z F(\alpha\left(\bar{b}+z\right))(R-z) = \operatorname*{argmax}_z F((1-\alpha)\left(\bar{b}+z\right))(R-z) = \dfrac{R-\bar{b}}{2} \\
z_2 = \operatorname*{argmax}_z F(\alpha\left(\underline{b}+z\right))(R-z) = \operatorname*{argmax}_z F((1-\alpha)\left(\underline{b}+z\right))(R-z) = \dfrac{R-\underline{b}}{2}
\end{cases}
$$

z_1 (resp. z_2) is the optimal wage the owner will provide the Implementer with after the success of his most (resp. least) preferred project. It does not depend on the signal received by the Decision Maker.

The value of a reactive organization is then given by:

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

while the value of the homogeneous non-reactive organization is:

$$
V^{NR} = \frac{\alpha^2 + (1-\alpha)^2}{2}\left(\frac{\bar{b}+R}{2}\right)
$$

The reactive organization dominates the non-reactive organization if and only if:

$$
V^R > V^{NR} \Leftrightarrow \alpha^2\left(\frac{\underline{b}+R}{2}\right)^2 \geq (1-\alpha)^2\left(\frac{\bar{b}+R}{2}\right)^2 \Leftrightarrow \alpha > \hat{\alpha}^\star
$$

Thus, when $\alpha > \hat{\alpha}^{\star}$, a reactive organization that pays out no compensation to the Decision Maker is profitable than any type of non reactive organization.

Heterogeneous organizations are reactive, without paying any compensation to the Decision Maker, as long as:

$$\alpha F\left(\alpha\left(\bar{b}+z_1\right)\right)\underline{B} \geq (1-\alpha) F\left((1-\alpha)\left(\underline{b}+z_2\right)\right)\bar{B} \Leftrightarrow \alpha \geq \hat{\alpha}^{\text{het}}$$

Similarly, an homogeneous organization (that does not compensate the Decision Maker) is reactive if and only if:

$$\alpha F\left(\alpha\left(\underline{b}+z_2\right)\right)\underline{B} \geq (1-\alpha) F\left((1-\alpha)\left(\bar{b}+z_1\right)\right)\bar{B} \Leftrightarrow \alpha \geq \hat{\alpha}^{\text{hom}}$$

Obviously, $\hat{\alpha}^{\text{hom}} \geq \hat{\alpha}^{\text{het}}$, even with an optimal compensation to the Implementer, the heterogeneous organization remains "more reactive" than the homogeneous one. The only way the Decision Maker affects profits is by being reactive or not. Thus, over $[\hat{\alpha}^{\text{het}}; \hat{\alpha}^{\text{hom}}]$, it is optimal to give zero compensation to the Decision Maker since (1) if reactivity is optimal, it can be achieved "for free" with an heterogeneous organization, and (2) if non reactivity is optimal, homogeneous organizations allow to obtain it. Thus, optimal firm value is given by V^{NR} and V^{R}.

Call $\psi(\alpha) = \alpha^2\left(\frac{\underline{b}+R}{2}\right)^2 - (1-\alpha)^2\left(\frac{\bar{b}+R}{2}\right)^2$. We now $\psi(\hat{\alpha}^{\star}) = 0$ and ψ is increasing with α.

$$\psi\left(\hat{\alpha}^{\text{hom}}\right) = \left(1-\hat{\alpha}^{\text{hom}}\right)^2\left(\frac{R+\underline{b}}{2}\right)^2\left(\frac{R+\underline{b}}{R+\bar{b}}\frac{\bar{B}}{\underline{B}}-1\right)$$

Thanks to assumption 1 adapted to the uniform case, we know that $\frac{\bar{B}}{\underline{B}} \geq \frac{\bar{b}}{\underline{b}}$. But $\frac{R+\underline{b}}{R+\bar{b}} > \frac{\underline{b}}{\bar{b}}$, so that: $\frac{R+\underline{b}}{R+\bar{b}}\frac{\bar{B}}{\underline{B}} > \frac{\underline{b}}{\bar{b}}\frac{\bar{B}}{\underline{B}} \geq 1$. This proves that: $\psi\left(\hat{\alpha}^{\text{hom}}\right) > 0$ so that $\hat{\alpha}^{\text{hom}} < \hat{\alpha}^{\star}$.

Over $[\hat{\alpha}^{\text{hom}}; \hat{\alpha}^{\star}]$, the heterogeneous organization is reactive and strictly dominates the homogeneous organization, which is non-reactive. Over that interval, compensating the Decision Maker in the heterogeneous organization useless, as he already has the "intrinsic" incentives to react and not reacting would lead to a strictly lower profit. Similarly, compensating the Decision Maker in the homogeneous organization to induce him to react to the signal would destroy profit as it would lead to the same probability of success as in the heterogeneous organization, but would cost strictly more in terms of incentives for the Decision Maker. Moreover, there is no point in compensating the Decision Maker if the organization remains non-reactive. Overall, this proves that over $[\hat{\alpha^{hom}} > \hat{\alpha^{\star}}]$ the best organizational form is heterogeneous, even though the Owner has access to complete contracting. QED.

E Proof of Proposition 2.4

Condition (10) is equivalent to $\beta < B(\alpha)$. B is an increasing function of α, and it is straightforward to see that $B = 1$ for all $\alpha > \alpha^{hom}$ and $B = 0$ for all $\alpha < \alpha^{het}$.

If $\beta < B(\alpha)$, the firm value is given by:

$$V = \frac{\alpha}{2}\left[F(\alpha\bar{b}) + F(\alpha\underline{b})\right]$$

and if $\beta > B(\alpha)$, firm value is given by:

$$\begin{aligned} V \quad = \quad & \frac{\alpha}{2}\left[\beta F(\alpha\bar{b}) + (1-\beta)F(\alpha\underline{b})\right] \\ & + \frac{1-\alpha}{2}\left[\beta F((1-\alpha)\bar{b}) + (1-\beta)F((1-\alpha)\underline{b})\right] \end{aligned}$$

which is increasing in β. The intuition is again that, given that order 1 is always given, the best is to have a motivated Implementer.

Thus, the choice of β is between $[0; B(\alpha)]$ and 1. The rest comes from Proposition 2.3. QED

F Proof of Proposition 3.1

We start with the case of an homogeneous organization. Define the reactive equilibrium by $\mathcal{P}(\sigma) = \sigma$ and $\mu(1) = \alpha,\ \mu(2) = 1 - \alpha$. For this to be an equilibrium, the Decision Maker must prefer selecting project 1 after observing signal 1. This condition is formally:

$$\alpha F(\alpha\bar{b})\bar{B} \geq (1-\alpha)F(\alpha\underline{b})\underline{B}$$

Because $\bar{B} > \underline{B}$ and $\bar{b} > \underline{b}$ this last condition is always verified. The other equilibrium condition requires that the Decision Maker prefers selecting project 2 after observing signal 2:

$$\alpha F(\alpha\underline{b})\underline{B} \geq (1-\alpha)F(\alpha\bar{b})\bar{B}$$

For $\alpha \in [\frac{1}{2}, 1]$, call $\psi(\alpha) = \alpha F(\alpha\underline{b})\underline{B} - (1-\alpha)F(\alpha\bar{b})\bar{B}$. We compute the first derivative of ψ with respect to α:

$$\forall \alpha \in [\frac{1}{2}, 1], \quad \psi'(\alpha) = \underline{B}\underbrace{\left(F\left(\alpha\underline{b}\right) + \alpha\underline{b}f\left(\alpha\underline{b}\right)\right)}_{>0} + \bar{B}\left(F\left(\alpha\bar{b}\right) - (1-\alpha)\,\bar{b}f\left(\alpha\bar{b}\right)\right)$$

Because F is concave and $F(0) = 0$, we know that for all $x \geq 0$, $F(x) \geq xf(x)$. Therefore:

$$F\left(\alpha\bar{b}\right) \geq \alpha\bar{b}f\left(\alpha\bar{b}\right) > (1-\alpha)\,\bar{b}f\left(\alpha\bar{b}\right)$$

For all $\alpha \in [\frac{1}{2}, 1]$, $\psi'(\alpha)$ is thus strictly positive so that ψ is strictly increasing with α. Note that $\psi\left(\frac{1}{2}\right) < 0$ while $\psi(1) > 0$. The intermediate value theorem thus implies that there is a unique $\alpha_R^{hom} \in]\frac{1}{2}, 1[$ such that the homogeneous organization is reactive if and only if $\alpha \geq \alpha_R^{hom}$.

The characterization of the reactive equilibrium in heterogeneous organizations goes along the exact same lines. There exists a unique $\alpha_R^{het} \in]\frac{1}{2}, 1[$ such that the heterogeneous organization is reactive if and only if $\alpha \geq \alpha_R^{het}$.

We now prove that reactivity is more prevalent in heterogeneous organizations, i.e. that $\alpha_R^{hom} > \alpha_R^{het}$. Let $\alpha > \alpha_R^{hom}$. By definition of α_R^{hom}:

$$\alpha F\left(\alpha\underline{b}\right)\underline{B} \geq (1-\alpha)\,F\left(\alpha\bar{b}\right)$$

Because $\bar{b} > \underline{b}$, this last inequality implies:

$$\alpha F\left(\alpha\bar{b}\right)\underline{B} > (1-\alpha)\,F\left(\alpha\underline{b}\right)$$

So that $\alpha > \alpha_R^{het}$, which proves that $\alpha_R^{hom} > \alpha_R^{het}$.

