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Resting on Laurels:
A Theory of Inertia in Organizations

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Abstract

We present a model where the employees of a firm have to search for profitable business projects in a changing environment. Employees who have found a successful project in the past period are shown to be reluctant to search for new and better projects leading to corporate inertia. This reduces the firm’s profits in the present period. Still, inertia can in some situations increase overall profits, because it raises the employees’ initial incentive to find successful projects. Reorganization and gradually reducing control over the employees’ search efforts are means to overcome inertia. However, optimal policies are not always time-consistent. This leads to too much reorganization and to too little control reduction when the firm has no commitment power.

JEL Codes: L2, M12, M54, O31, O32.

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1 Introduction

Business history is full of examples of successful firms that faced with a new challenge were unable to change and lost their market leadership. To mention but two examples: At the end of the sixties Firestone was one of the leading tire producers in the US. As Michelin introduced the superior radial tire, Firestone was too slow to leave bias tires behind and fell into deep financial trouble before finally being bought by Japanese Bridgestone (see Sull, 1999). Laura Ashley had initially great success with its romantic garb, but experienced declining demand as more women joined the workforce. Also Laura Ashley waited too long to adjust its business concept and entered a decade of red figures on the bottom line. Researchers confirm the importance of entrants for innovation. Scherer (1980) writes that "... new entrants contribute a disproportionately high share of all really revolutionary new industrial products and processes. [p. 438]" Tushman and Anderson (1986), Ghemawat (1991), and Christensen (1997) argue that incumbents are able to exploit incremental improvements but often miss opportunities outside their core businesses.

Reinganum (1983) points out that the high R&D activity by entrants may be explained by profit maximizing behavior of the firms. Incumbents have smaller marginal benefits from innovating than entrants since doing so cannibalizes existing profits. As a consequence, incumbents invest less in R&D than entrants and are thus less likely to innovate. Gilbert and Newbery (1982) claim, however, that incumbents may actually find it optimal to overinvest in R&D in order to preempt entry.

Whereas the economics literature on the persistence of leadership is primarily concerned with the incentives to invest in R&D created by the market situation, the management literature looks at how success or failure changes the behavior inside the firm taking the incentives created by the market as given. This literature attributes inertia frequently to insufficient information processing of organizations and the subsequent failure to pursue new courses of action. A prominent argument presented here revolves around the idea that individuals do not maximize utility but are content with a satisfying level of achievement (Simon, 1957, p. 204-205, and Simon, 1959). As long as a satisfactory level of performance is reached, no search for new alternatives of action is undertaken. The levels of aspiration are not chosen to maximize utility, but are determined by what is deemed practically attainable at the time. The change of an organization is then mainly an adaptive process rather than one in which improvements are constantly and actively pursued (Cyert and
March, 1963). It is also argued that even if search occurs, bounded rationality of employees leads, among other things, firms to improve matters only locally (for example, Nelson and Winter, 1982, and Levinthal and March, 1993). Firms then make small adjustments to current projects rather than undertake major new ones. As a consequence, firms often fail to react optimally to changes in their environments.

Henderson (1993) attempts to disentangle the components of R&D investment and organizational effects on innovation for a branch of the photolithographic industry. She finds that organizational effects play a significant role in explaining innovativeness by documenting that incumbents’ R&D is less productive than entrants’, at least if the new products involve a significantly innovative design.

In this paper, we present a theory of inertia based on inefficient actions within organizations. Whereas the above organizational arguments for explaining inertia rely on boundedly rational behavior on the side of the employees, our approach builds on standard agency theory and does not make use of any behavioral assumptions. The model is phrased in terms of a firm operating in a market, but the general idea applies to any organization that needs to reinvent itself from time to time due to pressure from, for example, competitors, interest groups, or politicians. We consider a setup where a firm hires an employee for two periods to look for and to implement a profitable business project. The employee receives a private benefit from running a business project, so in the first period she invests effort in finding a good one. If the employee is unlucky in the first period and finds no good project, she will search for one again in the second period. We show that the situation is different when the employee finds a profitable project. Then, the outcome depends on how volatile the environment is. If the environment is stable and the project found in period 1 is likely to be profitable also in period 2, the employee does not search in period 2. Instead, she hopes that the first period project is worth implementing again. Success breeds in this situation inertia: even if a superior project exists, this will not be known to members of the organization. If the environment is sufficiently volatile, the employee always searches in the second period and there is no inertia.

Inertia is costly. We show that it is important to distinguish between the ex-ante and the ex-post cost of inertia. Once the firm and the employee are in the second period (ex-post), the firm will find that the employee tends to invest too little in information acquisition. This means there are circumstances in which the employee does not search
even if the firm would prefer her to. The problem of inertia is less severe from an ex-ante perspective. The reason is that when the employee foresees that she can use a good project in both periods, she will search more extensively in period 1. As a consequence, inertia increases under some circumstances overall profits even if it reduces second period profits. In other words, inertia may be optimal.¹

In the second part of the paper we turn to the question of how and when to avoid inertia. We first consider policies that put pressure on employees to innovate. Specifically, we explicitly analyze reorganization as a means of overcoming inertia. In a reorganization the employees’ tasks are restructured in the second period. This forces all employees, including those who were successful in the first period, to look for a profitable project in their new area of responsibility. Microsoft, for example, reorganizes the corporation every second year to change outmoded structures and to challenge ‘comfortable people’ as Bill Gates puts it (Executive Excellence, Dec. 2000). We show that the firm can benefit from reorganizing in the second period. Still, if the firm cannot credibly promise to not reorganize, it risks changing the organization too often. This dilutes the employees’ incentive to find a good project in the first period and may reduce profits.

A reorganization is not the only way to fight inertia. We show in a second application that a stepwise decrease in restrictions for the employee may increase search and reduce inertia. The idea is the following: The employee is in the first period only allowed to look for projects that fit well into the firm’s business strategy. These are projects that have a high payoff to the firm but may not be the employee’s most preferred projects. The employee is, if successful in the first period, allowed to search in a wider class of projects, reflecting what we call reduced control. She can therefore look for the projects in the second period that fit her interests best. This could, for example, be projects that allow her to learn a new technology or to signal her ability to other firms. A reduction in control can overcome inertia, because the employee is tempted by the possibility of implementing a favored project. Thus, she searches for a new project in situations where she otherwise would not have. Reduced control in the second period solves the problem of inertia by rewarding the employee in the second period rather than ‘sticking’ her, so she searches harder in both the first and second period (unlike in the case with a reorganization). The cost of not keeping the employee on a short leash is that she searches for projects that

¹The tension between ex-ante and ex-post efficiency in the provision of incentives arises in many different economic situations, see, e.g., Cremer (1995) and Schmidt (1996).
are close to her interests, but not necessarily to those of the firm. We determine the circumstances under which the firm benefits from reducing the control over the employee’s actions and show that a firm with no commitment technology available tends to keep too much control.

We are not the first to study formally how the pressure from the market affects the incentives inside the firm. Holmström (1982) and Nalebuff and Stiglitz (1983) show that the performance of competitors provide information that can be used when contracting with a manager. Hart (1983) and Schmidt (1997) study how the degree of competition in the market affects the optimal managerial contract. These papers consider static setups and do not address the issue of inertia, which is dynamic in nature.

There are a few recent papers that develop complementary theories of inertia in organizations. Carrillo and Gromb (2002) study how diverse an organization should be in terms of the characteristics of the employees. They show that homogenous firms are less likely to undertake a radical change in their culture. This makes homogenous firms less flexible, but encourages at the same time culture specific investments. Insofar as the leading firms in the market are the ones with a homogenous culture, well-adjusted to current market conditions, this would be a competing explanation of why successful firms fail to change. Schaefer (1998) explains inertia as the result of influence costs. There are rents up for grabs when an organization changes, so employees get involved in rent-seeking behavior. This leads to inertia by increasing the cost of change. The paper perhaps closest to ours is Szalay (2001), which we discuss in more detail after presenting the model.

To facilitate comparability with the literature, we adopt a setup whose structure displays similarities with Aghion and Tirole’s (1997) model on authority in organizations. One of the differences between the approaches is that the model presented here is — although being simpler in each individual period — dynamic.

The paper is organized as follows: Section 2 presents the basic model and discusses it. Section 3 presents the analysis of corporate reorganizations to reduce inertia and section 4 studies the effects of reducing control. Section 5 discusses our contractual assumptions and section 6 contains some concluding remarks.
2 A Model of Organizational Inertia

In each of two periods, $t = 1, 2$, a firm can pursue one of infinitely many ex-ante identical projects of one period duration, $\mathcal{F} = \{1, 2, \ldots\}$. The projects we have in mind are not limited to new products but also includes improvements of the production process, marketing, or distribution. In each period only one of the projects is of positive value. This project is denoted by $x^*_t$. All other projects have non-positive values both for the firm and the employee.

An employee is hired to acquire information in order to identify $x^*_t$ and to implement the project, if a project is pursued. It is assumed that the employee is hired for two periods. The employee’s information acquisition yields a signal about $x^*_t$, $\hat{x}_t$. The signal is correct with probability $q_t$ and incorrect with probability $1 - q_t$. If the signal is incorrect, each of the projects with non-positive values are signalled with equal probability. Since there are infinitely many projects, this means that each of these projects is signalled with probability zero. Information acquisition is costly for the employee. Her private cost depends on the expected quality of the signal and is given by $\frac{1}{2} \gamma q_t^2$.

