



# Product-Market Competition and Managerial Autonomy

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# Product-Market Competition and Managerial Autonomy<sup>1</sup>

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## **Abstract**

It is often argued that competition forces managers to make better choices, thus favoring managerial autonomy in decision making. I formalize and challenge this idea. Suppose that managers care about keeping their position or avoiding interference, and that they can make strategic choices that affect both the expected profits of the firm and their riskiness. Even if competition at first pushes the manager towards profit maximization as commonly argued, I show that further increases in competitive forces might as well lead him to take excessive risks if the threat on his position is strong enough. To curb this possibility, the principal-owner optimally reduces the degree of autonomy granted to the manager. Hence higher levels of managerial autonomy are more likely for intermediate levels of competition.

**JEL Codes:** D23, L22, M12, M21

**Keywords:** product-market competition, authority, decision making, delegation, autonomy

# 1 Introduction

Most economists would agree that competition is a source of discipline. Competition is generally believed to reduce the amount of slack a manager can afford and to have a positive influence on managerial effort.<sup>1</sup> Aghion et al. (1999) and Schmidt (1997), in particular, have emphasized the idea that stronger competition increases the threat of liquidation of the firm, and that this might induce managers to work harder.

As pointed out by Diamond (1998), “managers are called on to make choices as well as to make efforts”, but it is often argued that the same disciplinary effect of competition also forces managers to make better choices, or pushes them towards profit maximization. The consequent prediction is that an increase in competition should favor the delegation of decision-making authority. Acemoglu et al. (2007), for instance, articulate this argument as follows:

“Yet another effect of a more competitive environment may be through disciplining the manager; faced with greater competition, managers may be forced to take profit-maximizing decisions more often, thus reducing the conflict of interest between the principal and the manager. This would naturally increase delegation, since delegation becomes more attractive to the principal” (p. 1797).

Though frequently referred to, the idea that competition induces better choices has been rarely subjected to formal analysis. In this paper I develop a highly stylized model of authority within the firm in which the degree of conflict between the parties is affected by the strength of competition, and challenge the common presumption that a more competitive environment always forces managers to make choices in the best interest of the firm, thereby fostering managerial autonomy in decision making.

In the model considered, a firm is run by a manager who exerts effort to figure out a better strategy for the organization and implements it. His strategic choices affect not only the expected profits of the firm, but also their riskiness. The manager has his own goals -

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<sup>1</sup>See Karuna (2007) for recent empirical evidence.

in particular, to keep his incumbency rents - which need not be perfectly aligned with the interests of the principal-owner. The principal-owner, on the other hand, can constrain the manager's autonomy or discretion in decision making through her own monitoring effort, and may intervene in the manager's operations if performance is poor. This intervention may take many forms (e.g., firing the manager, shutting down) and reduces the manager's rents - who will thus try to avoid it.

Under these conditions, I show that an increase in competition can lead to less delegation. Competition affects the congruence of interests between the manager and the organization through a reduction in profits that increases the likelihood of poor performance, and through the associated threat to the manager's incumbency rents. At first, a strengthening of competition induces the manager to make decisions more in line with the interests of the organization, and therefore leads to increased managerial autonomy - as commonly argued. Further increases in competitive forces, however, might as well lead the manager to take excessive risks if the threat on his rents is strong enough. To curb this possibility of having the manager gamble for his resurrection, the principal optimally reduces the degree of autonomy granted to the manager. With an intermediate level of competition the threat on incumbency rents is just enough to align the manager's interests with those of the organization without pushing him to take value-reducing risks. The paper then predicts a nonmonotonic relationship between competition and delegation: Higher degrees of managerial autonomy in decision making are more likely for intermediate levels of competition.