We now turn to the non-reactive equilibrium. Consider first the case of an homogeneous organization. A non-reactive equilibrium is defined as $\mathcal{P}(\sigma) = 1$, i.e. the Decision Maker always selects project 1, irrespective of her private signal σ. Baye's rule and the selection process $\mathcal{P}$ both implies that the Implementer can't draw any inference from project 1 being selected, i.e. $\mu(1) = \frac{1}{2}$. However, the equilibrium imposes *a priori* no restriction on the out-of-equilibrium belief $\mu(2)$, i.e. any $\mu(2) \in [1-\alpha, \alpha]$ is admissible. In order to refine this equilibrium, we impose the D1 criterion.

Let us briefly introduce some notations. Call $U_1^\star$ (resp. $U_2^\star$) the equilibrium utility of a Decision Maker receiving signal 1 (resp. signal 2). Call $U_1^D(\mu(2))$ (resp. $U_2^D(\mu(2))$) the out-of equilibrium utility of a Decision Maker receiving signal 1 (resp. signal 2) when out-of-equilibrium beliefs are given by $\mu(2)$, i.e. the utility a Decision Maker gets by deviating from the non-reactive equilibrium and selecting project 2.

Call now $D_i = \left\{\mu(2) \in [1-\alpha, \alpha] \ \mid \ U_i^\star < U_i^D(\mu(2))\right\}$ and $D_i^0 = \left\{\mu(2) \in [1-\alpha, \alpha] \ \mid \ U_i^\star = U_i^D(\mu(2))\right\}$. The D1 refinement is defined as follow[10]:

[10] The notations we use here are drawn from Fudenberg and Tirole [1991]

Definition (D1 Refinement)

If $D_1 \bigcup D_1^0 \subseteq D_2$, then $\mu(2) = 1-\alpha$. In words, if each out-of-equilibrium belief $\mu(2)$ that leads to a profitable deviation for a Decision Maker with signal 1 also leads to a strictly profitable deviation for a Decision Maker with signal 2, then the Implementer must believe that only Decision Makers with signal 2 deviate from the equilibrium, i.e. that $\mu(2) = 1-\alpha$.

Therefore, let $\mu(2) \in [1-\alpha, \alpha]$ such that $U_1^\star \leq U_1^D(\mu(2))$ (i.e. $\mu(2) \in D_1 \bigcup D_1^0$). This implies that:

$$(1-\alpha)\underline{B}F((1-\mu(2))\underline{b}) \geq \alpha \bar{B} F(\frac{b}{2})$$

But then, because $\alpha > 1-\alpha$, it must be that:

$$U_2^D(\mu(2)) = \alpha \underline{B} F((1-\mu(2))\underline{b}) > (1-\alpha)\bar{B}F(\frac{b}{2}) = U_2^\star$$

So that $\mu(2) \in D_2$, which implies $D_1 \bigcup D_1^0 \subseteq D_2$. Therefore, using our equilibrium concept (i.e. Perfect Bayesian Equilibrium with D1 refinement), the non-reactive equilibrium (which is nothing else than a pooling equilibrium where both types of Decision Maker selects the same project at equilibrium) must necessarily verify $\mu(2) = 1-\alpha$.

Now that $\mu(2)$ is specified, we can write the two incentive constraints that guarantee the existence of a non-reactive equilibrium in the homogeneous organization. The first of these constraints ensures that after observing signal 2, the Decision Maker nevertheless selects project 1:

$$(1-\alpha)F\left(\frac{\bar{b}}{2}\right)\bar{B} \geq \alpha F\left(\alpha \underline{b}\right)\underline{B} \tag{17}$$

The second constraint guarantees that after observing signal 1, the Decision Maker selects project 1:

$$\alpha F\left(\frac{\bar{b}}{2}\right)\bar{B} \geq (1-\alpha)\,F\left(\alpha \underline{b}\right)\underline{B} \tag{18}$$

It is straightforward that if inequality (17) is verified, inequality (18) is also satisfied, so that there is only one relevant incentive constraint, inequality (17). Moreover, inequality (17) is clearly strictly decreasing in α, strictly verified for $\alpha = \frac{1}{2}$ and strictly violated for $\alpha = 1$. Thus, there exists a unique $\alpha_{NR}^{\text{hom}} \in]\frac{1}{2}; 1[$ such that condition (17) is verified only if signal's precision α belongs to $[\frac{1}{2}; \alpha_{NR}^{\text{hom}}]$. Therefore, the non-reactive equilibrium is sustainable in an homogeneous organization only for $\alpha \in [\frac{1}{2}; \alpha_{NR}^{\text{hom}}]$.

Let move now to the case of an heterogeneous organization. We leave it to the reader to prove that the only admissible out-of-equilibrium belief satisfying the D1 refinement in a non-reactive equilibrium is $\mu(2) = 1-\alpha$. It is also left to the reader to show that there exists a unique $\alpha_{NR}^{\text{het}} \in [\frac{1}{2}; 1]$ such that condition (**??**) is verified only if signal's precision α belongs to $[\frac{1}{2}; \alpha_{NR}^{\text{het}}]$. Therefore, the non-reactive equilibrium is sustainable in an heterogeneous organization only for $\alpha \in [\frac{1}{2}; \alpha_{NR}^{\text{het}}]$.

We now turn to the characterization of semi-reactive equilibria. We first prove that there can't exist a semi-reactivity equilibrium where the Decision Maker would randomize over the two projects after having observed signal 1 and always select project 2 after observing signal 2. In this equilibrium, the Implementer's belief that state of nature is 1 after project 1 has been selected would be $\mu(1) = \alpha$. However, if such an equilibrium was to exist, the Decision Maker would have to be indifferent between selecting project 2 or project 1 after observing signal 1. Consider first the case of an homogeneous organization. Such indifference can never occur, as *whatever the ex post belief* $\mu(2) \in [1-\alpha, \alpha]$*, we always have:*

$$\alpha F\left(\alpha \bar{b}\right)\bar{B} > (1-\alpha)\,F\left((1-\mu(2))\,\underline{b}\right)\underline{B}$$

Consider now the case of an heterogeneous organization. The indifference condition between the two projects after signal 1 has been observed would imply that there exists a $\mu(2) \in [1-\alpha, \alpha]$ such that:

$$\alpha F\left(\alpha \underline{b}\right) \bar{B} = (1-\alpha)\, F\left(\mu \bar{b}\right) \underline{B} \tag{19}$$

This would imply that $\alpha F\left(\alpha \underline{b}\right) \bar{B} \leq (1-\alpha)\, F\left(\mu(2) \bar{b}\right) \underline{B}$.

However, we know that $\forall \alpha \in [\frac{1}{2}, 1], \quad \alpha F(\alpha \underline{b}) \bar{B} > (1-\alpha)\, F\left(\alpha \bar{b}\right) \underline{B}$. Indeed, call $\psi(\alpha) = \alpha F\left(\alpha \underline{b}\right) \bar{B} - (1-\alpha)\, F\left(\alpha \bar{b}\right) \underline{B}$. Using F's concavity, one can prove that ψ is strictly increasing. Using assumption 1, we have directly that $\psi\left(\frac{1}{2}\right) > 0$ so that ψ is indeed strictly positive over $[\frac{1}{2}, 1]$. Thus, we can conclude:

$$\forall \alpha \in [\frac{1}{2}, 1], \quad \forall \mu(2) \in [1-\alpha, \alpha] \quad \alpha F(\alpha \underline{b}) \bar{B} > (1-\alpha)\, F\left(\mu(2) \bar{b}\right) \underline{B}$$

Therefore, the equilibrium where the Decision Maker would be indifferent between the two projects after observing signal 1 cannot occur in an heterogeneous organization.

The only semi-reactive equilibrium involves the Decision Maker randomizing over the two projects after receiving signal 2. Formally this equilibrium is defined:

$$\mathcal{P}(1) = 1 \;\text{ and }\; \mathcal{P}(2) = \begin{cases} 1 & \text{with probability } \rho \\ 2 & \text{with probability } 1-\rho \end{cases},$$

where ρ is endogenous to the equilibrium and will be determined subsequently.

Project 2 is selected only when signal 2 has been received. Therefore, the Implementer's belief conditional on project 2 being selected is naturally $\mu(2) = 1-\alpha$. On the other hand, when project 1 is selected, the Implementer ignores whether the Decision Maker indeed received signal 1 or whether she randomized over the two projects after having received signal 2. Using Bayes' rule, the Implementer's posterior belief must satisfy:

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

Consider first the case of an homogeneous organization. For the semi-reactive equilibrium to be sustainable, it must be that the Decision Maker is indifferent between selecting project 1 or 2 after observing signal 2, lest she would not randomize between the two projects. This indifference condition writes:

$$\alpha F(\alpha \underline{b}) \underline{B} = (1-\alpha)\, F(\mu(1) \bar{b}) \bar{B},$$

which can be rewritten as:

$$F(\mu(1) \bar{b}) = \frac{\alpha}{1-\alpha} \frac{\underline{B}}{\bar{B}} F(\alpha \underline{b}) \tag{20}$$

This indifference condition implicitly defines, for each $\alpha \in [\alpha_{NR}^{hom}, \alpha_R^{hom}]$ a unique $\rho^{hom} \in [0,1]$. Indeed, the right hand side of equation (20) is strictly increasing in α and goes from $F\left(\frac{\bar{b}}{2}\right)$ for $\alpha = \alpha_{NR}^{hom}$ to $F\left(\alpha_R^{hom} \bar{b}\right)$ for $\alpha = \alpha_R^{hom}$. The left hand side expression is strictly increasing with $\mu(1)$. Thus, for each $\alpha \in [\alpha_{NR}^{hom}, \alpha_R^{hom}]$, there is a unique $\mu^{hom}(1)\,(\alpha) \in [1/2, \alpha_R^{hom}]$ that satisfies condition equation 20. In particular, $\mu^{hom}(1) = \frac{1}{2}$ for $\alpha = \alpha_{NR}^{hom}$ and $\mu^{hom}(1) = \alpha_R^{hom}$ for $\alpha = \alpha_R^{hom}$. Finally, because F is strictly increasing and the right hand side of equation (20) is a strictly increasing function of α, $\mu^{hom}(1)$ is also a strictly increasing function of α.