After the project is selected, the employee observes whether the project is of positive value or not. The employee has no interest in pursuing a project with non-positive value, and reveals the value of the project truthfully. If the project with a positive value is selected, it is fully implemented. In contrast, a project with non-positive value is scaled down to a minimum (a switch to a different project is impossible at this stage, however). If the project is scaled down to the minimum, the payoffs of both the firm and the employee are assumed to be zero.

The employee is integral to any full project implementation. Therefore, she obtains $b$ as a control rent and/or an informational rent. For example, this could be the employee’s compensation if it is costly to replace her at this point, because of an informational lock-in. Alternatively, it could be that the employee runs the project in a way that is best for her career rather than what is in the best interest of the firm’s owners. The value to the firm of a fully implemented project is $B$. We treat the above parameters $b$ and $B$ as exogenous and identical in each period. This assumption is relaxed in Appendix B that considers a complete contracts setup. Section 5 contains a summary of the analysis in Appendix B.

The project that has positive value in period 1 may not be a positive value project in period 2. The optimal projects in the two periods are not identical with probability
\( \alpha \in [0,1] \). \( \alpha \) thus characterizes the volatility of the firm’s environment. We can think of it as a change in the consumers’ taste or the technology frontier that requires a major redirection of the firm’s activities. We will refer to \( \alpha \) as the ‘volatility’ of the firm’s environment or the ‘external pressure’ for a firm that has implemented a profitable project.

We assume that all players are risk neutral and impose the following parametric restriction on \( \gamma \) to exclude any corner solutions:

\[
A.1. \quad \gamma \geq \max\{b + b/\sqrt{2}, b/2 + \sqrt{2B^2 - b^2}\}.
\]

### 2.1 The Second Period

At the beginning of the second period, there are two possible states of nature, \( j \): the first period project was a success (\( s \)), i.e. \( x^*_1 \) was implemented, or the selected project was a failure (\( f \)). Please note that \( x^*_2 \) does not have to be identical in the two cases, given there are valuable assets in place. If, for example, \( x^*_1 \) were the identification and adoption of a new production technology and was implemented in period 1, \( x^*_2 \) could be the further improvement of that technology to stay ahead of the competition. If this technology was not found in period 1, it could be that detecting and adopting it is the optimal project in period 2.

We denote the employee’s optimal search intensity in the second period by \( q^*_2 \), where \( j \in \{s,f\} \) indicates the first period outcome.

Suppose that the first period project was a failure, so the employee does not know \( x^*_1 \). When choosing how precise information to acquire, the employee solves:

\[
\max_{q_2} \left\{ q_2 b - \frac{1}{2} \gamma (q_2)^2 \right\}, \quad \text{so } q_2^f = b/\gamma. \tag{1}
\]

Using \( q_2^f = b/\gamma \), we obtain the expected utility of the employee in period 2 in case of a first period failure, \( E(u_2 \mid f) \), and the expected firm profits in this case, \( E(\pi_2 \mid f) \):

\[
E(u_2 \mid f) = b^2/2\gamma \quad \text{and} \quad E(\pi_2 \mid f) = bB/\gamma. \tag{2}
\]

Consider now the problem of an employee who was successful in the first period and knows \( x^*_1 \). The employee receives a signal \( \bar{x}_2 \). This signal indicates the optimal project in the second period with probability \( q_2 \). If \( \bar{x}_2 = x^*_1 \), the employee knows that \( x^*_1 \) is optimal also in the second period.\(^2\) The problem facing the employee is more difficult if \( \bar{x}_2 \neq x^*_1 \),

\(^2\)If \( \bar{x}_2 \neq x^*_1 \), the probability of receiving the signal \( x^*_1 \) is zero as there is an infinite number of non-positive value projects which are all equally likely to be signalled. Therefore, we have that \( \Pr(\bar{x}_2 = x^*_1 \mid \bar{x}_2 = x^*_1) = 1.\)
as she has two conflicting signals. Here, we have the conditional expectations:

\[
\Pr(\bar{x}_2 = x_2^* | \bar{x}_2 \neq x_1^*) = \frac{\alpha q_2}{\alpha + (1 - \alpha)(1 - q_2)},
\]

\[
\Pr(x_1^* = x_2^* | \bar{x}_2 \neq x_1^*) = \frac{(1 - \alpha)(1 - q_2)}{\alpha + (1 - \alpha)(1 - q_2)}.
\]

Therefore, the employee follows the new signal iff

\[
\Pr(\bar{x}_2 = x_2^* | \bar{x}_2 \neq x_1^*) \geq \Pr(x_1^* = x_2^* | \bar{x}_2 \neq x_1^*) \iff q_2 \geq 1 - \alpha.
\]

Choosing a precision lower than \(1 - \alpha\) has thus no value, as the signal is ignored whenever it is different from \(x_1^*\). The optimal precision is either \(q_2 = 0\) or the solution to the following program:

\[
\max_{q_2} \left\{ q_2 b - \frac{1}{2} \gamma (q_2)^2 \right\}
\]

\[\text{s.t. } q_2 \geq 1 - \alpha \]

If the employee chooses \(q_2 = 0\), the project \(x_1^*\) is implemented. Then, the expected period 2 utility is \(E(u_2) = (1 - \alpha)b\). If she chooses \(q_2 \geq 1 - \alpha\), \(\bar{x}_2\) is implemented. Comparing these two possibilities, we obtain:

**Lemma 1** A successful employee searches in the second period only if the external pressure is sufficiently high:

\[
q_2^* = \begin{cases} 
0 & \text{for } \alpha < 1 - b/2\gamma \\
\frac{b}{\gamma} & \text{otherwise}
\end{cases}
\]

As mentioned above, \(\alpha\) can be understood as the external pressure to search for a new project. An employee who experienced success in the first period does not invest in acquiring new information if the external pressure is not large enough.\(^3\) We will in this situation say that the organization experiences inertia. Several authors have noticed that it may be rational not to search in a stable environment when there are costs of collecting and processing information. Stigler and Becker (1977), for example, write: ‘In order to make a decision one requires information, and the information must be analyzed. The costs of searching for information and of applying the information to a new situation are such that habit is often a more efficient way to deal with moderate or temporary changes in the environment than would be a full, apparently utility-maximizing decision’.\(^4\) Let us define the critical level of \(\alpha\) by \(\pi_2 \equiv 1 - b/2\gamma\).

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\(^3\)This is consistent with the belief of many management consultants that change requires a sufficient sense of urgency among employees (see, for example, Kotter, 1996, p. 4).

For an unsuccessful employee the external pressure is never lower than for a successful employee, since the current project’s probability of being successful in the second period is zero. An employee who was not successful in the first period always invests in information acquisition.

In case of a success in period 1 it follows from (3) for the expected utility of the employee and firm’s profits in the second period:

\[
E(u_2 \mid s) = \begin{cases} 
(1 - \alpha)b & \text{if } \alpha < \overline{\alpha}_2 \\
\frac{b^2}{2\gamma} & \text{otherwise}
\end{cases}
\]  
\[
E(\pi_2 \mid s) = \begin{cases} 
(1 - \alpha)B & \text{if } \alpha < \overline{\alpha}_2 \\
\frac{Bb}{\gamma} & \text{otherwise}
\end{cases}
\]  

(4)

The above analysis shows that the employee either searches with the intensity \(b/\gamma\) or not at all. The following proposition shows that the level of external pressure needed to make a successful employee search again is too high from the point of view of the firm’s second period profits. The reason is that the employee carries the full cost of finding a better project but only captures a part of the benefits.

**Proposition 1** Given that the employee either searches with the intensity \(b/\gamma\) or not at all, the second period profits of the firm are maximized when the employee searches for all \(\alpha\) such that

\[
\alpha > 1 - \frac{b}{\gamma} = \underline{\alpha}_2.
\]

(5)

Note that \(\underline{\alpha}_2 < \overline{\alpha}_2\). Hence, for \(\alpha \in (\underline{\alpha}_2, \overline{\alpha}_2)\) a successful employee does not search even if it would increase the firm’s second period profits.

**Proof.** Whenever the employee searches, she chooses the intensity \(b/\gamma\). Hence, the expected profits are \(bB/\gamma\) if the employee searches, and \((1-\alpha)B\) if she does not. Comparing the two profits yields the proposition. \(\blacksquare\)

Proposition 1 is the bad news in this story for successful firms: successful employees do not always rest on their laurels, but the level of external pressure necessary to motivate them to look for ways to reinvent the business is too high from point of view of the firm’s second period profits. This provides a simple, agency based explanation for the notion that success fosters inertia. It is consistent with the empirical evidence cited in the introduction as long as the direction of incremental progress is known and work on it can be monitored more easily while more significant innovation requires a search process as described in the model.
2.2 The First Period

We denote the period 1 intensity of search by \( q_1 \). The employee faces the following problem when choosing \( q_1 \):

\[
\max_{q_1} \begin{cases} 
q_1(b + (1 - \alpha)b) + (1 - q_1)\frac{b^2}{2\gamma} - \frac{1}{2}\gamma(q_1)^2 & \text{if } \alpha < \alpha_2 \\
q_1(b + \frac{b^2}{2\gamma}) + (1 - q_1)\frac{b^2}{2\gamma} - \frac{1}{2}\gamma(q_1)^2 & \text{otherwise}
\end{cases}
\]

Solving this problem, we obtain the optimal search intensity, \( q_1^* \):

\[
q_1^* = \begin{cases} 
\frac{b}{\gamma} + \frac{2\gamma(1-\alpha)b-b^2}{2\gamma^2} & \text{if } \alpha < \alpha_2 \\
\frac{b}{2\gamma} & \text{otherwise}
\end{cases}
\] (6)

Since \( q_1^* > b/\gamma \) for \( \alpha < \alpha_2 \), equation (6) makes apparent that inertia in the second period is not only bad news: an employee foreseeing that a successful project can be reemployed in the next period has a stronger incentive to find the right project in the first period. We show in the next section that inertia might in some situations be optimal for the firm, even if it reduces second period profits, because it increases the employee’s incentive to acquire information in the first period.