Although there is much informal discussion about how increasing competition is driving corporate change, empirical evidence on the relationship between competition and delegation does not abound - and is far from conclusive. Acemoglu et al. (2007) and Bloom et al. (2007) document a positive correlation between competition and delegation. Caroli and van Reenen (2001), however, find basically no evidence of a relationship between competition and organizational change (as characterized by delegation of responsibility and delayering). Khandwalla (1973) also finds no correlation between delegation and price competition, and between delegation and overall competition, but documents a positive correlation between

delegation and product competition (differentiation).<sup>2</sup> Marin and Verdier (2008a), on the other hand, report evidence from Germany and Austria that firms are more likely to centralize decision-making powers when competition strengthens. More indirectly, Nickell et al. (2001) show that poor performance leads firms to centralize decision making.

The argument that a strengthening of competition induces better managerial choices can only explain a positive correlation between competition and delegation, but cannot account for the negative relationship found in several studies. The model envisioned here, by stressing that at some point more competition leads to worse choices, suggests a possible explanation for the findings of those studies: when competition is tough and performance is poor, a manager concerned with his survival or reputation would tend to take excessive risks if left unchecked – hence the principal intervenes more and grants him less autonomy.

The remainder of the paper is organized as follows: Section 2 presents a simple model to analyze the delegation problem within the firm. In Section 3 I look for the optimal organizational response to changes in the strength of competitive forces facing the firm. Section 4 concludes.

## **2 A simple model of the determinants of managerial autonomy**

We begin in this section with a simple model of delegation that emphasizes the organizational problem faced by a firm. To fix ideas, I focus on an organization that produces a good (or service) to be sold in a (final) product market. To stress the delegation problem, I do not model market interaction here, but represent its outcome by a reduced-form profit function  $\pi(\theta)$ , where  $\theta$  is a known competition parameter, like the number of competitors in the product market (see more below).

The firm I consider is a simple hierarchy composed of a principal ('she') and an agent

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<sup>2</sup>This work underlines the importance of clarifying the type of competition firms are facing when analyzing the effect of competition on delegation practices. See Ruzzier (2008) for a modeling effort in this direction.

(the manager; ‘he’). The manager is in charge of running the firm.<sup>3</sup> Managing the firm involves “figuring out what to do” and “doing it” (Radner, 1992); that is, the managerial task comprises two different activities: planning and implementation. Planning refers to the acquisition of information; implementation refers to its use (Demski and Sappington, 1987).

Concerning information, I will assume that the manager has specific knowledge “that in practice is too costly to communicate to others in the firm [...] and is often the reason why managers are entrusted with decisions in the first place” (Raith, 2008).<sup>4</sup> To be concrete, we will think of this specific knowledge as concerning the routine way of running the firm, and stemming from the manager’s being in charge of day-to-day management of the company. I place all the routine actions of the manager under the header ‘status quo’ – specific knowledge implies that the manager can always resort to the status quo even if he exerts no further planning effort. In other words the planning task is only important for nonroutine activities.<sup>5</sup>

To keep things simple, there are three possible profit levels,  $\pi_H(\theta) > \pi_M(\theta) > \pi_L(\theta)$ , for every  $\theta$ , and expected profits under the status quo are

$$E_{sq}[\pi] = \frac{1}{3}\pi_H + \frac{1}{3}\pi_M + \frac{1}{3}\pi_L$$

where  $E[\cdot]$  is the expectation operator, and the subindex *sq* stands for ‘status quo’. At least three profit levels are necessary for strategies to be noncomparable in terms of first-order stochastic dominance, so as to be able to consider risk-taking behavior within the model (see, for instance, Lambert, 1986). In what follows, I omit the dependence of  $\pi$  on  $\theta$  when there is no risk of confusion.

The principal is unaware of the status quo, but she may learn about it through her monitoring effort, as I explain below. These assumptions are meant to capture the idea that the principal is somewhat removed from day-to-day management and that managers are often

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<sup>3</sup>I refer to a firm for the sake of concreteness, but the analysis can also be applied to a division, a subsidiary, or generally, to any independent profit center.

<sup>4</sup>Colombo and Delmastro (2004) show evidence that the information advantage of the manager is actually a key determinant of delegation.