The definition of $\mu^{hom}(1)$ as a function of ρ^{hom} is :

$$\mu^{hom}(1) = \frac{\alpha + \rho^{hom}(1-\alpha)}{1+\rho^{hom}}$$

This is a strictly decreasing function of ρ^{hom} so that there is a unique $\rho^{hom} \in [0,1]$ associated with each $\mu^{hom}(1) \in [1/2, \alpha_R^{hom}]$. In particular, $\rho^{hom}\left(\alpha_{NR}^{hom}\right) = 1$ while $\rho^{hom}\left(\alpha_R^{hom}\right) = 0$. Note that μ^{hom} is a strictly decreasing function of ρ^{hom}:

$$\frac{\partial \mu^{hom}(1)}{\partial \rho^{hom}} = \frac{1-2\alpha}{\left(1+\rho^{hom}\right)^2} < 0$$

Because $\mu^{hom}(1)$ is a strictly increasing function of α and ρ^{hom} is a strictly decreasing function of $\mu^{hom}(1)$, ρ^{hom} must be a strictly decreasing function of α.

Consider now the case of an heterogeneous organization. Similarly, the indifference condition becomes:

$$F(\mu(1)\underline{b}) = \frac{\alpha}{1-\alpha}\frac{\underline{B}}{\bar{b}}F(\alpha\bar{b}) \tag{21}$$

This indifference condition implicitly defines, for each $\alpha \in [\alpha_{NR}^{het}, \alpha_R^{het}]$ a unique $\rho^{het} \in [0,1]$. Indeed, the right hand side of equation (21) is strictly increasing in α and goes from $F\left(\frac{b}{2}\right)$ for $\alpha = \alpha_{NR}^{het}$ to $F\left(\alpha_R^{het}\underline{b}\right)$ for $\alpha = \alpha_R^{het}$. The left hand side expression is strictly increasing with $\mu(1)$. Thus, for each $\alpha \in [\alpha_{NR}^{het}, \alpha_R^{het}]$, there is a unique $\mu^{het}(1)(\alpha) \in [1/2, \alpha_R^{het}]$ that satisfies condition equation 20. In particular, $\mu^{het}(1) = \frac{1}{2}$ for $\alpha = \alpha_{NR}^{het}$ and $\mu^{het}(1) = \alpha_R^{het}$ for $\alpha = \alpha_R^{het}$. Finally, because F is strictly increasing and the right hand side of equation (21) is a strictly increasing function of α, $\mu^{het}(1)$ is also a strictly increasing function of α.

As we proved earlier, ρ is a strictly decreasing function of μ. Thus, for each $\alpha \in [\alpha_{NR}^{het}, \alpha_R^{het}]$, there is a unique $\rho^{het} \in [0,1]$ that satisfies equation (21). In particular, $\rho^{het}\left(\alpha_{NR}^{het}\right) = 1$ while $\rho^{het}\left(\alpha_R^{het}\right) = 0$. Finally, note that because $\mu^{het}(1)$ is strictly increasing with α, ρ^{het} is a strictly decreasing function of α.

From equation (20) and (21), using the implicit function theorem[11], we also conclude that μ^{hom} and μ^{het} are continuous functions of α over $[\alpha_{NR}^{hom}, \alpha_R^{hom}]$ and $[\alpha_{NR}^{het}, \alpha_R^{het}]$ respectively.

G Proof of Lemma 3.2

We first prove that $\alpha_{NR}^{\text{hom}} > \alpha_{NR}^{\text{het}}$. Consider $\alpha \geq \alpha_{NR}^{\text{hom}}$. By definition of α_{NR}^{hom}:

$$\alpha F\left(\alpha\underline{b}\right)\underline{B} \geq (1-\alpha)\,F\left(\frac{\bar{b}}{2}\right)\bar{B}$$

But because $\bar{b} > \underline{b}$,this in turn implies that:

$$\alpha F\left(\alpha\bar{b}\right)\underline{B} > (1-\alpha)\,F\left(\frac{\underline{b}}{2}\right)\bar{B}$$

So that $\alpha > \alpha_{NR}^{\text{het}}$. This proves that $\alpha_{NR}^{\text{hom}} > \alpha_{NR}^{\text{het}}$. We then define ρ as the probability that the Decision Maker selects project 1 when signal is 2.

Secondly, we show that $\rho^{\text{hom}} > \rho^{\text{het}}$ when both organization are semi reactive. For $\alpha \in [\frac{1}{2}, \alpha_{NR}^{het}] \cup [\alpha_R^{hom}, 1]$, both organizational forms share the same selection process, so that they share the same reactivity. For $\alpha \in]\alpha_{NR}^{het}, \alpha_{NR}^{hom}]$, the heterogeneous organization is semi-reactive, with non-reactivity[12] $\rho^{het} > 0$ while the homogeneous organization is non-reactive, i.e. $\rho^{hom} = 1 > \rho^{het}$. For $\alpha \in]\alpha_R^{het}, \alpha_R^{hom}[$, the heterogeneous organization is fully reactive, with non-reactivity $\rho^{het} = 0$ while the homogeneous organization is semi-reactive with $\rho^{hom} > 0 = \rho^{het}$.

[11] f is strictly positive over $\mathbb{R}_+$.

[12] Remember that ρ is the probability that the Decision Maker selects project 1 after observing signal 2, so it measures non-reactivity ($\rho = 1$ means non-reactivity while $\rho = 0$ means perfect reactivity).

Finally, there is the possibility that both organizations are in a semi-reactive equilibrium, which happens when $\alpha_{NR}^{hom} \leq \alpha_{R}^{het}$ and for $\alpha \in [\alpha_{NR}^{hom}, \alpha_{R}^{het}]$). In that case, we can write the two indifference conditions 21 and 20 as:

$$\begin{aligned} F\left(\mu^{het}\underline{b}\right) &= \frac{\alpha\underline{B}}{(1-\alpha)\bar{B}}F\left(\alpha\bar{b}\right) \\ &> \frac{\alpha\underline{B}}{(1-\alpha)\bar{B}}F\left(\alpha\underline{b}\right) \\ &= F\left(\mu^{hom}\bar{b}\right) \end{aligned}$$

As F is strictly increasing, this proves that $\mu^{het} > \mu^{hom}$, which in turn implies that: $\rho^{hom} > \rho^{het}$. Thus, there is more reactivity in the heterogeneous organization compared to the homogeneous organization even in the case where both organizations are semi-reactive. This achieves the proof of proposition 3.1 QED

H Proof of proposition 3.3

The proof that $\alpha_{NR}^{j} < \alpha_{R}^{j}$ for $j \in \{het, hom\}$ is direct. When $j = hom$ for instance, if $\alpha < \alpha_{NR}^{hom}$, then: $\alpha F(\alpha\underline{b})\underline{B} < (1-\alpha)F(\frac{\bar{b}}{2})\bar{B} < (1-\alpha)F(\alpha\bar{b})\bar{B}$ so that $\alpha < \alpha_{R}^{hom}$.

Similarly, if $j = hom$ and $\alpha < \alpha^{hom}$, then $\alpha F(\alpha\underline{b})\underline{B} < (1-\alpha)F((1-\alpha)\bar{b})\bar{B} < (1-\alpha)F(\frac{\bar{b}}{2})\bar{B}$ so that $\alpha < \alpha_{NR}^{hom}$. The proofs are similar when $j = het$.

I Proof of proposition 3.4

We first extend the definition of ρ^{hom}:

$$\rho^{hom} = \begin{cases} 0 \quad \text{if } \alpha \geq \alpha_{R}^{hom} \\ \rho^{hom} \quad \text{as defined by equation 20 for } \alpha \in [\alpha_{NR}^{hom}, \alpha_{R}^{hom}] \\ 1 \quad \text{if } \alpha \leq \alpha_{NR}^{hom} \end{cases}$$

One can also extend the definition of ρ^{het} in a similar fashion:

$$\rho^{het} = \begin{cases} 0 \quad \text{if } \alpha \geq \alpha_{R}^{het} \\ \rho^{het} \quad \text{as defined by equation 21 for } \alpha \in [\alpha_{NR}^{het}, \alpha_{R}^{het}] \\ 1 \quad \text{if } \alpha \leq \alpha_{NR}^{het} \end{cases}$$

We note $\mu^{het} = \frac{\alpha+\rho^{het}(1-\alpha)}{1+\rho^{het}}$ and $\mu^{hom} = \frac{\alpha+\rho^{hom}(1-\alpha)}{1+\rho^{hom}}$ the posterior beliefs associated with the extended ρs. We can now write for each α, the Owner's expected profit from the two organizational form:

$$\begin{cases} V^{hom} = \frac{R}{2}.\left(\alpha + (1-\alpha)\rho^{hom}\right)F\left(\mu^{hom}\bar{b}\right) + \frac{R}{2}\alpha(1-\rho^{hom}).F(\alpha\underline{b})R \\ V^{het} = \frac{R}{2}.\left(\alpha + (1-\alpha)\rho^{het}\right)F\left(\mu^{het}\underline{b}\right) + \frac{R}{2}\alpha(1-\rho^{het}).F(\alpha\bar{b})R \end{cases}$$

We begin this proof by showing that the expected profits from both organizational forms are weakly increasing with α. We have shown in Appendix F that both ρ^{hom} and ρ^{het} are strictly decreasing functions of α over $[\alpha_{NR}^{hom}, \alpha_{R}^{hom}]$ and $[\alpha_{NR}^{het}, \alpha_{R}^{het}]$ respectively. However, using the definition of ρ^{het} and ρ^{het} over $[\alpha_{NR}^{hom}, \alpha_{R}^{hom}]$ and

$[\alpha_{NR}^{het}, \alpha_R^{het}]$ respectively, one can show that V^{hom} and V^{het} are strictly increasing functions of α over this interval. The Owner's expected profit from the two organizational forms can be rewritten as:

$$\begin{cases} V^{hom} = \frac{1}{2}.\left(\frac{\alpha \underline{B}}{(1-\alpha)\bar{B}}\left(\alpha + \rho^{hom}(1-\alpha)\right) + \alpha(1-\rho^{hom})\right).F(\alpha\underline{b})R \\ V^{het} = \frac{1}{2}.\left(\frac{\alpha \underline{B}}{(1-\alpha)\bar{B}}\left(\alpha + \rho^{het}(1-\alpha)\right) + \alpha(1-\rho^{het})\right).F(\alpha\bar{b})R \end{cases}$$

These two expressions are clearly increasing in α as their partial derivative in α is positive, while their partial derivative in ρ are negative and ρ is a strictly decreasing function of α.