The total expected profits of the firm, \( E(\pi) \), are:

\[
E(\pi) = \begin{cases} 
q_1^*(b + (1 - \alpha)B) + (1 - q_1^*)bB/\gamma & \text{if } \alpha < \alpha_2 \\
2bB/\gamma & \text{otherwise}
\end{cases}
\] (7)

Figure 1 illustrates the total and the second period profits as a function of \( \alpha \). The second period profit is drawn assuming that the employee found and implemented \( x_1^* \) in the first period. There is a discrete 'jump' up in profits at \( \alpha_2 \), where the external pressure becomes so high that a successful employee starts to search in the second period. The figure shows how \( \alpha_2 \) is defined as the value of \( \alpha \) such that the second period profits are the same when a successful employee searches and when she does not. \( \alpha_2 \) is always strictly smaller than \( \alpha_2 \).

3 Overcoming Inertia I: Adding Internal Pressure

Since successful firms may display excess inertia if external pressure for the employees is insufficient, it seems natural for the firm to complement it with pressure from within the firm. In the following we analyze reorganization as one policy measure to achieve this. Afterwards we discuss two more policies that increase overall pressure on the employees.

One way of adding pressure on the employees – and hence of overcoming inertia – is to reorganize the firm in the second period and restructure the employees’ tasks. This
Figure 1: The total expected ex-ante profits (solid) and the expected second period profits given that the employee was successful in the first period (dotted) as a function of $\alpha$. ($B = 1$, $b = 1/2$, and $\gamma = 2$).

can, for example, be done through a new organizational structure in which also individual responsibilities and goals change. A change in responsibilities adds internal pressure to the pressure from the environment as it forces the employees to find a way to accomplish their new tasks efficiently. To do this they have to invest in acquiring information in the second period. Thus, a reorganization forces successful employees to search in situations where they otherwise would not have.\(^5\)

In our simple framework, a reorganization can be represented as an activity by the firm that renders the probability that a successful project in the first period can be reemployed in the second period zero. That is, for the employees it is as if $\alpha = 1$.\(^6\) We assume that a reorganization does not introduce any costs or benefits except those arising endogenously due to knowledge being destroyed and created.

First notice that a corporate reorganization does not affect an employee who was unsuccessful in the first period. She will search with the intensity $b/\gamma$ in all tasks, so the payoff to the firm and the employee are the same whether tasks are restructured or not. Therefore,

\(^5\)A reorganization creates higher incentives for information acquisition than simply rotating jobs. In an environment of job rotation it is possible for the employees to retrieve the information about the previous course of action, for example, from internal documents or conversations with the former incumbent of the position. Any search effort would then potentially be misdirected towards past actions rather than new ones.

\(^6\)One can also interpret a restructuring as an event that erases the firm’s memory of past actions, which forces it to ‘reinvent’ itself.
the firm will embark on a reorganization if and only if it wants successful employees to search again.

Suppose first that the firm cannot commit to not reorganizing production in the second period. Then, it will reorganize, if doing so increases second period profits. The analysis in the previous section shows that a reorganization will occur for all \( \alpha \in (\alpha_2, \pi_2) \).

Suppose instead that the firm has a commitment technology available. A commitment to not reorganize the production decreases second period profits for \( \alpha \in (\alpha_2, \pi_2) \). On the other hand, it increases at the same time the intensity of search in the first period. The next lemma defines the region of \( \alpha \) for which the firm would want to commit to keeping the same organization for two periods.

**Lemma 2** Define \( \alpha \in (\alpha_2, \pi_2) \) as the unique solution to the following equation:

\[
\left( \frac{b}{\gamma} + \frac{2\gamma(1-\alpha)b-b^2}{2\gamma^2} \right)(2-\alpha) + \left( 1 - \left( \frac{b}{\gamma} + \frac{2\gamma(1-\alpha)b-b^2}{2\gamma^2} \right) \right) \frac{b}{\gamma} b - \frac{2Bb}{\gamma} = 0. \tag{8}
\]

Then, the firm will commit not to reorganizing the production in the second period for all \( \alpha \leq \alpha_2 \).

**Proof.** The first term on the left hand side (LHS) of (8) is the profits of the firm when the employee does not search in the second period, and the second term is the profits when she does. The LHS is strictly decreasing in \( \alpha \). For \( \alpha_2 = \alpha \), the LHS reduces to \( \frac{Bb^2}{2\gamma^2} > 0 \), and for \( \frac{b}{\gamma} = \pi_2 \) it reduces to \( -\frac{Bb^2}{2\gamma^2} < 0 \). The proof follows from continuity of the LHS of (8).

Figure 1 illustrates \( \alpha \) that is defined as the \( \alpha \) such that the firm is indifferent ex-ante whether a successful employee searches in the second period or not. Therefore, \( \alpha \) takes both the effect on second and first period search into account. We are now ready to state the main result of this section.

**Proposition 2** *(Excess Corporate Restructuring)* A firm that has a commitment technology available will reorganize the firm in the second period for \( \alpha > \alpha_2 \). A firm with no commitment technology will reorganize the firm for \( \alpha > \alpha_2 \). Without commitment, the possibility of reorganization strictly reduces profits for \( \alpha \in (\alpha_2, \alpha) \), because the employee invests less in information acquisition in the first period.

Proposition 2 illustrates the time-consistency problem that the firm may face. The firm will reorganize the production in the second period for all \( \alpha > \alpha_2 \). However, ex-ante the
firm would prefer only to reorganize for $\alpha > \underline{\alpha}$ in order to not dilute period 1 incentives. Without a way to commit itself, the firm may end up in a situation where there is too much reorganization. That is, inertia is fought excessively and reduces total expected profits. This occurs for $\alpha \in (\underline{\alpha}, \overline{\alpha})$ in equilibrium. In the other regions of the parameter space the decision whether to reorganize will be optimal both from an ex-ante and an ex-post point of view.

**Alternative policies that add internal pressure: Discussion**

Regular reorganizations is one example of how firms can fight inertia by increasing internal pressure. In the following we discuss two alternatives to restructuring that also impose internal pressure on the employee.

One measure of avoiding repetition of the same project is simply excluding the status quo. The firm asks the employee to propose a project different from the currently implemented one, $x^*_1$. Szalay (2001) develops an elegant model of delegation along these lines. He considers a situation where an advisor has to recommend which action to take. Szalay shows that it is optimal to exclude advice close to the prior belief about the right action. This has a cost when the optimal action is close to the prior, but in Szalay’s framework it induces the advisor to search harder, because the mistakes she can make become larger.8 Translated into our framework this means that if the prior belief is based on previous search a) for a successful employee $\alpha$ is artificially rendered 1 in period 2 and b) even if the signal obtained in period 2 is the status quo it cannot be chosen. We show in this paper that in a dynamic context there is an additional cost that needs to be taken into account: excluding advice around the prior reduces the advisor’s incentive to search for the best possible advice in the periods before, because accumulated knowledge is usable for fewer periods.

Another alternative is to require a certain percentage of sales to stem from recent innovations. For example, 3M requires that 30% of sales have to come from products introduced within the last four years (see von Hippel, Thomke and Sonnack (1999)). This gives employees a strong incentive to innovate as established product lines might be scaled down or closed. This policy increases $\alpha$ and is essentially a milder form of the application

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7 Notice that the informational requirements to implement this strategy is higher than for a reorganization, because the management of the firm needs to know $x^*_1$.

8 Since advice close to the prior can be optimal ex-post, it requires the possibility to commit to such a policy.
discussed above. Again, this way of fighting inertia has its costs. First, the bias towards
new products is costly when the existing products have the most promising prospects.
Second, it reduces the employees’ incentives to find good products in the first place. Any
organizational measure that increases $\alpha$ suffers from the problem of reducing ex-ante incen-
tives. Thus, the measure will be applied inefficiently often, if intertemporal commitment
is impossible.

4 Overcoming Inertia II: Limiting Control

Applying additional pressure on the employee is one way to reduce inertial tendencies
within the organization. After a success, where the employee would prefer to rest on
her laurels, she is forced to invest in information acquisition again. In the absence of
intertemporal commitment, however, the negative effect on the employee’s initial effort
causes this policy to be imperfect. In the following we analyze a policy that rewards
success rather than penalizes it. As one would expect, such a policy does not suffer from
the drawback of stifling initial effort; to the contrary, it facilitates initial effort exertion. We
uphold for now the assumption of payoff non-verifiability and focus on the consequences of
organizational policies for employee behavior. Specifically, we study the effect of a stepwise
increase in the employee’s liberties (or reduced of control over the employee). By this we
mean that in the second period the employee has the opportunity to search in an expanded
set of projects.