<sup>5</sup>The idea of the status quo has some parallel with Demski and Sappington’s (1987) null information structure, which is costless for the manager to access.

much better informed about current operations than their superiors. Several examples come to mind: shareholders/CEO (Shleifer and Vishny, 1997, argue that managers normally get the residual control rights when they have more expertise than shareholders and contracts are incomplete, and that this may lead to poor choices from the point of view of the shareholders), CEO/division manager (Jennergren, 1981, for instance, claims that “in a divisionally decentralized firm, divisions are largely independent in day-to-day operations”), headquarters/local office (Newman and Novoselov, 2005, consider such an organizational structure to be descriptive of firms whose local offices, especially in remote locations, enjoy considerable autonomy and discretion over decisions), production manager/plant manager, or any other situation in which the principal is, to some extent, not privy to day-to-day operations of the firm.

*Strategies.* Through his planning effort the manager can figure out changes to the way things are done. These changes will be summarized in what I will call a ‘strategy’: a set of actions that, if implemented, lead to a new probability distribution on profits. ‘Strategy’ should be interpreted in a broad sense, to include actions that affect not only the expected value of the firm’s profits, but also their riskiness. The manager’s control over the idiosyncratic risks of the firm may come under many guises: expanding production capacity or relocating production plants, doing more or less preventive maintenance of the productive equipment, outsourcing activities or carrying them out in-house, adopting a hard or a soft stance at wage negotiations, diversifying into other business lines or concentrating on core activities. All these actions differ in their observability. I focus here on the kind of controls over risk that are difficult to observe, and simplify things by assuming there are different strategies available to the manager, which modify the risk-return characteristics of the firm’s operations in a way summarized by the induced probability distributions.

The firm faces  $n \geq 3$  ex ante identical strategies that could be potentially implemented, but strategies cannot be described in advance and put into an enforceable contract, as in Aghion and Tirole (1997). I will further assume that there are just two strategies worth

selecting: the first I call ‘aggressive’; the other, ‘conservative’. Every other strategy yields a disastrous (i.e., sufficiently negative) payoff to both parties.

Being aggressive amounts to choosing a riskier strategy, whereby the probability of high profits is increased by  $\alpha$  and that of low profits by  $\beta$ , and the probability of an intermediate level of profits is reduced by  $\alpha + \beta$ . Adopting an aggressive strategy reduces expected profits, namely

$$E_{ag}[\pi] < E_{sq}[\pi] \iff \Delta(\theta) \equiv (\alpha + \beta)\pi_M - (\alpha\pi_H + \beta\pi_L) > 0. \quad (1)$$

In other words, I assume that taking risk results in a probability distribution that is second-order stochastically dominated by the status quo. The idea that risk taking reduces values is common in the analysis of risk-shifting problems and is consistent with empirical evidence on the matter (see Biais and Casamatta, 1999, and the references therein).

On the other hand, if the manager chooses the conservative strategy, the probability of high profits is *decreased* by  $\alpha$  and that of low profits by  $\beta$ , and the probability of a medium level of profits is increased by  $\alpha + \beta$ . Notice that the condition (1) implies also that expected profits are highest under the conservative strategy, i.e.,  $E_{co}[\pi] > E_{sq}[\pi] > E_{ag}[\pi]$ , and that

$$\begin{aligned} \Delta(\theta) &= E_{co}[\pi] - E_{sq}[\pi] \\ &= E_{sq}[\pi] - E_{ag}[\pi]. \end{aligned}$$

**Planning.** Ex ante, all the strategies look alike. Planning allows the manager to tell them apart. At date 1 the manager exerts noncontractible planning effort to find out available strategies and associated payoffs. If the manager exerts effort level  $e$ , at personal cost  $\psi_m(e)$  he is perfectly able to discern strategies with probability  $e$ . With probability  $1 - e$ , he remains uninformed.<sup>6</sup> Effort can be thought of as time and resources devoted to gathering and processing information – for example, the manager may seek the advice of consultants or may investigate how things are done in other firms in the industry.