Over $[1/2, \alpha_{NR}^{hom}]$ (resp. $[1/2, \alpha_{NR}^{het}]$) the homogeneous (resp. heterogeneous) organization's expected profit is independent of α. Over $[\alpha_R^{hom}, 1]$ (resp. $[\alpha_R^{het}, 1]$) the homogeneous (resp. heterogeneous) organization's expected profit is strictly increasing in α, as it is given by: $\frac{\alpha}{2}\left(F(\alpha\bar{b}) + F(\alpha\underline{b})\right)$.

Overall, the expected profit from the two organizational forms is weakly increasing with α.

We now compare the Owner's expected profit from the two organizational forms. To do so, we need to condition the analysis on the existence of a region where both organizations are semi-reactive, which happens when $\alpha_{NR}^{hom} \leq \alpha_R^{het}$.

Assume this is a case: $\alpha_{NR}^{hom} \leq \alpha_R^{het}$. First, over $[\alpha_{NR}^{het}, \alpha_{NR}^{hom}]$, the homogeneous organization is non-reactive, while the heterogeneous organization is semi-reactive. The difference in profit is then strictly increasing with α, as the non-reactive organization's profit are constant with respect to α and the semi-reactive organization's profit are increasing with α (see above). For $\alpha = \alpha_{NR}^{het}$, the heterogeneous organization is non-reactive, so that its expected profit is $\frac{R}{2}F\left(\frac{b}{2}\right)$ and is strictly inferior to the expected profit from the homogeneous non-reactive organization. For $\alpha = \alpha_{NR}^{hom}$, a little computation (using the definition of α_{NR}^{hom} and the indifference condition in the semi-reactive heterogeneous organization) allows us to write the difference in expected profit as:

$$V^{het}(\alpha_{NR}^{hom}) - V^{hom}(\alpha_{NR}^{hom}) = \left(1-\rho^{hom}\right)F(\alpha_{NR}^{hom}\underline{b})\left(\alpha_{NR}^{hom} - \frac{\alpha_{NR}^{hom}\underline{B}}{(1-\alpha_{NR}^{hom})\bar{B}}\left(1-\alpha_{NR}^{hom}\right)\right)$$

But remember we have assumed that $\alpha_{NR}^{hom} \leq \alpha_R^{het}$. Using the definition of this two thresholds, this implies that for $\alpha \in [\alpha_{NR}^{hom}, \alpha_R^{het}]$, $F(\alpha\underline{b}) \geq F(\frac{\bar{b}}{2})$. For $\alpha = \alpha_{NR}^{hom}$, we thus have $\frac{\alpha_{NR}^{hom}\underline{B}}{(1-\alpha_{NR}^{hom})\bar{B}} = \frac{F(\frac{\bar{b}}{2})}{F(\alpha_{NR}^{hom}\underline{b})} \leq 1$.

Therefore: $V^{het}(\alpha_{NR}^{hom}) - V^{hom}(\alpha_{NR}^{hom}) \geq \left(1-\rho^{hom}\right)F(\alpha_{NR}^{hom}\underline{b})\,(2\alpha - 1) > 0$. Thus, the difference in profit is strictly positive in α_{NR}^{hom} and strictly negative in α_{NR}^{het}. By the intermediate value theorem, there must be $\alpha^{\star\star} \in]\alpha_{NR}^{het}, \alpha_{NR}^{hom}[$ such that the heterogeneous organization delivers a higher expected profit than the homogeneous organization on $]\alpha^{\star\star}, \alpha_{NR}^{hom}]$ while the converse is true over $[\alpha_{NR}^{het}, \alpha^{\star\star}[$.

Let $\alpha \in]\alpha_{NR}^{hom}, \alpha_R^{het}[$. Then the two organizations are semi-reactive. Using the indifference conditions 20 and 21 defining the semi-reactive equilibrium, we can write the two expected profits as:

$$\begin{cases} V^{hom} = \frac{1}{2}.\left(\frac{\alpha \underline{B}}{(1-\alpha)\bar{B}}\left(\alpha + \rho^{hom}(1-\alpha)\right) + \alpha(1-\rho^{hom})\right).F(\alpha\underline{b})R \\ V^{het} = \frac{1}{2}.\left(\frac{\alpha \underline{B}}{(1-\alpha)\bar{B}}\left(\alpha + \rho^{het}(1-\alpha)\right) + \alpha(1-\rho^{het})\right).F(\alpha\bar{b})R \end{cases}$$

$\underline{b} < \bar{b}$ and $\rho^{hom} > \rho^{het}$ over $]\alpha_{NR}^{hom}, \alpha_R^{het}[$. Therefore, it is obvious that over this interval: $V^{het} > V^{hom}$.

Let $\alpha \in]\alpha_R^{het}, \alpha_R^{hom}[$. Over this interval, the heterogeneous organization is reactive, while the homogeneous organization is semi-reactive. The expected profit from the two organizational forms are given by:

$$\begin{cases} V^{hom} = \frac{1}{2}. \left(\left(\alpha + \rho^{hom} \left(1-\alpha\right) \right) F \left(\mu^{hom} \bar{b} \right) + \alpha (1-\rho^{hom}) F(\alpha \underline{b}) \right) R \\ V^{het} = \frac{\alpha}{2}. \left(F(\alpha \bar{b}) + F(\alpha \underline{b}) \right) R \end{cases}$$

The difference in expected profit writes:

$$\begin{aligned} 2V^{het} - 2V^{hom} &= \alpha \left(F \left(\alpha \bar{b} \right) - F \left(\mu^{hom} \bar{b} \right) \right) + \rho^{hom} \left(\alpha F(\alpha \underline{b}) - (1-\alpha) F \left(\mu^{hom} \bar{b} \right) \right) \\ &\geq \alpha \left(F \left(\alpha \bar{b} \right) - F(\mu^{hom} \bar{b}) \right) + \rho^{hom} \alpha F(\alpha \underline{b}) \left(1 - \frac{\underline{B}}{\bar{B}} \right) \\ &> 0 \end{aligned}$$

Thus, over $]\alpha_R^{het}, \alpha_R^{hom}[$, the heterogeneous organization delivers a higher expected profit to the Owner than the homogeneous organization.

Finally, over $[\alpha_R^{hom}, 1]$, both organizations are reactive, so that they share the same expected profit.

Now, assume that $\alpha_{NR}^{hom} > \alpha_R^{het}$.

For $\alpha \leq \alpha_{NR}^{het}$, both organizations are non-reactive, so that the homogeneous organization has a higher value. For $\alpha_{NR}^{het} < \alpha < \alpha_{NR}^{hom}$, the heterogeneous organization is semi-reactive or reactive while the homogeneous organization is non-reactive. As we showed above, the difference in expected profit between the heterogeneous and the homogeneous organization is then increasing with α. For $\alpha = \alpha_{NR}^{het}$, this difference is strictly negative as the heterogeneous organization is still non-reactive. For $\alpha = \alpha_{NR}^{hom}$, the difference in expected profit can be written as:

$$\begin{aligned} 2V^{het} - 2V^{hom} &= \alpha \left(F \left(\alpha \bar{b} \right) - F \left(\frac{\bar{b}}{2} \right) \right) + \left(\alpha F(\alpha \underline{b}) - (1-\alpha) F \left(\frac{\bar{b}}{2} \right) \right) \\ &\geq \alpha \left(F \left(\alpha \bar{b} \right) - F(\frac{\bar{b}}{2}) \right) + \alpha F(\alpha \underline{b}) \left(1 - \frac{\underline{B}}{\bar{B}} \right) \\ &> 0 \end{aligned}$$

Therefore, there must be $\alpha^{\star\star} \in]\alpha_{NR}^{het}, \alpha_{NR}^{hom}[$ such that the heterogeneous organization has strictly higher expected profits over $]\alpha^{\star\star}, \alpha_{NR}^{hom}]$ while the homogeneous organization delivers strictly higher expected profits over $[\alpha_{NR}^{het}, \alpha^{\star\star}[$.

If $\alpha \in [\alpha_{NR}^{hom}, \alpha_R^{hom}$, the homogeneous organization is semi-reactive, while the heterogeneous organization is fully reactive. We proved above that in such a case, the heterogeneous organization had a higher expected profit[13]. Finally, if $\alpha > \alpha_R^{hom}$, both organizations are reactive and have thus the same expected profit.