If the additional projects are more attractive to the employee than the initial set, the
possibility to search in an expanded set of projects increases the employee’s incentive to
look for a new project, because she can channel her search towards the new set of projects.
Expanding the project set may then increase profits even if the added projects are less
profitable than the projects in the original set. To formalize this notion, consider the
following variation of the model. In addition to the initial set of projects $F$ there is a
second group of alternatives that the agent can search in, $E$. There exists a profitable
project in each of the two sets of projects in each period. The optimal projects in $E$ and
$F$ in period $t$ are denoted $x_{1_t,E}$ and $x_{1_t,F}$, respectively, $t \in \{1, 2\}$. Again, $x_{1_t,i} \neq x_{2_t,i}$ with probability $\alpha$, $i \in \{E, F\}$. The two sets differ in their payoffs to the employee and the
firm. When $x_{1_t,F}$ is found and implemented, it pays $B$ to the firm and $b$ to the employee
whereas $x_{1_t,E}$ pays $\hat{b}$ to the employee and $\hat{B}$ to the firm ($\hat{b} > b$ and $B > \hat{B}$). Thus, $F$
contains a project that is very profitable for the firm but provides only modest utility for the employee; in $E$ it is the other way around. We can think of $F$ as the projects that fit well into the firm’s business strategy whereas $E$ are projects that allow the agent to learn a new technology, to signal her ability to the outside world, to pursue a project in which she has intrinsic interest in or to enjoy other perks. In addition, we assume that the overall surplus of the profitable project in the new set is lower than in the original one, $\hat{B} + \hat{b} < B + b$. To simplify notation we will, however, be more specific regarding parameters and assume that $\hat{b} = B$ and $\hat{B} = \phi b$, where $\phi < 1$.

We assume that the principal can ensure that the agent searches only in $F$. The CEO can, for example, attend preliminary meetings and make sure that the proposed products can be sold using existing distribution channels or be produced in existing plants. An employee who searches in $F$ with the intensity $q_t$ in period $t$ will find $x_{t,F}^*$ with probability $q_t$. On the other hand, there are ways to (credibly) give up control and allow the employee to search in both $E$ and $F$. The CEO may oversee many projects and be too busy to interfere, or the employee may be given the formal authority to make decisions in her business area. An employee who is allowed to search in both $E$ and $F$ focuses on $E$ and thus finds $x_{t,E}^*$ with probability $q_t$. The set of assumption implies that allowing the employee to search in both sets is suboptimal for the firm in a one-period setting.

We compare two organizational forms: one where the firm keeps control in both periods and restricts the employee to search in $F$, which we call control, and another where the employee is allowed to search in both $E$ and $F$ after a success in the first period. We term the latter case limited or reduced control. The analysis in section 2 corresponds to the case of control. In the following we thus analyze the case of reduced control. The results obtained when the firm follows an limited control policy are indicated with a diamond superscript. Afterwards, we compare the two organizational policies.

---

9 Before 3M established the rule that a certain percentage of sales had to come from recent innovations its R&D efforts were characterized by significant liberties for researchers. As one manager noted: "There is clearly less freedom in the labs than there was 10 of 15 years ago, and it means that it’s less fun for researchers. As a result, there are more motivation and morale issues to deal with today." See Bartlett and Mohammed (1995).

10 Our the setup is therefore different from, for example, Aghion and Tirole (1997) where the employee and the firm search in $E$ and $F$, respectively.

11 There are, of course, other possibilities such as allowing to employee to search in $E$ and $F$ in both periods or only after a failure in the first period. It can be shown that these other possibilities are never optimal.
4.1 Limiting Control and Inertia: The Second Period

As before we proceed backwards and start with the analysis of period 2.

Suppose first that the employee was unsuccessful in the first period. Then, she has to search again in \( F \) and chooses the intensity \( b/\gamma \). Suppose instead that the employee was successful in the first period and is allowed to search in both project sets. The expected utility if the employee searches is \( B^2/2\gamma \). If she chooses not to search, she has to implement the old project in \( F \), which gives an expected utility of \( (1 - \alpha)b \). It follows that

\[
q_{f^2}^\circ = \frac{b}{\gamma} \quad \text{and} \quad q_{s^2}^\circ = \begin{cases} 
0 & \text{if} \quad \alpha < 1 - \frac{B^2}{2\gamma} = \tilde{\alpha}_2 \\
B/\gamma & \text{otherwise}
\end{cases}.
\]

If we compare how much the employee invests in information acquisition in the second period under control and reduced control, we obtain:

**Remark 1** There is less inertia and a higher intensity of search in period 2 if success is rewarded with a reduction in control.

Allowing the employee to search in both \( E \) and \( F \) in the second period gives her a greater incentive to acquire information, since she has the possibility to find a project yielding a higher utility than the one found in the first period. On the one hand, this increases the intensity with which the employee searches, \( B/\gamma \) instead of \( b/\gamma \). On the other hand, it also implies a larger region of \( \alpha \) for which she undertakes search, \( \alpha \in [1 - \frac{B^2}{2\gamma}, 1] \) instead of \( \alpha \in [1 - \frac{b}{2\gamma}, 1] \).

While reducing control increases search activity, it is directed towards a less profitable set of projects in period 2. In order to compare the policies of control and limited control we have to include also differences in search activity in period 1.

4.2 Limiting Control and Inertia: The First Period

The employee’s search decision in period 1 under limited control takes her optimal period 2 choices into account. The employee solves the following problem in the first period:

\[
\max_{q_1} \begin{cases} 
q_1(b + (1 - \alpha)b) + (1 - q_1)\frac{b^2}{2\gamma} \frac{1}{2}\gamma(q_1)^2 & \text{if} \quad \alpha < \tilde{\alpha}_2 \\
q_1(b + \frac{B^2}{2\gamma}) + (1 - q_1)\frac{b^2}{2\gamma} \frac{1}{2}\gamma(q_1)^2 & \text{otherwise}
\end{cases}.
\]

Solving this problem, one obtains:
\[ q_1^\diamond = \begin{cases} \frac{b}{\gamma} + \frac{b(1-\alpha-b/2\gamma)}{2\gamma} & \text{if } \alpha < \tilde{\alpha}_2 \\ \frac{b}{\gamma} + \frac{(B^2-b^2)}{2\gamma} & \text{otherwise} \end{cases}, \quad (10) \]

\[ E(\pi^\diamond) = \begin{cases} q_1^\diamond (B + (1-\alpha)B) + (1-q_1^\diamond)\frac{bB}{\gamma} & \text{if } \alpha < \tilde{\alpha}_2 \\ q_1^\diamond (B + \phi b\frac{B}{\gamma}) + (1-q_1^\diamond)b\frac{B}{\gamma} & \text{otherwise} \end{cases}. \quad (11) \]

For \( \alpha < \tilde{\alpha}_2 \) the employee’s actions are identical under control and limited control. \( \alpha \) is too small to induce a successful employee to search in period 2 even under limited control. This also implies that search in period 1 is unaltered if the firm reduces control over the employee in the second period. As a consequence, profits are the same under control and limited control in this parameter range (see (7) and (11)).

To exclude this less interesting area of the parameter space we make the following assumption:

**A.2.** \( \alpha \geq \tilde{\alpha}_2 \).

Comparing equations (6) and (10) makes it evident that:

**Remark 2** Under A.2. there is a higher intensity of search in period 1 when success is rewarded with a reduction of control.

Since success is rewarded with more freedom under reduced control, initial search incentives increase. In contrast to period 2, these are not directed towards projects with a lower profitability, but to the original project set \( \mathcal{F} \) and, thus, constitute an additional benefit of reducing control for the firm.

Albeit Remarks 1 and 2 taken together document that reducing control leads to more search in both periods, this does not imply that reducing control is the optimal policy. Under reduced control the employee chooses to channel her search towards less profitable projects in period 2. This negative effect of limiting control has to be weighed against higher search activities in both periods.
4.3 The Optimal Level of Control

Suppose first that the firm has no commitment technology available. Then, the firm reduces control over the employee’s search only if it increases second period profits.

Lemma 3 Suppose that $\phi \geq 1/2$. Then, reducing control maximizes second period profits in the following regions of the parameter space:

i) for all $\alpha \in [\bar{\alpha}_2, \bar{\alpha}_2]$ if $B^2/2b^2 \leq \phi$ and

ii) for $\alpha \in [1 - \phi b/\gamma, 1]$ if $B^2/2b^2 > \phi$.

If $\phi < 1/2$, reducing control is not profitable in the second period.

Proof: See Appendix.

In our setup, it reduces the second period profits to let the employee search in $E$ and $F$ if she would search also in $F$ only. In particular, the profits are $Bb/\gamma$ under control but only $\phi Bb/\gamma$ under reduced control. Hence, without commitment the firm does not reduce control over the employee’s search for $\alpha > \bar{\alpha}_2$, since there is no problem of inertia. Reduced control may potentially increase profits in period 2 for $\alpha \in [\bar{\alpha}_2, \bar{\alpha}_2]$ where there is no search under control but search under reduced control. Whether limited control indeed maximizes period 2 profits depends also on the level of profits possible under this policy, parametrized by $\phi$. For very low potential profits $\phi < 1/2$, control leads to higher period 2 profits for all $\alpha$. Reduced control yields higher profits in period 2 for the entire range of potential $\alpha$ if $\phi$ is large, $\phi \geq B^2/2b^2$.\(^{12}\) For $\phi$ between these two extreme ranges, reduced control maximizes period 2 profits for part of the potential range of $\alpha$, $\bar{\alpha}_2 < 1 - \phi b/\gamma \leq \alpha < \bar{\alpha}_2$.