Also at date 1 the principal can constrain the manager through monitoring of his activities. To this end, she simultaneously chooses noncontractible monitoring (or control) effort

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<sup>6</sup>The information acquisition technology is familiar from Aghion and Tirole (1997).

$c$ : with probability  $c$ , she is informed about the possible strategies, including the status quo. This effort is costly to the principal: her cost-of-effort function is  $\psi_p(c)$ . For  $j = m, p$ , I assume that  $\psi_j$  is increasing and strictly convex, and satisfies  $\psi_j(0) = \psi'_j(0) = 0$ , and  $\psi'_j(1) = +\infty$ .

The principal's monitoring effort can be interpreted as the time and resources devoted to establishing a management control system (MCS), for it is her way of trying to ensure that the manager will do what is best for the organization. Having  $\psi'_p(1) = +\infty$  just reflects that perfect control is rarely cost-effective (Merchant, 1998).

Planning, if successful, generates a set of possible strategies from which the manager must choose at the implementation stage. Contrary to planning, implementation is costless; for instance, all strategies may require roughly the same level of implementation effort (normalized to zero) from the manager.<sup>7</sup> Which strategy is implemented depends on the authority relationship, as well as on the preferences of both parties.

**Implementation.** The organization must implement one and only one strategy (maybe the status quo). Given that I treat the firm as an ongoing business, implementing no strategy is not an option. That is, the status quo is not the outcome of inaction.<sup>8</sup>

Managerial effort generates a set of alternatives to the status quo, and the manager is then free to (costlessly) choose any element of the set at date 2, unless otherwise directed by an informed principal (see below). Since the manager already knows the status quo, he can stick to it if nothing new obtains from his effort in information gathering; i.e., the manager can always carry on the business as usual if he cannot devise new strategies. The disastrous-payoff assumption guarantees that an uninformed manager will always stick to the status quo (if that choice is his to make).

Strategy choice is observable only to an informed party, but it is unverifiable. This

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<sup>7</sup>I adopt this formulation to emphasize the planning activity. See Demski and Sappington (1987), Diamond (1998), and Sung (1995) for similar assumptions.

<sup>8</sup>Newman and Novoselov (2005) adopt a similar approach. This is contrary to Aghion and Tirole's (1997) assumption that the organization can always decide to do nothing and realize a zero payoff for both parties.

means that strategy selection cannot be made part of a contract, and that an uninformed principal will, out of necessity, delegate this choice to the manager (who, at the very least, is informed about the status quo and can thus avoid very negative outcomes). If the principal is uninformed, ordering the manager to maintain the status quo is meaningless, since an uninformed principal cannot tell whether the status quo stands just by looking at what the manager is doing. Given that something has to be done, picking at random when uninformed might result in a disastrous alternative being implemented. The principal might then rubberstamp a suboptimal strategy choice when uninformed by fear of picking a worse alternative.

The only way for the principal to be able to effectively direct the manager's actions is by being herself informed of strategies. That is, authority has to be enforced. What I have in mind is that, although endowed with decision or control rights, the principal only has effective control or real authority when she has enough incentives to exercise those rights. Else, she can decide to grant autonomy in decision making to the manager. In the event that both parties are informed the principal prevails since she has formal authority.<sup>9</sup>

As my main interest is in managerial autonomy (i.e., the extent of real authority enjoyed by managers), I do not analyze the possibility of giving the manager formal authority over decisions. The transfer of formal authority looks very much like splitting up the firm, which is not a main concern in this study. Furthermore, it can be shown that in this setup full delegation of formal authority is actually dominated. Matter-of-factly, the principal normally keeps the right to overrule the manager, as she can always fire him.

One can also regard the assumptions about the exercise of authority as picturing an intermediate allocation of formal authority. Authority is delegated to the subordinate, but the superior can reestablish her authority at a cost – the cost of monitoring the subordinate.<sup>10</sup>

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<sup>9</sup>Shleifer and Vishny (1997) also present this idea that there is a cost of exercising a control right. In Hart and Moore (2005), owners have all decision rights (formal authority), but lack the time to exercise them all and hence must delegate some to managers (real authority). As they have put it, “a senior individual has formal authority while a junior individual has real authority if he has an idea and his boss does not”.