[13]The proof did not involve the assumption that $\alpha_{NR}^{hom} \leq \alpha_R^{het}$

J Proof of Proposition 3.5

Let us start with the case of an heterogeneous organization. For $\alpha < \alpha^{het}$, the net gain, for the Owner, of having the signal public information is given by the difference between the expected payoff in the model of Section 3, and the basic model of Section 2:

$$\begin{aligned}
\Delta &= \frac{1}{2}.\left[\alpha F(\alpha \underline{b}) + (1-\alpha)F((1-\alpha)\underline{b})\right] - \frac{1}{2}\left[F(\frac{b}{2})\right] \\
&\leqslant \frac{\overline{B}}{2}.\left[F\left(\underbrace{(\alpha^2+(1-\alpha)^2).\underline{b}}_{<\underline{b}/2}\right) - F(\frac{b}{2})\right] \\
&\leqslant 0
\end{aligned}$$

Thus the Owner prefers information asymmetry.

For $\alpha^{het} < \alpha < \alpha^{het}_{NR}$, the net gain for the Owner of having the signal public information is given by:

$$\begin{aligned}
\Delta &= \frac{1}{2}.\left[\alpha F(\alpha \bar{b}) + \alpha F(\alpha \underline{b})\right] - \frac{1}{2}\left[F(\frac{b}{2})\right] \\
&\geqslant \alpha F(\alpha \underline{b}) - \frac{1}{2}\left[F(\frac{b}{2})\right] \\
&\geqslant 0 \text{ as } \alpha > 1/2
\end{aligned}$$

Thus the owner now prefers when the signal is publicly observed.

For $\alpha^{het}_{NR} < \alpha < \alpha^{het}_{R}$, the gain for the Owner of having the signal public information is given by:

$$\begin{aligned}
\Delta &= \frac{1}{2}.\left[\alpha F(\alpha \bar{b}) + \alpha F(\alpha \underline{b})\right] - \\
&\quad \frac{1}{2}\left(\alpha + \rho^{het}(1-\alpha)\right).F\left(\mu^{het}.\underline{b}\right) - \frac{1}{2}\alpha(1-\rho^{het}).F(\alpha \bar{b})
\end{aligned}$$

The above expression can be rewritten as:

$$\Delta = \frac{\alpha \rho^{het}}{2} F(\alpha \bar{b}) + \frac{\alpha}{2}\left[F(\alpha \underline{b}) - F(\mu^{het}\underline{b})\right] - \frac{(1-\alpha)\rho^{het}}{2} F(\mu^{het}.\underline{b})$$

Using the indifference condition (19), we obtain:

$$\begin{aligned}
\Delta &= \left(1 - \frac{\underline{\underline{B}}}{\overline{\overline{B}}}\right)\frac{\alpha \rho^{het}}{2} F(\alpha \bar{b}) + \frac{\alpha}{2}\left[F(\alpha \underline{b}) - F(\mu^{het}\underline{b})\right] \\
&> 0
\end{aligned}$$

Thus the owner strictly prefers when the signal is publicly observed.

For $\alpha^{het}_{R} < \alpha$, both organizations are fully reactive and therefore generate the same expected profits. Thus, for each $\alpha > \alpha^{het}$, the Owner also prefers when the signal is publicly observed .

We now turn to the case of an homogeneous organization: assume first that $\alpha < \alpha^{hom}$. The net gain for the Owner of having the signal public information is given by:

$$\begin{aligned}\Delta &= \frac{1}{2}.\left[\alpha F(\alpha\bar{b}) + (1-\alpha)F((1-\alpha)\bar{b})\right] - \frac{1}{2}\left[F(\frac{\bar{b}}{2})\right] \\ &\leqslant \frac{\overline{B}}{2}.\left[F\left(\underbrace{\alpha^2+(1-\alpha)^2).\bar{b}}_{<\underline{b}/2}\right) - F(\frac{\bar{b}}{2})\right] \\ &\leqslant 0\end{aligned}$$

Thus the owner prefers when the signal remains asymmetric information.

For $\alpha^{hom} < \alpha < \alpha^{hom}_{NR}$, the net gain for the Owner of having the signal public information is given by:

$$\Delta=\frac{1}{2}.\left[\alpha F(\alpha\bar{b}) + \alpha F(\alpha\underline{b})\right] - \frac{1}{2}\left[F(\frac{\bar{b}}{2})\right]$$

which cannot be signed but is an increasing function of α. We define $\widehat{\alpha}^{hom}$ such that: $\alpha > \widehat{\alpha}^{hom} \iff \Delta(\widehat{\alpha}^{hom}) > 0$

For $\alpha^{hom}_{NR} < \alpha < \alpha^{hom}_{R}$, the gain for the Owner of having the signal public information is given by:

$$\begin{aligned}\Delta = &\frac{1}{2}.\left[\alpha F(\alpha\bar{b}) + \alpha F(\alpha\underline{b})\right] - \\ &\frac{1}{2}\left(\alpha+\rho^{hom}(1-\alpha)\right).F\left(\mu^{hom}.\bar{b}\right) - \frac{1}{2}\alpha(1-\rho^{hom}).F(\alpha\underline{b})\end{aligned}$$

The above expression can be rewritten as:

$$\Delta = \frac{\alpha\rho^{hom}}{2}F(\alpha\underline{b}) + \frac{\alpha}{2}\left[F(\alpha\bar{b}) - F(\mu^{hom}\bar{b})\right] - \frac{(1-\alpha)\rho^{hom}}{2}F(\mu^{hom}\bar{b})$$

Using the indifference condition (20), we obtain:

$$\begin{aligned}\Delta &= \left(1-\frac{\underline{B}}{\overline{\overline{B}}}\right)\frac{\alpha\rho^{hom}}{2}F(\alpha\underline{b}) + \frac{\alpha}{2}\left[F(\alpha\bar{b}) - F(\mu^{hom}\bar{b})\right] \\ &> 0\end{aligned}$$

Thus the owner strictly prefers when the signal becomes public information.

For $\alpha^{hom}_{R} < \alpha$, both organizations are fully reactive and therefore generate the same expect profits. Thus, there exists $\widehat{\alpha}^{hom} \in \left[\alpha^{hom};\alpha^{hom}_{NR}\right]$, such that $\alpha > \widehat{\alpha}^{hom}$ if and only if the owner prefers the signal to be public information.

K Proof of Lemma 3.6

If $\alpha > \max(\alpha^{\star}, \alpha^{\star\star})$, then the optimal organization is heterogeneous, whether the signal is public or private information. Also, $\alpha > \alpha^{\star\star} > \alpha^{\text{het}}_{NR}$, which ensures, from Appendix J, that the Owner at least weakly prefers the signal to be public information, i.e. the payoffs from the basic model of Section 2.

If $\alpha < \min(\alpha^{\star}, \alpha^{\star\star})$, then $\alpha < \alpha^{\star} < \alpha^{\text{hom}}_{R}$, which ensures, from Appendix J, that the Owner at least weakly prefers that the signal remains the Decision Maker's private information.

L Proof of Lemma 3.7

We first compute the Decision Maker's reaction function, i.e. the Decision Maker's choice of "transparency" as a function of the organizational form (i.e. heterogeneity vs. homogeneity). For $\alpha < \alpha^{het}$, the net gain for the Decision Maker of having the signal public information is given by the difference between her expected utility in the model of Section 3, and her expected utility in the basic model of Section 2:

$$\begin{aligned}
\Delta &= \frac{1}{2}.\left[\alpha F(\alpha \underline{b}) + (1-\alpha)F((1-\alpha)\underline{b})\right].\overline{B} - \frac{1}{2}\left[F(\frac{\underline{b}}{2})\right].\overline{B} \\
&\leqslant \frac{\overline{B}}{2}.\left[F\left(\underbrace{(\alpha^2+(1-\alpha)^2).\underline{b}}_{<\underline{b}/2}\right) - F(\frac{\underline{b}}{2})\right] \\
&\leqslant 0
\end{aligned}$$

Thus the Decision Maker prefers the signal to remain private information.

For $\alpha^{het} < \alpha < \alpha^{het}_{NR}$, the net gain for the Decision Maker of having the signal public information is given by:

$$\Delta = \frac{1}{2}.\left[\alpha F(\alpha \overline{b}).\underline{B} + \alpha F(\alpha \underline{b}).\overline{B}\right] - \frac{1}{2}\left[F(\frac{\underline{b}}{2})\right]\overline{B}$$

This expression cannot be signed but is an increasing function of α. We define $\widetilde{\alpha}^{het}$) such that $\Delta(\widetilde{\alpha}^{het}) = 0$

For $\alpha^{het}_{NR} < \alpha < \alpha^{het}_{R}$, the gain for the Decision Maker of having the signal public information is given by:

$$\begin{aligned}
\Delta = &\frac{1}{2}.\left[\alpha F(\alpha \overline{b}).\underline{B} + \alpha F(\alpha \underline{b}).\overline{B}\right] - \\
&\frac{1}{2}\left(\alpha + \rho^{het}(1-\alpha)\right).F\left(\mu^{het}.\underline{b}\right).\overline{B} - \frac{1}{2}\alpha(1-\rho^{het}).F(\alpha \overline{b}).\underline{B}
\end{aligned}$$

The above expression can be rewritten as:

$$\Delta = \frac{\alpha \rho^{het}}{2} F(\alpha \overline{b})\underline{B} + \frac{\alpha}{2}\left[F(\alpha \underline{b}) - F(\mu^{het}\underline{b})\right].\overline{B} - \frac{(1-\alpha)\rho^{het}}{2} F(\mu^{het}.\underline{b}).\overline{B}$$

using the indifference condition (19), we obtain:

$$\begin{aligned}
\Delta &= \frac{\alpha}{2}\left[F(\alpha \underline{b}) - F(\mu^{het}\underline{b})\right].\overline{B} \\
&> 0
\end{aligned}$$

Thus the Decision Maker strictly prefers the symmetric information case.