A firm without the possibility to commit to a certain policy ex-ante will choose between them governed by the result described in Lemma 3. To compare the firm’s choice under non-commitment to the ex-ante most profitable one (the strategy that is selected if commitment is possible), we compute the optimal policy from an ex-ante perspective. This is done by comparing $E(\pi)$ and $E(\pi^{\phi})$, the expected ex-ante profits under control and reduced control, respectively. These are given by (7) and (11).

\(^{12}\)This requires that $B \leq 2b$, since $\phi \leq 1$. 

17
Lemma 4 Compare the ex-ante profits under control and reduced control. There are three regions where reduced control maximizes ex-ante profits:

i) For $B^2/2b^2 > \phi \geq 1 - B^2\gamma/b(2b\gamma + B^2 - b^2)$ define $\alpha(\phi)$ as the unique solution to the equation $E(\pi^\phi) = E(\pi)$. $\alpha(\phi)$ belongs to $[\alpha_2, \pi_2)$ and is strictly decreasing in $\phi$.

Then, reduced control maximizes ex-ante profits for $\alpha \in [\alpha(\phi), \pi_2)$.

ii) For $B^2/2b^2 \leq \phi$ reduced control maximizes ex-ante profits for all $\alpha \in [\alpha_2, \pi_2)$.

iii) Reduced control maximizes ex-ante profits for $\alpha \in (\pi_2, 1]$ iff. $\phi \geq 1 - (B^2 - b^2)\gamma/b(2b\gamma + B^2 - b^2)$.

In all other regions of the parameter space control maximizes ex-ante profits.

Proof: See Appendix.

The analysis requires more case discriminations, since it includes the intertemporal effects of the two policies. Again, the optimal outcome depends crucially on the potential profit in period 2 under reduced control, measured by $\phi$.

We are now in a position to state the main result of this section:

Proposition 3 (Excess Control) A firm that has no commitment technology available will limit control over the employee’s search in the second period for $\alpha \in [\min\{\alpha_2, 1 - \phi b/\gamma\}, \pi_2)$ to avoid inertia. A firm with a commitment technology will reduce control for a strictly larger set of the parameter space than without commitment.

Proof: See Appendix.

Given the analysis in the previous section it is not surprising that reducing control is a policy that is applied too seldom. Reducing control in the second period increases the investment in information acquisition in the first period, and it may thus increase total ex-ante profits even if it reduces second period profits. This positive effect is not exploited if the firm cannot commit ex-ante to a policy of reducing control over a successful employee.

Figure 2 illustrates the equilibrium outcome with and without commitment. Region I-III in the figure correspond to region $i. – iii.$ in Lemma 4, respectively. Reduced control is the outcome in region II when the firm does not have access to a commitment technology. Here, reducing control solves the problem of inertia that arises if the firm keeps control in the second period. Furthermore, $\phi$ is sufficiently high that reduced control does not diminish the profitability of a new second period project by too much. In regions I and III
it is optimal to reduce control over a successful employee even if doing so decreases second period profits. The reason is that reduced control serves as a carrot in the first period, and induces the employee to search more extensively. In regions I and III the firm thus faces a time-consistency problem, and reduced control is the equilibrium outcome only if the firm has a commitment technology available. Outside the regions I-III the firm always keeps control. \( \phi \) is here so low that the loss of profits in the second period outweighs the benefits from a greater investment in information acquisition.

As long as the external pressure is not sufficiently high, employees in successful firms have to be continually motivated from within the organization to search for new opportunities. This analysis documents that rewarding employees with increased liberties can be a sensible policy if the environment is not too stable even when no intertemporal commitment is possible. The absence of commitment, however, induces this policy to be applied too seldom, since positive ex-ante effects on search effort will not be factored into the decision. Notice that the employee’s freedom to pursue her favorite projects is not a cause of success as in, e.g., Aghion and Tirole (1997). Rather, it is a consequence of success and serves to maintain the company’s success.
Limiting control if the overall surplus increases: Discussion

We have in this section chosen to focus on the case $\phi < 1$. Under these circumstances, the firm would never reduce control if the employee was hired for only one period. What if one-period profits increase rather than decrease if the employee is allowed to search in both sets of projects? Then, the question is whether it is not always best to provide the employee with the freedom of search in both periods. This is, however, not the case, since the firm may want to keep control to induce the employee to search harder in the first period and/or to fight inertia in the second period.

We can capture the situation of an increasing overall surplus by assuming that $1 < \phi < B/b$. Suppose first that the firm has no commitment technology. Then, it will always allow the employee to search in $E$ and $F$ in the second period, as it increases second period profits. This eliminates the possibility of reducing control as a reward, so it has no effect on the first period search. Reduced control may still be used to avoid inertia in the second period. To see this, suppose that the employee were allowed to search in both sets already in period 1 and found a successful project (in $E$). The employee would only search in the second period for $\alpha \geq 1 - B/2\gamma$. On the other hand, she would search again for $\alpha \geq 1 - B^2/2b\gamma$ were the project in $F$, so limiting control reduces the external pressure necessary to induce search. When the firm can commit to not relaxing control over unsuccessful employees, reducing control can be used in certain circumstances even more profitably. Then, rewarding success only, which increases the initial investment in information acquisition.

5 Complete Contracts

Contracts were up to now incomplete in the sense that even if both the employee and the firm could observe the outcome of the search, it was not possible to contract on this information. This is – in our opinion – often a quite realistic assumption. It is much harder to measure objectively the output of creative effort than subjectively. One way around the measurement problem is to contract on profits. However, the profits that accrue from an idea will typically depend on the effort and talent of the whole organization, and might be a poor measure of the value of the initial idea. This said, it is nevertheless important to explore to what extent our results are driven by the contractual assumptions made.

In appendix B we analyze the model assuming that the parties can contract directly
on the outcome of the search. A successful employee receives as before a non-monetary benefit of $b > 0$, but the firm can now pay a bonus on top of this. It is assumed that the employee is cash-constrained in both periods.\footnote{Without an initial cash-constraint it is trivial to implement the first best: the firm simply offers a bonus of $B$, which makes the employee the residual claimant, and extracts all surplus with an initial negative wage. As residual claimant, the employee searches in such a way that total surplus is maximized.} We consider both the case where the firm can commit to its second period actions and where it cannot. The refinement that a two-period bonus scheme should be renegotiation proof is imposed. The aim of the analysis is to find out under which conditions organizational measures will be used to fight inertia when it is possible to contract on the outcome of the search. It turns out that the necessary conditions for reorganization and reduction in control to be used are very similar. Therefore, we only consider reorganization in the appendix, but details concerning reduction in control are available upon request.

We show that it makes an important difference whether the firm can commit to a two-period bonus scheme. Without commitment, there exists a region of $\alpha$ for which a reorganization following success increases second period profits. Furthermore, as long as the non-monetary benefit is a sufficiently important part of a project’s payoff ($B < 2b$), we find as in Proposition 2 that the firm tends to reorganize too often in the second period from point of view of ex-ante profits.

The firm has much better possibilities to solve the moral hazard problem when it can commit to a two-period bonus scheme. Success in the first period can either be rewarded by paying a bonus right away or by promising a better bonus in the second period. We show that if it is optimal to avoid inertia, the firm pushes the reward for success forward to the second period. The employee is then only paid a low bonus in the first period but is made residual claimant in the second. This leads to the search that maximizes overall surplus in the second period and solves the problem of inertia. There is thus no role for second-best measures such as reorganization or reduction in control.\footnote{A caveat is in place here: the two-period contract described is not always feasible, as it may require a negative first period wage. In the appendix we state the necessary and sufficient conditions for the contract to be feasible. When the non-negativity constraint on the first period wage binds, there may again be a role for reorganization or reduction in control.}

To summarize: the results of the main model do not change qualitatively if it is possible to contract on the outcome of the search as long as a) the employee is cash-constrained, b) the firm cannot commit to a two-period bonus scheme, and c) the non-monetary benefit of a successful project is sufficiently important.
6 Conclusion

We present in this paper a theory of inertia in organizations. It builds on the simple, intuitive idea that employees who were successful in the past are reluctant to search for new and better ways of doing business, because they carry the full cost of the search but only get a part of the benefit.

We show that the volatility of the environment, or the external pressure, plays a crucial role. Inertia arises only when the external pressure is not too high, so yesterday’s success is likely to be successful again today. Inertia may reduce the profits of a firm that was successful in the past, but even then it is not necessarily bad news for overall profits. An employee invests more in finding a good project when there is inertia, because it can be employed in more than one period. Therefore, inertia increases total profits as long as the environment is stable. However, if the environment is relatively volatile, but not enough to stop a successful employee from resting on her laurels, inertia reduces total profits.

In the second part of the paper it is discussed how and when to avoid inertia. In the first application we consider the possibility of a corporate reorganization where the employees are assigned new tasks in the second period. It is shown that the firm can benefit from a reorganization, but without commitment it risks reorganizing too many times. As an alternative way of fighting inertia, we analyze reducing control. Here, if the employees are successful, they are allowed to search for new opportunities in an extended and, for the employees, more favorable set of alternatives in the second period. On the upside, this policy alleviates the problem of inertia. Furthermore, since reducing control works like a carrot rather than a stick, the employees also search more extensively initially. On the downside, the projects found are less valuable to the firm. We show that reducing control is optimal if the difference between the profitability of the firm’s and the employees’ preferred projects is not too large. It is also shown that, absent a commitment technology, the firm tends to keep control too often and to reduce control over the employee too seldom.