<sup>10</sup>Aghion and Tirole (1997) discuss such an allocation, but authority is reestablished by an ex post per-

Think of the manager as receiving broad profit responsibilities, and think of the principal as being the dispersed stockholders (or the board of directors): they can monitor and give instructions to the manager, but only if they organize themselves and collect relevant information, which is costly.<sup>11</sup>

**Profits and competition.** At date 3, profits are realized according to the probability distribution induced by the implemented strategy. I represent the outcome of market interaction by the following reduced-form gross profit function, which implicitly assumes a unique equilibrium in the ensuing market game:<sup>12</sup>

$$\pi = \pi(\theta). \quad (2)$$

Profits depend on an exogenous parameter  $\theta \in \Theta = [0, \bar{\theta}]$  that measures the strength of competition (e.g.,  $\theta$  could be the number of competitors in the product market, the degree of substitutability between products, a measure of barriers to entry, and so on), and is known to both parties at the outset. I make the natural assumption that competition destroys profits, that is,

$$\theta > \theta' \implies \pi(\theta) < \pi(\theta') \quad \forall \pi \in \{\pi_H, \pi_M, \pi_L\}. \quad (3)$$

For my purposes, how (2) is derived does not matter. To show that the analysis is not vacuous, however, I present several alternative derivations of  $\pi(\theta)$  from explicit market games in Appendix B.

**Preferences.** The principal is risk-neutral and her utility is given by expected profits  $E_k[\pi(\theta)]$ . Expectations are taken over the probability distribution induced by the chosen strategy: status quo, aggressive, conservative (i.e.,  $k = sq, ag, co$ ). The manager, on the other hand, does not respond to monetary incentives (for instance, because he is infinitely averse to income risk) and thus receives a constant wage normalized to zero. This extreme

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formance evaluation in their paper. See also Hart and Holmström (2008).

<sup>11</sup>See Burkart et al. (1997), and Shleifer and Vishny (1997) for related ideas.

<sup>12</sup>See Hermalin (1992) and Schmidt (1997) for a similar approach.

assumption is typical in models that study optimal delegation decisions (Aghion and Tirole, 1997; Burkart et al., 1997; De Bijl, 1994; and Dessein, 2002). It simplifies the analysis and allows me to stress the role of incumbency rents, as in Fudenberg and Tirole (1995). Equivalently, if profits are noncontractible and the agent is protected by limited liability, a constant wage also results.<sup>13</sup>

The manager also receives private benefits  $B$  from job tenure. These may take many forms, like perquisites on the job, prestige and power associated with the position, acquisition of human capital and work experience, job satisfaction, or career concerns. The existence and magnitude of these benefits have been extensively documented (see Zingales, 1995, and the references cited therein).

***Intervention.*** After profits are realized and observed by the parties, at date 4 the principal decides whether to intervene or not in the manager's operations. Intervention may take many forms (such as the firing of the manager, the liquidation or shut down of his profit center); the general feature is that intervention reduces the manager's private benefits or incumbency rents. For the sake of brevity, I will not model the particulars of this intervention – I just assume it is automatically triggered if realized profits fall below a certain threshold or target, a situation I will label 'poor performance'.

Even though I treat the intervention decision as exogenous here, it can be endogenized as I show in Appendix A. There, I present a two-period version of the model in which this intervention takes the form of a firing decision that results from the firm's optimizing behavior. Coughlan and Schmidt (1985), Murphy and Zimmerman (1993), Warner et al. (1988), and Weisbach (1988) actually find evidence that poor performance (measured by stock performance or changes in earnings) contributes to non-routine CEO turnover.