For $\alpha^{het}_{R} < \alpha$, both organizations are fully reactive and therefore generate the same expect profits. Thus, for each $\alpha > \widetilde{\alpha}^{het} \geqslant \alpha^{het}$, the Decision Maker prefers information symmetry.

We now turn to the case of an homogeneous organization. We first assume that $\alpha < \alpha^{hom}$. In this case, the net gain for the Decision Maker of having the signal public information is given by:

$$\begin{aligned}\Delta &= \frac{1}{2}.\left[\alpha F(\alpha\bar{b}).\overline{B}+(1-\alpha)F((1-\alpha)\bar{b}).\overline{B}\right]-\frac{1}{2}\left[F(\frac{\bar{b}}{2})\right].\overline{B}\\ &\leqslant \frac{\overline{B}}{2}.\left[F\left(\underbrace{\alpha^2+(1-\alpha)^2).\bar{b}}_{<\underline{b}/2}\right)-F(\frac{\bar{b}}{2})\right].\overline{B}\\ &\leqslant 0\end{aligned}$$

Thus the Decision Maker prefers the signal to remain private information.

For $\alpha^{hom}<\alpha<\alpha^{hom}_{NR}$, the net gain for the Decision Maker of having the signal public information is given by:

$$\Delta=\frac{1}{2}.\left[\alpha F(\alpha\bar{b}).\overline{B}+\alpha F(\alpha\underline{b}).\underline{B}\right]-\frac{1}{2}\left[F(\frac{\bar{b}}{2})\right].\overline{B}$$

This expression cannot be signed but is an increasing function of α. We define $\widetilde{\alpha}^{hom}$ such that $\Delta(\widetilde{\alpha}^{hom})=0$. It is straightforward to see that: $\widetilde{\alpha}^{hom}>\widehat{\alpha}^{hom}$. The Decision Maker exhibits a weaker preference for making the signal public information in an homogeneous organization than in an heterogeneous organization.

For $\alpha^{hom}_{NR}<\alpha<\alpha^{hom}_{R}$, the gain for the Decision Maker of having the signal public information is given by:

$$\begin{aligned}\Delta &= \frac{1}{2}.\left[\alpha F(\alpha\bar{b}).\overline{B}+\alpha F(\alpha\underline{b}).\underline{B}\right]-\\ &\quad\frac{1}{2}\left(\alpha+\rho^{\text{hom}}(1-\alpha)\right).F\left(\mu^{\text{hom}}.\bar{b}\right).\overline{B}-\frac{1}{2}\alpha(1-\rho^{\text{hom}}).F(\alpha\underline{b}).\underline{B}\end{aligned}$$

The above expression can be rewritten as:

$$\Delta=\frac{\alpha\rho^{\text{hom}}}{2}F(\alpha\underline{b}).\underline{B}+\frac{\alpha}{2}\left[F(\alpha\bar{b})-F(\mu^{\text{hom}}\bar{b})\right].\overline{B}-\frac{(1-\alpha)\rho^{\text{hom}}}{2}F(\mu^{\text{hom}}\bar{b}).\overline{B}$$

Using the indifference condition (20), we obtain:

$$\begin{aligned}\Delta &= \frac{\alpha}{2}\left[F(\alpha\bar{b})-F(\mu^{\text{hom}}\bar{b})\right].\overline{B}\\ &> 0\end{aligned}$$

thus the Decision Maker strictly prefers that the signal be made public information.

For $\alpha^{\text{hom}}_{R}<\alpha$, both organizations are fully reactive and therefore generate the same expect profits. Thus, for each $\alpha>\widetilde{\alpha}^{\text{hom}}\geqslant\widehat{\alpha}^{\text{hom}}$, the Decision Maker prefers information symmetry.

We look for the Nash equilibrium between the Owner (who selects the organizational form (i.e. homogeneity vs. heterogeneity)) and the Decision Maker (who selects "transparency", i.e. whether the signal is made public information or not).

We are now ready to prove Lemma 3.7. If $\alpha>\max(\alpha^{\star},\alpha^{\star\star})$, then the optimal organization is heterogeneous, whatever the level of transparency. So this is the dominant strategy for the Owner. Also, $\alpha>\alpha^{\star\star}>$

α_{NR}^{het}, which ensures, from Appendix J, that the Decision Maker at least weakly prefers when the signal is public information. So part 1 of Lemma 3.7 is a Nash equilibrium.

If $\alpha < \min(\alpha^{\star}, \alpha^{\star\star})$, then the Owner chooses homogeneity as a dominant strategy. $\alpha < \alpha^{\star} < \alpha^{hom}$, which ensures, from Appendix J, that, conditionally on the Owners selecting homogeneity, the Decision Maker prefers that the signal remains her private information. Part 2 of Lemma 3.7 is thus a Nash Equilibrium.

M Proof of proposition 4.1

Consider first the model of section 2.1. For $\alpha \leq \alpha^{het}$, both organizational forms are non-reactive. The Decision Maker then clearly prefers the homogeneous organization, as it has the most intrinsically motivated Implementer. For $\alpha \geq \alpha^{hom}$, both organizations are reactive and thus delivers the following expected utility for the Decision Maker:

$$\begin{cases} V^{het} = \dfrac{\alpha}{2}\left(F(\alpha\bar{b})\underline{B} + F(\alpha\underline{b})\bar{B}\right) \\ V^{hom} = \dfrac{\alpha}{2}\left(F(\alpha\underline{b})\underline{B} + F(\alpha\bar{b})\bar{B}\right) \end{cases}$$

Therefore, $V^{hom} - V^{het} = \frac{\alpha}{2}\left(F(\alpha\bar{b}) - F(\alpha\underline{b})\right)\left(\bar{B} - \underline{B}\right) > 0$.

Finally, when $\alpha \in \left[\alpha^{het}, \alpha^{hom}\right]$, the heterogeneous organization is reactive, while the homogeneous organization is non-reactive. The two organizational forms provide the Decision Maker with expected utility:

$$\begin{cases} V^{het} = \dfrac{\alpha}{2}\left(F(\alpha\bar{b})\underline{B} + F(\alpha\underline{b})\bar{B}\right) \\ V^{hom} = \dfrac{1}{2}\left((1-\alpha)F((1-\alpha)\bar{b})\bar{B} + \alpha F(\alpha\bar{b})\bar{B}\right) \end{cases}$$

We know, however, that the homogeneous organization is non-reactive, so that: $(1-\alpha)F((1-\alpha)\bar{b})\bar{B} \geq \alpha F(\alpha\underline{b})\underline{B}$. Thus:

$$V^{hom} - V^{het} \geq = \frac{\alpha}{2}\left(F(\alpha\bar{b}) - F(\alpha\underline{b})\right)\left(\bar{B} - \underline{B}\right) > 0$$

Consider now the model of section 3 and let us assume first that $\alpha_{NR}^{hom} < \alpha_{R}^{het}$. This corresponds to the case where the threshold $\alpha^{\star\star}$ trades-off the non-reactive homogeneous organization with the semi-reactive heterogeneous organization.

1. For $\alpha \leq \alpha_{NR}^{het}$, both organizations are non-reactive and provide the Decision Maker with the following utility:

$$\begin{cases} 2W^{het} = F(\frac{\underline{b}}{2})\bar{B} \\ 2W^{hom} = F(\frac{\bar{b}}{2})\bar{B} \end{cases}$$

   So that the Decision Maker clearly selects the homogeneous organization.

2. For $\alpha_{NR}^{hom}\alpha \geq \alpha_{NR}^{het}$, the homogeneous organization is non-reactive while the heterogeneous organization is semi-reactive. Using the Decision Maker indifference condition in the heterogeneous organization, we find that for such levels of signal precision:

$$\begin{cases} 2W^{het} = \dfrac{\alpha}{1-\alpha}F(\alpha\bar{b})\underline{B} \\ 2W^{hom} = F(\frac{\bar{b}}{2})\bar{B} \end{cases}$$

$\Delta W(\alpha) = 2W^{het}(\alpha) - 2W^{hom}(\alpha)$ is thus an increasing function of α. We know from case 1 that $\Delta W(\alpha_{NR}^{het}) < 0$ and we have $\Delta W(\alpha_{NR}^{hom}) = \frac{\alpha}{1-\alpha}F(\alpha\bar{b})\underline{B} - \frac{\alpha}{1-\alpha}F(\alpha\underline{b})\underline{B} > 0$ using the definition of α_{NR}^{hom}. Therefore, there is $\breve{\alpha}_1 \in [\alpha_{NR}^{het}, \alpha_{NR}^{hom}]$ such that $\Delta W > 0$ if and only if $\alpha > \breve{\alpha}_1$. Thus, when $\alpha_{NR}^{hom}\alpha \geq \alpha_{NR}^{het}$, the Decision Maker selects the heterogeneous organization if and only if $\alpha > \breve{\alpha}_1$. We note that $\Delta W(\alpha^{\star\star} < 0$ so that $\breve{\alpha}_1 > \alpha^{\star\star}$.

3. For $\alpha_R^{het}\alpha \geq \alpha_{NR}^{hom}$, both organizations are semi-reactive, yielding the following utility to the Decision Maker:

$$\begin{cases} 2W^{het} = \dfrac{\alpha}{1-\alpha}F(\alpha\bar{b})\underline{B} \\ 2W^{hom} = \dfrac{\alpha}{1-\alpha}F(\alpha\underline{b})\underline{B} \end{cases}$$

Clearly, the Decision Maker prefers the heterogeneous organization when $\alpha_R^{het}\alpha \geq \alpha_{NR}^{hom}$.