Our results imply that organizational policies are dynamic in nature. Successful firms require more changes than unsuccessful ones from a pure organizational standpoint (increasing internal pressure or increasing freedom) even though these measures may be sub-optimal from a one-period perspective. As a firm becomes unsuccessful it reverts to the optimum organizational structure for near-term search. Assumed that this structure is known to the firm it stays in place until success arrives.
The basic framework developed in this paper is very simple and has potentially a number of applications. It could, for instance, be very interesting to embed it more explicitly into a market and study industry dynamics. We leave this and other possible extensions for future work.
A Appendix

Proof of Lemma 3

We first consider $\alpha \geq \bar{\alpha}_2$ such that a successful employee searches both under limited control and control. The expected second period profits are $Bb/\gamma$ under control and $\phi Bb/\gamma$ under limited control. Since $\phi < 1$, the firm always chooses control in the second period. Consider thus $\alpha \in [\bar{\alpha}_2, \bar{\alpha}_2)$. The profits are $B(1 - \alpha)$ under control and $\phi Bb/\gamma$ under limited control. Hence, limited control maximizes second period profits iff $\alpha \geq 1 - \phi b/\gamma$.

The proof follows from computing the intersect of the set $\alpha \geq 1 - \phi b/\gamma$ with $\bar{\alpha}_2 \leq \alpha \leq \bar{\alpha}_2$.

Proof of Lemma 4

Consider $\alpha \in [\bar{\alpha}_2, \bar{\alpha}_2)$. $E(\pi)$ is continuous and strictly decreasing in $\alpha$ whereas $E(\pi^\diamond)$ is constant. Since $E(\pi) |_{\alpha=\bar{\alpha}_2} \leq E(\pi^\diamond) |_{\alpha=\bar{\alpha}_2} \iff B^2/2b^2 \leq \phi$, the first part of the proof follows. The second and the third part follow from $E(\pi) |_{\alpha=\bar{\alpha}_2} \leq E(\pi^\diamond) |_{\alpha=\bar{\alpha}_2} \iff \phi \geq 1 - B^2/\gamma(b(2b\gamma + B^2 - b^2))$ and $d\alpha(\phi)/d\phi = (\partial E(\pi)/\partial \alpha)/(\partial E(\pi^\diamond)/\partial \phi) < 0$. Finally, for $\alpha \in [\bar{\alpha}_2, 1]$ $E(\pi)$ and $E(\pi^\diamond)$ are both independent of $\alpha$, and proof follows from comparing the two profit functions.

Proof of Proposition 3

We need to show that there is limited control for a strictly larger set of the parameter space with commitment than without. For $\alpha \in (\bar{\alpha}_2, 1]$ this follows immediately from Lemmas 3 and 4. For $\alpha \in [\min\{\bar{\alpha}_2, \bar{\alpha}_2\}]$ and $B^2/2b^2 \leq \phi$ there is limited control with and without commitment. Finally, consider $\alpha \in [\min\{\bar{\alpha}_2, \bar{\alpha}_2\}]$ and $B^2/2b^2 > \phi$. There is limited control for $\alpha \in [\max\{\bar{\alpha}_2, \alpha(\phi)\}, \bar{\alpha}_2)$ with commitment and for $\alpha \in [\max\{\bar{\alpha}_2, 1 - \phi b/\gamma\}, \bar{\alpha}_2)$ without commitment. Since $E(\pi) |_{\alpha=1-\phi b/\gamma} < E(\pi^\diamond) |_{\alpha=1-\phi b/\gamma}$ and $E(\pi)$ is decreasing in $\alpha$, it follows that $\alpha(\phi) < 1 - \phi b/\gamma$. Hence, there is limited control for a larger set of the parameter space with commitment than without. This proves the claim.
B Complete Contracts and Reorganization

In this appendix we analyze whether the firm would want to reorganize in the second period to induce search if it were possible to contract directly upon the outcome of the employee’s search. We start from the following additional assumptions:

- A successful project has a *monetary* and a *non-monetary pay-off*. The monetary pay-off \( B \) accrues to the firm and the non-monetary \( b \) to the employee. It is assumed that \( B > b \).
- The employee is *cash-constrained* every period. A bonus payment in the first period is thus consumed within the period.

The firm offers to pay a bonus to a successful employee to provide incentives to search. A negative wage in case of failure would be optimal were the employee not cash-constrained. Instead, the firm offers a zero wage (the lowest possible wage) if the project is a failure. In what follows, the wage will refer to the bonus in case of success.

We divide the analysis into two cases. First, we consider a situation where the firm has no commitment power. The firm will thus offer the bonus that maximizes profits in the subgame considered. It seems plausible that it is harder to commit to an organizational form than to a bonus scheme. Consistent with this idea, we assume that if the firm cannot commit to the second period bonus in the first period, it can neither commit or not to reorganize. After having analyzed the case of no commitment, we determine the outcome when two-period contracts are available.

**The Optimal Contract without Commitment**

**The Second Period**

Suppose that \( x^*_1 \) was not identified in the first period. Then, the employee solves the following problem in the second period:

\[
\text{Max}_{q_2^f} \left\{ q_2^f (b + w_2^f) - \frac{1}{2} \gamma (q_2^f)^2 \right\} \Rightarrow q_2^f = \frac{b + w_2^f}{\gamma}.
\]

Using \( q_2^f \), the problem of the firm is:

\[
\text{Max}_{w_2^f} \left\{ (B - w_2^f)(w_2^f + b)/\gamma \right\} \Rightarrow w_2^f = \frac{B - b}{2}.
\]
The expected second period profits and utility of the firm and the employee, respectively, are:

\[ E(\pi_2 \mid f) = (B + b)^2 / 4\gamma, \]
\[ E(U_2 \mid f) = (B + b)^2 / 8\gamma. \]

Suppose instead that \( x_1^* \) was found. The firm has then to decide whether it wants to induce search. We proceed in two steps. First, we solve the firm’s problem assuming that it wants to induce search. After this, we compare profits with and without inertia to determine the optimal wage.

The firm’s problem when search is imposed (subscript \( A \)):

\[
\max_{w_{2,A}} \left\{ \frac{(B - w_{2,A}^*) (w_{2,A}^* + b)}{\gamma} \right\}
\]
\[ \text{st.} \frac{(w_{2,A}^* + b)}{2\gamma} \geq 1 - \alpha, \]

which gives:

\[ w_{2,A}^* = \begin{cases} 
2\gamma(1 - \alpha) - b & \text{if } \alpha \leq 1 - (B + b)/4\gamma, \\
(B - b)/2 & \text{otherwise.}
\end{cases} \]

Another possibility is not to encourage search (subscript \( B \)) by setting \( w_{2,B} = 0 \). The employee will still search if the environment is very volatile, \( \alpha > 1 - b/2\gamma \), because she gets \( b \) from a successful project.

The optimal wage can now easily be obtained by comparing the profits of the two programs.

**Lemma 5** The optimal wage in the second period following a success is:

\[ w_2^* = \begin{cases} 
0 & \text{if } \alpha \leq 1 - (B + 2b)/4\gamma, \\
2\gamma(1 - \alpha) - b & \text{if } 1 - (B + 2b)/4\gamma < \alpha \leq 1 - (B + b)/4\gamma, \\
(B - b)/2 & \text{otherwise.}
\end{cases} \]

The expected second period profits and utility are thus:

\[
E(\pi_2 \mid s) = \begin{cases} 
(1 - \alpha)B & \text{if } \alpha \leq 1 - (B + 2b)/4\gamma, \\
(B + b - 2\gamma(1 - \alpha))2(1 - \alpha) & \text{if } 1 - (B + 2b)/4\gamma < \alpha \leq 1 - (B + b)/4\gamma, \\
(B + b)^2 / 4\gamma & \text{otherwise.}
\end{cases}
\]
\[
E(U_2 \mid s) = \begin{cases} 
(1 - \alpha)b & \text{if } \alpha \leq 1 - (B + 2b)/4\gamma, \\
2\gamma(1 - \alpha)^2 & \text{if } 1 - (B + 2b)/4\gamma < \alpha \leq 1 - (B + b)/4\gamma, \\
(B + b)^2 / 8\gamma & \text{otherwise.}
\end{cases}
\]

A reorganization increases profits in the second period if \( E(\pi_2 \mid f) > E(\pi_2 \mid s) \), because it deletes the memory of the organization. From comparing \( E(\pi_2 \mid f) \) and \( E(\pi_2 \mid s) \), we obtain:
Lemma 6 The firm is reorganized in the second period for \( \alpha \in (1 - (B + b)^2/4\gamma B, 1 - (B + b)/4\gamma) \).

The lemma shows that as long as there is a non-monetary benefit (i.e. \( b > 0 \)), there exists a region of \( \alpha \) where reorganizing the firm increases second period profits. Here, it decreases the wage necessary to induce search by reducing the utility from not searching to zero.