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<sup>13</sup>As is common in this kind of models, all the qualitative results go through if the manager responds to monetary incentives, as long as he cares enough about his private benefits. The proof is available from the author upon request. Burkart et al. (1997) discuss how both monetary incentives and private benefits can coexist in an optimal arrangement, and show that performance pay normally does not render monitoring redundant.

To capture that poor performance has costs for managers, I assume that intervention implies a utility loss  $L$  for the manager; i.e., his rents are reduced from  $B$  to  $B - L$ .<sup>14</sup> The utility loss  $L$  can be caused by career concerns considerations (e.g., the market interpreting poor performance as a signal of bad quality) or arise from actions that the manager must take in case of intervention and that he does not like (as downsizing). If poor performance triggers the removal of the manager,  $L$  could represent “possible losses in income and firm-specific human capital, and in any power, prestige, and other non-pecuniary benefits [the manager] derived from managing” the firm (Gilson, 1989). Even if there is no turnover, the manager may suffer from reductions in his compensation or decision-making authority.<sup>15</sup>

Let  $\pi^I$  be the profit threshold that triggers intervention. Realized profits  $\pi(\theta)$  can fall short of  $\pi^I$  – assumption (3) implies that stronger competition makes this event more likely. To make this notion more precise, assume that there exists a  $\underline{\theta}$  such that  $\pi_L(\underline{\theta}) = \pi^I$ . This implies that for every  $\theta \in \underline{\Theta} \equiv [0, \underline{\theta}]$ , we have  $\pi_H > \pi_M > \pi_L \geq \pi^I$ . Analogously, define  $\hat{\theta}$  by  $\pi_M(\hat{\theta}) = \pi^I$ , and  $\bar{\theta}$  by  $\pi_H(\bar{\theta}) = \pi^I$ . Then, for all  $\theta \in \hat{\Theta} \equiv (\underline{\theta}, \hat{\theta}]$ , we have  $\pi_H > \pi_M \geq \pi^I > \pi_L$ , and for  $\theta \in \bar{\Theta} \equiv (\hat{\theta}, \bar{\theta}]$ , we know  $\pi_H \geq \pi^I > \pi_M > \pi_L$ . It is clear that  $\underline{\theta} < \hat{\theta} < \bar{\theta}$ , and that  $\underline{\Theta}$ ,  $\hat{\Theta}$ , and  $\bar{\Theta}$  form a partition of  $\Theta$ .

To sum up,

	$\pi_H(\theta)$	$\pi_M(\theta)$	$\pi_L(\theta)$
$\theta \in \underline{\Theta}$	$> \pi^I$	$> \pi^I$	$\geq \pi^I$
$\theta \in \hat{\Theta}$	$> \pi^I$	$\geq \pi^I$	$< \pi^I$
$\theta \in \bar{\Theta}$	$\geq \pi^I$	$< \pi^I$	$< \pi^I$

(4)

In what follows, we will say that competition is weak whenever  $\theta \in \underline{\Theta}$ . Similarly, intermediate competition will make reference to cases where  $\theta \in \hat{\Theta}$ , and when  $\theta \in \bar{\Theta}$  we will speak of intense competition.

It is clear that poor performance jeopardizes the manager’s rents. The direct consequence

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<sup>14</sup>Gilson (1989, 1990), for example, presents evidence on managers’ personal costs from financial distress. I assume that distress does not imply a utility loss for the principal. Schmidt (1997) makes similar assumptions.

<sup>15</sup>He might even face losses in terms of reduced self-esteem. Even though extreme as an example, Gilson (1989) has a case of suicide among his sample of managers in financially-distressed firms.

of my assumptions is that all the manager cares about is avoiding such a situation, like the conservative managers in Hart (1983), Fudenberg and Tirole (1995), or Aghion et al. (1999).