4. For $\alpha_R^{hom}\alpha \geq \alpha_R^{het}$, the heterogeneous organization is reactive while the homogeneous organization is semi-reactive. This leaves the Decision Maker with the following utility:

$$\begin{cases} 2W^{het} = \alpha F(\alpha\underline{b})\bar{B} + \alpha F(\alpha\bar{b})\underline{B} \\ 2W^{hom} = \dfrac{\alpha}{1-\alpha}F(\alpha\underline{b})\underline{B} \end{cases}$$

Introduce as before: $\Delta W(\alpha) = 2W^{het}(\alpha) - 2W^{hom}(\alpha)$. We know from the previous case that $\Delta W(\alpha_R^{het}) > 0$. When $\alpha = \alpha_R^{hom}$, we have $2W^{hom}(\alpha_R^{hom}) = \alpha F(\alpha\bar{b})\bar{B} + \alpha F(\alpha\underline{b})\underline{B} > 2W^{het}(\alpha_R^{hom})$. Therefore, $\Delta W(\alpha_R^{hom}) < 0$. Thus there exists $alp\breve{h}a_2 \in [\alpha_R^{hom}, \alpha_R^{het}]$ such that $\Delta W(\breve{\alpha}_2) = 0$.

We have:

$$\begin{aligned} \Delta W'(\breve{\alpha}_2) &= \underbrace{\left(F(\breve{\alpha}_2\underline{b})\bar{B} + F(\breve{\alpha}_2\bar{b})\underline{B}\right)}_{=\frac{F(\breve{\alpha}_2\underline{b})}{1-\breve{\alpha}_2}\underline{B}} - \frac{1}{(1-\breve{\alpha}_2)^2}F(\breve{\alpha}_2\underline{b})\underline{B} \\ &\quad + \breve{\alpha}_2\underline{b}f(\breve{\alpha}_2\underline{b})\bar{B} + \breve{\alpha}_2\bar{b}f(\breve{\alpha}_2\bar{b})\underline{B} - \frac{\breve{\alpha}_2\underline{b}}{1-\breve{\alpha}_2}f(\breve{\alpha}_2\underline{b})\underline{B} \\ &= \breve{\alpha}_2\underline{b}f(\breve{\alpha}_2\underline{b})\bar{B} + \breve{\alpha}_2\bar{b}f(\breve{\alpha}_2\bar{b})\underline{B} - \frac{\breve{\alpha}_2}{(1-\breve{\alpha}_2)^2}F(\breve{\alpha}_2\underline{b})\underline{B} - \frac{\breve{\alpha}_2\underline{b}}{1-\breve{\alpha}_2}f(\breve{\alpha}_2\underline{b})\underline{B} \end{aligned}$$

But we know, using the definition of $\breve{\alpha}_2$ that $\underline{B} > (1-\breve{\alpha}_2)\bar{B}$ and $F(\breve{\alpha}_2\underline{b}) > (1-\breve{\alpha}_2)F(\breve{\alpha}_2\bar{b})$so that:

$$\begin{aligned} \Delta W'(\breve{\alpha}_2) &< \breve{\alpha}_2\underline{b}f(\breve{\alpha}_2\underline{b})\bar{B} + \breve{\alpha}_2\bar{b}f(\breve{\alpha}_2\bar{b})\underline{B} - \frac{\breve{\alpha}_2}{1-\breve{\alpha}_2}F(\breve{\alpha}_2\bar{b})\underline{B} - \breve{\alpha}_2\underline{b}f(\breve{\alpha}_2\underline{b})\bar{B} \\ &< \breve{\alpha}_2\bar{b}f(\breve{\alpha}_2\bar{b})\underline{B} - \frac{\breve{\alpha}_2}{1-\breve{\alpha}_2}F(\breve{\alpha}_2\bar{b})\underline{B} \\ &< \breve{\alpha}_2\bar{b}f(\breve{\alpha}_2\bar{b})\underline{B} - F(\breve{\alpha}_2\bar{b})\underline{B} \\ &< 0 \end{aligned}$$

Therefore, we conclude that ΔW crosses 0 once and only once over $[\alpha_R^{hom}, \alpha_R^{het}]$, and that this happens in $\breve{\alpha}_2$. Thus, when $\alpha_R^{hom}\alpha \geq \alpha_R^{het}$, the Decision Maker selects the heterogeneous organization if and only if $\alpha < \breve{\alpha}_2$.

5. Finally, when $\alpha > \alpha_R^{hom}$, both organizations are reactive. They deliver the following utility to the Decision Maker:

$$\begin{cases} 2W^{het} = \alpha F(\alpha\underline{b})\bar{B} + \alpha F(\alpha\bar{b})\underline{B} \\ 2W^{hom} = \alpha F(\alpha\underline{b})\underline{B} + \alpha F(\alpha\bar{b})\bar{B} \end{cases}$$

And clearly, the Decision Maker then selects the homogeneous organization.

The proof of proposition 4.1 when $\alpha_{NR}^{hom} < \alpha_R^{het}$ is left to the reader.

N Proof of proposition 4.2

1. Let us first show points 1. and 2. The expected profit of the reactive heterogeneous and the non-reactive homogeneous organizations are given by:

$$\begin{aligned} V_R^{het} &= \frac{1}{2}\left[\alpha F(\alpha\bar{b}) + \alpha F(\alpha\underline{b})\right].R \\ V_{NR}^{hom} &= \frac{1}{2}\left[\alpha F(\alpha\bar{b}) + (1-\alpha)F((1-\alpha)\bar{b})\right].R \end{aligned}$$

The Implementers' expected utility in each of these organizations is given by:

$$\begin{aligned} U_R^{het} &= \frac{1}{2}\left[\alpha F(\alpha\bar{b}).\bar{b} - \int_0^{\alpha\bar{b}} cdF(c) + \alpha F(\alpha\underline{b}).\underline{b} - \int_0^{\alpha\underline{b}} cdF(c)\right] \\ U_{NR}^{hom} &= \frac{1}{2}\left[\alpha F(\alpha\bar{b}).\bar{b} - \int_0^{\alpha\bar{b}} cdF(c) + (1-\alpha)F((1-\alpha)\bar{b}).\bar{b} - \int_0^{(1-\alpha)\bar{b}} cdF(c)\right] \end{aligned}$$

We thus compute the joint surplus generated by both the homogeneous and the heterogeneous organization:

$$\begin{aligned} S_R^{het} &= \frac{1}{2}\left[\alpha F(\alpha\bar{b}).\left(R+\bar{b}\right) - \int_0^{\alpha\bar{b}} cdF(c) + \alpha F(\alpha\underline{b}).\left(R+\underline{b}\right) - \int_0^{\alpha\underline{b}} cdF(c)\right] \\ S_{NR}^{hom} &= \frac{1}{2}\left[\alpha F(\alpha\bar{b}).\left(R+\bar{b}\right) - \int_0^{\alpha\bar{b}} cdF(c) + (1-\alpha)F((1-\alpha)\bar{b}).\left(R+\bar{b}\right) - \int_0^{(1-\alpha)\bar{b}} cdF(c)\right] \end{aligned}$$

Assume $\alpha \in [\alpha^{het}, \alpha^{hom}]$. If the joint surplus from the non-reactive homogeneous organization is higher that the joint surplus from the reactive heterogeneous organization, then the Implementers naturally end up in an homogeneous organization, which, because $\alpha \in [\alpha^{het}, \alpha^{hom}]$, is indeed non-reactive (see proposition 2.3). Conversely, if $S_{NR}^{hom} < S_R^{het}$, then the Implementers will end up in heterogeneous organizations, which happen to be reactive in this range of α. Thus, there will be only homogeneous organizations at equilibrium if and only if $S_{NR}^{hom} > S_R^{het}$:

$$\begin{aligned} \int_0^{\alpha\underline{b}} \left[\alpha\left(R+\underline{b}\right) - c\right].dF(c) \quad &< \quad \int_0^{(1-\alpha)\bar{b}} \left[(1-\alpha).\left(R+\bar{b}\right) - c\right].dF(c) \\ &\Longleftrightarrow \quad \alpha < \widehat{\alpha} \end{aligned} \tag{22}$$

It appears from the above expression that $\widehat{\alpha} \in [1/2; 1]$. If $\widehat{\alpha} < \alpha^{het}$, then the homogeneous organization is never an equilibrium on $[\alpha^{het}; \alpha^{hom}]$. If on the contrary, $\widehat{\alpha} > \alpha^{hom}$, it always is. Finally, if $\widehat{\alpha} \in [\alpha^{het}, \alpha^{hom}]$, then we have part 1 and 2 of proposition 4.2.

2. We move to point 3. Let us assume that $\widehat{\alpha} \geqslant \alpha^{hom}$. This implies:

$$\frac{\widehat{\alpha}.F(\widehat{\alpha}\underline{b})}{(1-\alpha\widehat{\alpha}).F((1-\widehat{\alpha}).\underline{b})} \geqslant \frac{\overline{B}}{\underline{B}}$$

while, from condition (22) we can write the definition of $\widehat{\alpha}$ such that:

$$\frac{\widehat{\alpha}.F(\widehat{\alpha}\underline{b})}{(1-\widehat{\alpha}).F((1-\widehat{\alpha}).\underline{b})} = \frac{(R+\bar{b}) - E(\widetilde{c}/(1-\widehat{\alpha})|\widetilde{c} < (1-\widehat{\alpha}).\bar{b})}{(R+\underline{b}) - E(\widetilde{c}/\widehat{\alpha}|\widetilde{c} < \widehat{\alpha}\underline{b})} \tag{23}$$

It is straightforward to see that $E(\widetilde{c}/(1-\widehat{\alpha})|\widetilde{c} < (1-\widehat{\alpha}).\bar{b}) < \bar{b}$ and $E(\widetilde{c}/\widehat{\alpha}|\widetilde{c} < \widehat{\alpha}\underline{b}) < \underline{b}$. As $R \longrightarrow \infty$, both conditional expectations are bounded above which means that the right hand side of (23) tends toward 1. Thus, there exists $\widehat{R}$ large enough such that, for $R > \widehat{R}$, the RHS of (23) is smaller than $\overline{B}/\underline{B}$. In this case, $\widehat{\alpha}$ has to be strictly smaller than α^{hom}. Hence there then exists a non zero interval $[\widehat{\alpha}; \alpha^{hom}]$ for which heterogeneous organizations survive in equilibrium.