The first period

We now turn to the first period. The employee solves the following problem when choosing search effort:

\[
Max_{q_1} \left\{ q_1(w_1 + E(U_2 \mid s) + b) + (1 - q_1)E(U_2 \mid f) - \frac{1}{2}\gamma(q_1)^2 \right\},
\]

which implies that

\[
q_1 = \frac{(w_1 + \Delta E(U_2) + b)/\gamma}{\gamma} \text{ where } \Delta E(U_2) \equiv E(U_2 \mid s) - E(U_2 \mid f).
\]

The firm solves:

\[
Max_{w_1} \left\{ q_1(B + E(\pi_2 \mid s) - w_1) + (1 - q_1)E(\pi_2 \mid f) \right\},
\]

where \( q_1 \) is defined above. Solving the firm’s problem, we obtain:

\[
w_1 = \frac{(B - b + \Delta E(\pi_2) - \Delta E(U_2))/2}{\gamma} \text{ where } \Delta E(\pi_2) \equiv E(\pi_2 \mid s) - E(\pi_2 \mid f).
\]

Using \( w_1 \), we have that the total expected profits, \( E(\pi) \), are:

\[
E(\pi) = \frac{(B + b + \Delta E(S_2))^2}{4\gamma} + E(\pi_2 \mid f) \text{ where } \Delta E(S_2) = \Delta E(\pi_2) + \Delta E(U_2).
\]

Notice that if there is a reorganization in case of success \( \Delta E(S_2) = 0 \). This leads to the following result:

Lemma 7 A reorganization maximizes overall profits of the game if and only if it increases total surplus in the second period.

This illustrates the commitment problem facing the firm: reorganizing increases ex-ante profits if and only if \( \Delta E(S_2) < 0 \). In the second period, however, the firm has an incentive to reorganize if \( \Delta E(\pi_2) < 0 \).
Lemma 8  A reorganization increases (strictly) ex-ante profits in the non-empty set \( \alpha \in (1 - 3(B + b)/8 \gamma, 1 - (B + 2b)/4 \gamma) \).

Proof. Consider first the region \( \alpha \leq 1 - (B + 2b)/4 \gamma \). Here, \( \Delta E(S_2) \leq 0 \) iff. \( \alpha \leq 1 - 3(B + b)/8 \gamma \). Notice that \( B > b \) implies that \( 1 - 3(B + b)/8 \gamma < 1 - (B + 2b)/4 \gamma \). For \( 1 - (B + 2b)/4 \gamma < \alpha \leq 1 - (B + b)/4 \gamma \), \( \Delta E(S_2) = (B + b - \gamma(1 - \alpha))^2(1 - \alpha) - 3(B + b)^2/8 \gamma \). We have that \( \partial \Delta E(S_2)/\partial \alpha = -2(B + b) + 4 \gamma(1 - \alpha) < 0 \) in the region considered. Furthermore, since \( \Delta E(S_2) = 0 \) for \( \alpha = 1 - (B + b)/4 \gamma \), we have that \( \Delta E(S_2) > 0 \) for \( \alpha \in (1 - (B + 2b)/4 \gamma, 1 - (B + b)/4 \gamma) \). A reorganization would thus reduce profits. Finally, \( \Delta E(S_2) = 0 \) for \( \alpha \geq 1 - (B + b)/4 \gamma \).

We are ready to determine whether there is too much or too little reorganization going on when the firm has no commitment technology available.

Proposition 4  If the size of the monetary pay-off is less than twice the size of the non-monetary pay-off \( B < 2b \), there is strictly too much reorganization going on when the firm has no commitment technology available. Otherwise, there is a region of \( \alpha \) with too little and a region with too much reorganization.

Proof. Follows from comparing the thresholds in Lemma 6 and 8.

The proposition shows that under the assumption of a) no commitment and b) cash-constraints, the results of the model do not change qualitatively with the introduction of complete contracts, at least if the non-monetary benefit is a sufficiently important part of the return on a project. Proposition 4 summarizes results from two separate regions. For \( 1 - (B + 2b)/4 \gamma < \alpha \leq 1 - (B + b)/4 \gamma \), a successful employee is offered a higher wage when there is no reorganization in order to induce search. The higher wage decreases profits, but increases total surplus in the second period. Lemma 7 implies then that a firm with no commitment power would reorganize in this region of the parameter space whereas a firm with commitment power would not. For \( \alpha < 1 - (B + 2b)/4 \gamma \), it is too costly to induce search without reorganizing. In this region the firm gets \( 2/3 \) of the total surplus in the second period if it reorganizes. If it does not reorganize, it gets less (more) than \( 2/3 \) of the surplus if \( B < 2b \) \( (B > 2b) \). Therefore, a firm with no commitment technology available tends to reorganize too often (seldom) if \( B < 2b \) \( (B > 2b) \) to capture a larger share of the surplus.
The Optimal Contract with Commitment

The main difference compared to the previous analysis is that the firm can now commit to a two-period bonus scheme. We will impose the constraint that the contract offered is renegotiation proof. The contract can thus not include a wage that is lower than the one that maximizes second period profits. If it did, the firm would have an incentive to offer a higher wage in the second period, an offer the employee would accept.\(^{15}\)

We make the following assumption on the parameters of the model, which excludes corner solutions where the first period wage is zero:

- **A.3.** \(B - b \geq 5(B + b)^2/8\gamma\)

We first find the optimal contract when there is no inertia (subscript \(A\)) and when there is inertia (subscript \(B\)), and then we compare them.

The Optimal Contract with No Inertia

Suppose that the firm wants the employee to search following a success. The firm solves the following problem:

\[
\max_{w_{1,A},w_{2,A}^s,w_{2,A}^f} \{q_{1,A}(B - w_{1,A} + E(\pi_{2,A} \mid s)) + (1 - q_{1,A})E(\pi_{2,A} \mid f)\}
\]

subject to:

\[
\begin{align*}
  w_{2,A}^s &\geq \begin{cases} 
  2\gamma(1 - \alpha) - b & \text{if } \alpha \leq 1 - (B + b)^2/4\gamma, \\
  (B - b)/2 & \text{otherwise},
\end{cases} \\
  w_{2,A}^f &\geq (B - b)/2.
\end{align*}
\]

where \(q_{1,A} = (w_{1,A} + b + \Delta E(U_{2,A}))/\gamma\) and \(E(\pi_{2,A} \mid i) = (B - w_{2,A}^i)(w_{2,A}^i + b)/\gamma, i = F,S\). The constraint on \(w_{2,A}^s\) ensures that the employee searches and that the contract is renegotiation proof in case of success. Similarly, the constraint on \(w_{2,A}^f\) takes care that the contract is renegotiation proof if the first period project is a failure. We have left out the non-negativity constraint on \(w_{1,A}\), but comment on it later. Writing down the Lagrangian of this problem, we have:

\[
L_A = q_{1,A}(B - w_{1,A} + E(\pi_{2,A} \mid s)) + (1 - q_{1,A})E(\pi_{2,A} \mid f) - \\
\lambda_1 \max \{2\gamma(1 - \alpha) - b - w_{2,A}^s, (B - b)/2 - w_{2,A}^s\} - \lambda_2 ((B - b)/2 - w_{2,A}^f).
\]

\(^{15}\)The firm and the employee will not renegotiate a wage higher than the one maximizing second period profits. A higher wage could increase total surplus, but it is not profitable for the firm, because the cash-constraint makes it impossible for the firm and the employee to share the additional surplus generated.
After simplifying the expressions, the first-order conditions can be written as:

\[
\begin{align*}
w_{1,A} &= (B - b + \Delta E(\pi_{2,A}) - \Delta E(U_{2,A}))/2, \\
\partial L/\partial w^f_{2,A} &= \frac{\partial E(\pi_{2,A} | f)}{\partial w^f_{2,A}} - \frac{\partial E(S_{2,A} | f)}{\partial w^f_{2,A}} (B + b + \Delta S_{2,A})/2\gamma + \lambda_2 \\
&= 0, \\
\partial L/\partial w^s_{2,A} &= \frac{\partial E(S_{2,A} | s)}{\partial w^s_{2,A}} (B + b + \Delta S_{2,A})/2\gamma + \lambda_1 \\
&= 0.
\end{align*}
\]

where \(\lambda_i \geq 0\) with \(\lambda_i = 0\) if the associated constraint does not bind. From these conditions, a couple of results follow:

**Lemma 9** The wage following a success is equal to:

\[
w^s_{2,A} = \begin{cases} 
B & \text{for } \alpha \geq 1 - (B + b)/2\gamma, \\
2\gamma(1 - \alpha) - b & \text{otherwise.}
\end{cases}
\]

The wage following a failure is equal to the one that maximizes the second period profits, \(w^f_{2,A} = (B - b)/2\).

**Proof.** Consider \(\partial L_A/\partial w^s_{2,A} = 0\) and suppose that \(\lambda_1 = 0\). The solution to \(\partial E(S_{2,A} | s)/\partial w^s_{2,A} = 0\) is \(w^s_{2,A} = B\). \(w^s_{2,A}\) follows then from the constraint: \(B \geq Max\{(B - b)/2, 2\gamma(1 - \alpha) - b\} \Leftrightarrow \alpha \geq 1 - (B + b)/2\gamma\). Consider now \(\partial L_A/\partial w^f_{2,A} = 0\). We have that \(\frac{\partial E(\pi_{2,A} | f)}{\partial w^f_{2,A}} = 0\) and \(\frac{\partial E(S_{2,A} | f)}{\partial w^f_{2,A}} (B + b + \Delta S_{2,A})/2\gamma > 0\) for \(w^f_{2,A} = (B - b)/2\). Hence, \(\lambda_2 > 0\) and \(w^f_{2,A} = (B - b)/2\). \(\blacksquare\)

The optimal contract with no inertia has the interesting feature that for \(\alpha \geq 1 - (B + b)/2\gamma\) a successful employee is made residual claimant in the second period. The firm extracts thus no surplus in the second period. In the first period, however, the firm can offer a low wage without destroying the employee’s incentives. This way of constructing the contract allows the firm to get (partially) around the cash-constraint.