3. Last, we show that $\widehat{\alpha} > \alpha^\star$. Integrating $cF(c)$ by part in expression (22) leads to:

$$\begin{aligned} \alpha &< \widehat{\alpha} \Longleftrightarrow \\ R.\left[\alpha F(\alpha \underline{b}) - (1-\alpha) . F((1-\alpha)\,\bar{b})\right] &< \int_{\alpha \underline{b}}^{(1-\alpha)\bar{b}} F(c)dc \end{aligned}$$

the left hand side of the above expression is equal to zero for $\alpha = \alpha^\star$ by definition of $\alpha^\star$. Thus:

$$\begin{aligned} \alpha^\star &< \widehat{\alpha} \\ &\Longleftrightarrow \quad 0 < \int_{\alpha^\star \underline{b}}^{(1-\alpha^\star)\bar{b}} F(c)dc \\ &\Longleftrightarrow \quad \alpha^\star < \frac{\bar{b}}{\bar{b}+\underline{b}} \end{aligned}$$

By definition of $\alpha^\star$:

$$\begin{aligned} z &> \alpha^\star \\ &\Longleftrightarrow \quad z.F(z\underline{b}) > (1-z).F((1-z)\bar{b}) \end{aligned}$$

Thus:

$$\begin{aligned} \frac{\bar{b}}{\bar{b}+\underline{b}} &> \alpha^\star \\ &\Longleftrightarrow \quad \bar{b} > \underline{b} \end{aligned}$$

which always holds.

O Proof of proposition 5.1

We first introduce two notations:

$$\begin{aligned} \mu &= \frac{(1-\theta)\alpha}{(1-\theta)\alpha + (1-\alpha)\theta} = \mathbb{P}(s=2|\sigma=2) \\ \eta &= \frac{\theta\alpha}{\theta\alpha + (1-\alpha)(1-\theta)} = \mathbb{P}(s=1|\sigma=1) \end{aligned}$$

where it is easy to see that $\eta > \mu$ and $\eta > 1-\mu$.

Let us first consider the two homogeneous organizations. In a status-quo biased, homogeneous, organization, reactivity emerges if and only if:

$$\begin{aligned} \mu F(\mu\underline{b})\underline{B} &> (1-\mu).F((1-\mu)\bar{b})\overline{B} \\ &\Leftrightarrow \quad \mu > \frac{\bar{b}}{\bar{b}+\underline{b}} \end{aligned} \tag{24}$$

Condition 24 alone defines reactivity as, in any case, project 1 is always selected by the Decision Maker after signal 1 has been observed. An homogeneous, change biased, organization is reactive the following two conditions are met:

$$\begin{cases} \mu F(\mu\bar{b})\bar{B} \geq (1-\mu).F((1-\mu)\underline{b})\underline{B} \Leftrightarrow \alpha \geq \alpha_{T1} \\ \eta F(\eta\underline{b})\underline{B} \geq (1-\eta).F((1-\eta)\bar{b})\bar{B} \Leftrightarrow \alpha \geq \alpha_{T2} \end{cases}$$

We have used the fact that μ and η are both increasing functions of α. Assume that $\alpha = \alpha_{T1}$, then: $\mu F(\mu\bar{b})\bar{B} = (1-\mu).F((1-\mu)\underline{b})\underline{B}$. But because $\eta > 1-\mu$ and $\mu > 1-\eta$, this implies: $\eta F(\eta\underline{b})\underline{B} > (1-\eta).F((1-\eta)\bar{b})\bar{B}$, i.e. $\alpha > \alpha_{T2}$, thus $\alpha_{T1} > \alpha_{T2}$ and only the first equation defines the reactive equilibrium in this organization.

Note that when the change biased homogeneous organization is not reactive, its Decision Maker always selects the change project, i.e. project 2.

Obviously, if a status-quo biased homogeneous organization is reactive, then a change biased homogeneous organization is also reactive.

We now show that the pro change organization is always less profitable than the status-quo biased organization. Let us first consider the case where the status-quo biased organization is reactive. In this case, both organizations are reactive so the profit functions are given by:

$$\begin{cases} V^{hom}_{change} = \theta\alpha F(\eta\underline{b}) + (1-\theta)\alpha F(\mu\bar{b}) \\ V^{hom}_{status-quo} = \theta\alpha F(\eta\bar{b}) + (1-\theta)\alpha F(\mu\underline{b}) \end{cases}$$

Thanks to assumption 12, and using $\eta > \mu$, it is easy to prove that in that case, $V^{hom}_{status-quo} > V^{hom}_{change}$

We now move to the case where the status-quo biased and the changed biased homogeneous organizations are non-reactive. The status-quo biased organization is given by:

$$V^{hom}_{status-quo} = \theta\left(\alpha F(\eta\bar{b}) + (1-\alpha)F((1-\mu)\underline{b})\right)$$

The change biased non reactive organization eitherIt is easy to check that there is no equilibrium in which the Decision Maker would select project 1 after signal 2 and project 2 after signal 1:

1. always selects project 1 in which case its expected profit is: $V^{hom}_{change} = \theta\left(\alpha F(\eta\underline{b}) + (1-\alpha)F((1-\mu)\bar{b})\right)$, and is always lower that the expected profit of the status-quo biased non-reactive organization or
2. it always selects project 2, in which case its expected profit is: $V^{hom}_{change} = (1-\theta)\left(\alpha F(\mu\bar{b}) + (1-\alpha)F((1-\eta)\underline{b})\right)$. In that case, $\theta > 1-\theta$ and condition 12 ensures that this profit is also lower that the expected profit of the status-quo biased non-reactive organization.

Finally, we need to consider the case where the change biased homogeneous organization is reactive while the status-quo biased homogeneous organization is non-reactive. Expected profits are then given by:

$$\begin{cases} V^{hom}_{change} = \theta\alpha F(\eta\underline{b}) + (1-\theta)\alpha F(\mu\bar{b}) \\ V^{hom}_{status-quo} = \theta\left(\alpha F(\eta\bar{b}) + (1-\alpha)F((1-\mu)\underline{b})\right) \end{cases}$$

Here again, thanks to assumption 12, and using $\eta > \mu$, it is easy to prove that in that case, $V^{hom}_{status-quo} > V^{hom}_{change}$.

We now consider the two different heterogeneous organizations. When the Implementer is status-quo biased (and thus the Decision Maker is change biased), the two reactivity conditions are now:

$$\begin{cases} \eta.F(\eta\bar{b})\underline{B} > (1-\eta).F((1-\eta)\underline{b})\bar{B} \\ \mu.F(\mu\underline{b})\overline{B} > (1-\mu).F((1-\mu)\bar{b})\underline{B} \end{cases}$$

We leave it to the reader to show that the heterogeneous organization where the Decision Maker is change biased always delivers a (weakly) higher expected profit than the heterogeneous organization where the Decision Maker is status-quo biased.

We have thus proved that the optimal organization is either (1) an homogeneous organization with a status-quo biased Decision Maker and Implementer or (2) an heterogeneous organization with a change biased Decision Maker and a status-quo biased Implementer. Both organizations features a status-quo biased Implementer.

Define α^{het}_{change} the threshold above which the heterogeneous organization with a change biased Decision Maker becomes reactive. Similarly, define $\alpha^{hom}_{status-quo}$ the threshold above which the homogeneous organization with a status-quo biased Decision Maker is reactive.

For $\alpha > \alpha^{hom}_{status-quo}$, both organizations have the same expected profit as they are both reactive and have an Implementer with similar preferences. For $\alpha < \alpha^{het}_{change}$, both organizations are non reactive and always implementing 1and thus also deliver the same expected profit as they, again, have an Implementer with similar preferences.

Finally, for $\alpha \in [\alpha^{het}_{change}, \alpha^{hom}_{status-quo}]$, the homogeneous organization is non reactive (and always selects project 1) while the heterogeneous one is reactive. Their expected profit are given by:

$$\begin{cases} V^{hom}_{status-quo} = \theta\left(\alpha F(\eta\bar{b}) + (1-\alpha)F((1-\mu)\bar{b})\right) \\ V^{het}_{change} = \theta\alpha F(\eta\bar{b}) + (1-\theta)\alpha F(\mu\underline{b}) \end{cases}$$

The heterogeneous, reactive organizations has a higher expected profit if and only if:

$$(1-\theta)\alpha F(\mu\underline{b}) - \theta(1-\alpha)F((1-\mu)\bar{b}) \geq 0$$

It is easy to see that this defines an increasing function of α, negative in $\alpha = \alpha^{het}_{change}$ and positive in $\alpha = \alpha^{hom}_{status-quo}$. Thus, there exists $\tilde{\alpha_1}$such that, for $\alpha \in [\tilde{\alpha_1}; \alpha^{hom}_{status-quo}]$,the heterogeneous, reactive, organization has higher expected profit.

We defer the reader to our working version paper (Landier et al. [2007]) for the proof that $\alpha^{hom}_{status-quo}$ and $\tilde{\alpha_1}$ are increasing functions of θ.