Let us finally comment on the non-negativity constraint on \(w_{1,A}\), which has been ignored in the problem above. It can be checked that

\[
w_{1,A} = (B - b - 5(B + b)^2/8\gamma)/2 \text{ for } \alpha \geq 1 - (B + b)/2\gamma,
\]

so A.3. implies that the non-negativity constraint is not binding in this region. However, for \(\alpha < 1 - (B + b)/2\gamma\) it may be binding. It turns out that it is not necessary to solve the program for \(\alpha < 1 - (B + b)/2\gamma\) taking the constraint \(w_{1,A} \geq 0\) into account explicitly.
The reason is that for $\alpha < 1 - (B + b)/2\gamma$ allowing inertia gives higher expected profits than inducing search. We need the following auxiliary result to show this:

**Lemma 10** The profits when search is induced are no greater for $\alpha < 1 - (B + b)/2\gamma$ than for $\alpha \geq 1 - (B + b)/2\gamma$.

**Proof.** It can be shown that $w_{2,A}^i = (B - b)/2$ for all $\alpha$. For $\alpha \geq 1 - (B + b)/2\gamma$ neither the constraint $w_{1,A} \geq 0$ nor $w_{2,A}^i \geq \max\{2\gamma(1 - \alpha) - b, (B - b)/2\}$ are binding. For $\alpha < 1 - (B + b)/2\gamma$, the latter constraint, and sometimes the former, is binding. Since $\alpha$ does not enter the objective function, but only the constraints, the proof follows. ■

**The Optimal Contract with Inertia**

Suppose that a successful employee is not given incentives to search in the second period. Then, the firm solves the following problem:

$$\max_{w_{1,B}, w_{2,B}^i, w_{2,B}} \{ q_{1,B}(B - w_{1,B} + E(\pi_{2,B} \mid s)) + (1 - q_{1,B})E(\pi_{2,B} \mid f) \}$$

subject to:

$$2\gamma(1 - \alpha) - b \geq w_{2,B}^i,$$

$$w_{2,B}^i \geq 0,$$

$$w_{2,B}^f \geq (B - b)/2,$$

where $q_{1,B} = (w_{1,B} + b + \Delta E(U_{2,B}))/\gamma$, $E(\pi_{2,B} \mid s) = (B - w_{2,B}^f)(w_{2,B} + b)/\gamma$, and $E(\pi_{2,B} \mid s) = (1 - \alpha)B$. Writing down the Lagrangian, we have:

$$L_B = q_{1,B}(B - w_{1,B} + E(\pi_{2,B} \mid s)) + (1 - q_{1,B})E(\pi_{2,B} \mid f) - \lambda_1(2\gamma(1 - \alpha) - b) - \lambda_2((B - b)/2 - w_{2,B}) + \lambda_3 w_{2,B}^i.$$

After some manipulations, the first-order conditions are:

$$w_{1,B} = (B - b + \Delta E(\pi_{2,B}) - \Delta E(U_{2,B}))/2 = 0,$$

$$\frac{\partial L_B}{\partial w_{2,B}^i} = -\lambda_1 + \lambda_3 = 0,$$

$$\frac{\partial L_B}{\partial w_{2,B}^f} = \frac{\partial E(\pi_{2,B} \mid f)}{\partial w_{2,B}^f} - \frac{\partial E(S_{2,B} \mid f)}{\partial w_{2,B}^f}(B + b + \Delta S_{2,B})/2\gamma + \lambda_3 = 0,$$

where $\lambda_i \geq 0$ with $\lambda_i = 0$ if the associated constraint does not bind. It can be shown as above that $w_{2,B}^f = (B - b)/2$. Any $w_{2,B}^i \in [0, 2\gamma(1 - \alpha) - b]$ can be a solution to
∂L_2 / ∂w_2^* = 0.\textsuperscript{16} Considering the non-negativity constraint w_{1,B} ≥ 0, we have that for w_{2,B} = 0, which relaxes this constraint as much as possible, w_{1,B} = ((2 - α)(B - b) - (B + b)^2/8γ)/2. Hence, w_1^B > 0 under A.3. for all α.

The Optimal Contract

We are now ready to determine the optimal contract with commitment. The first step is to show that the profits of the two programs (inertia and no inertia) coincide for α = 1 - (B + b)/2γ. Afterwards, we show that it is optimal to allow inertia for α < 1 - (B + b)/2γ but not for α > 1 - (B + b)/2γ.

Lemma 11 The profits with and without inertia coincide for α = 1 - (B + b)/2γ.

Proof. If there is no inertia, the constraint on w_{2,A}^S is (exactly) not binding for α = 1 - (B + b)/2γ and w_{2,A}^S = B. Consider now the program with inertia. It follows from ∂L_2 / ∂w_{2,B} = 0 that any w_{2,B} ∈ [0, B] can be part of the solution to the program. Consider thus w_{2,B} = B. It is easy to show that in this case w_A = (w_{1,A}, w_{2,A}^f, w_{2,A}^S) = w_B = (w_{1,B}, w_{2,B}^f, w_{2,B}^S). Finally, w_A = w_B and α = 1 - (B + b)/2γ imply that the profits of the two programs are the same. ■

Lemma 12 The profits with (without) inertia are higher than without (with) for α < (≥)1 - (B + b)/2γ.

Proof. Denote by w_i^*(α) = (w_{1,A}, w_{2,A}^f, w_{2,A}^S) the solution to program i, i ∈ {A, B}, as a function of α. Denote w_i = w_i^*(1 - (B + b)/2γ), i = A, B. The overall profits of the game as a function of the vector of wages and α are denoted π_i(w_i, α), i = A, B. Consider first the program where search is induced. We have that w_A = w_A^*(α) for all α ≥ 1 - (B + b)/2γ. Using Lemma 10, it follows that π_A(w_A^*(α), α) ≤ (≥)π_A(w_A, 1 - (B + b)/2γ) for α < (≥)1 - (B + b)/2γ. Consider now the program with inertia. w_B^*(α) = ((B - b + ΔE(π_2,B) - ΔE(U_2,B))/2, (B - b)/2, 0) is a solution to this program whenever a solution exists. Applying the envelope theorem, we have:

\[ \frac{∂π_B(w_B^*(α), α)}{∂α} = -(B + b)q_{1,B} < 0. \]

Using Lemma 11, we have that π_B(w_B^*(α), α) > (≤)π_A(w_A, 1 - (B + b)/2γ) for α < (≥)1 - (B + b)/2γ. The proof follows from comparing the profits of the two programs. ■

\textsuperscript{16}It follows that there is no solution to the program for α > 1 - b/2γ.
The next proposition summarizes the analysis up to now:

**Proposition 5** The optimal renegotiation proof contract when the firm has a commitment technology available is

$$w_1 = \frac{(B - b + \Delta E(\pi_{2,B}) - \Delta E(U_{2,B}))/2}{2}$$

and

$$w_{2f} = \frac{(B - b)}{2}.$$  

For \(\alpha \geq 1 - (B + b)/2\gamma\) a successful employee is induced to search again by setting \(w_{2s} = B\). For \(\alpha < 1 - (B + b)/2\gamma\) there is inertia, and \(w_{2s} = 0\) is an optimal wage.

A couple of interesting results follow from this proposition.

**Corollary 1** There is inertia precisely when it maximizes the joint surplus of the employee and the firm.

**Proof.** With no inertia, the maximal joint surplus in the second period is \((b + B)^2/2\gamma\), which is obtained for \(w_{2s} = B\). With inertia the joint surplus is \((1 - \alpha)(B + b)\). Hence, inertia is optimal if and only if \(\alpha \leq 1 - (B + b)/2\gamma\). \(\blacksquare\)

**Corollary 2** Under A.3. a firm with a commitment technology available will never reorganize in the second period.

**Proof.** It follows from Lemma 9 that the constraint \(w_{2,A} \geq Max\{(B - b)/2, 2\gamma(1 - \alpha) - b\}\) only binds for \(\alpha \leq 1 - (B + b)/2\gamma\). However, arguing as in the proof of Lemma 12 it can be shown that inertia is optimal for \(\alpha \leq 1 - (B + b)/2\gamma\) even if the constraint on \(w_{2,A}\) is removed. It follows that a reorganization cannot increase profits for any \(\alpha\). \(\blacksquare\)

A firm that can commit to a two-period bonus scheme has, as long as the non-negativity constraint on the first period wage does not bind, the possibility to solve the problem of inertia. If it is optimal to induce search, the firm offers a contract that makes the employee the residual claimant in the second period. This leads to the search behavior that maximizes overall surplus, a surplus that the firm extracts through a low first period wage. Since the optimal contract solves the problem of inertia, there is no role for second-best measures such as a reorganization or reduction in control.

We have looked at the solution when A.3. does not hold. In this situation, it is not optimal to make the employee residual claimant in the second period, because the firm cannot extract enough rents in the first period due to the cash-constraint. Hence, \(w_{2,A} < B\) for \(\alpha \geq 1 - (B + b)/2\gamma\). Here, it is possible to construct examples where a reorganization increases profits.

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References