The likelihood of intervention will depend, of course, on the probability distribution of profits that results from the planning and implementation activities, but also on the strength of competition. Let us call this likelihood  $d^k(\theta)$ . We can easily compute it from table (4). To simplify notation, let  $d^k(\theta) \equiv \underline{d}^k$ ,  $k = co, sq, ag$ , denote the probability that realized profits fall short of the threshold when competition is weak and the manager implements strategy  $k$ . All other probabilities in the table below are defined accordingly. Then:

	conservative	status quo	aggressive
$\theta \in \underline{\Theta}$	$\underline{d}^{co} = 0$	$\underline{d}^{sq} = 0$	$\underline{d}^{ag} = 0$
$\theta \in \widehat{\Theta}$	$\widehat{d}^{co} = \frac{1}{3} - \beta$	$\widehat{d}^{sq} = \frac{1}{3}$	$\widehat{d}^{ag} = \frac{1}{3} + \beta$
$\theta \in \overline{\Theta}$	$\overline{d}^{co} = \frac{2}{3} + \alpha$	$\overline{d}^{sq} = \frac{2}{3}$	$\overline{d}^{ag} = \frac{2}{3} - \alpha$

(5)

For instance, if competition is intermediate and the organization implements the conservative strategy, the probability of intervention in this case ( $\widehat{d}^{co}$ ) is equal to the probability of  $\pi_L$ , i.e.,  $\frac{1}{3} - \beta$ . Quite naturally, stronger competition increases the likelihood of an intervention from the principal.<sup>16</sup> Indeed, DeFond and Park (1999) present evidence showing that the probability of CEO turnover increases with higher levels of competition (proxied by the Herfindahl index).

### 3 Optimal degree of autonomy granted to the manager

In this section, I look for the optimal organizational response to changes in the firm's environment – that is, I discuss the optimal choices of planning and monitoring efforts as a function of the strength of competitive forces.

Condition (1) implies that the principal would always prefer to implement a conservative strategy, regardless of the level of competition. The manager's preferred strategy, on

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<sup>16</sup>I have assumed that the probability of poor performance is zero when competition is weak. This is no more than a simplifying assumption, the essential feature being that the probability of poor performance is higher for a low-profit firm than for a high-profit one.

the other hand, is the one that minimizes the likelihood of poor performance, and thus it changes with  $\theta$ . Simple inspection of table (5) shows that the manager is indifferent between strategies when competition is weak, strictly prefers being conservative when competition is intermediate, and strictly prefers taking risk when competition is intense. This is the basic conflict of interests between principal and manager. It does not arise from different risk preferences (as in, e.g., Lambert, 1986), but from different goals – maximization of expected profits vs. minimization of the likelihood of intervention.

The case of weak competition ( $\theta \in \underline{\Theta}$ ) is straightforward to examine: since the manager can never fail the profit target when competition is weak, the principal cannot expect him to exert any costly effort to find ways to do things better for the organization – the manager just puts in minimal effort (i.e., his optimal choice is  $\underline{e} = 0$ ).<sup>17</sup> The principal has, nevertheless, an incentive to get herself involved in daily operations and exert some effort in order to be able to instruct the manager to implement the conservative strategy rather than the status quo. If she exerts effort  $c$ , her preferred strategy is implemented with probability  $c$ ; otherwise the manager just sticks to the routine.

Let  $\pi^k(\theta) \equiv E_k[\pi(\theta)]$ ,  $k = sq, ag, co$ . The objective function of the principal in the case  $\theta \in \underline{\Theta}$  can be written as

$$\underline{u}_p = c \cdot \pi^{co}(\theta) + (1 - c) \cdot \pi^{sq}(\theta) - \psi_p(m).$$

The principal chooses the monitoring effort that maximizes this expression – call it  $\underline{c}$ . It satisfies the following first-order condition:

$$\Delta(\theta) = \psi'_p(\underline{c}).$$

Since  $\Delta(\theta) > 0$  by (1),  $\psi'_p(0) = 0$  and  $\psi''_p > 0$ , we have  $\underline{c} > 0$ . The principal just puts effort up to the point where the marginal benefit given by the increase in expected profits if informed,  $\Delta$ , equals the marginal cost of monitoring.

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<sup>17</sup>Strong competition in the market for corporate control may place a lower bound on managerial effort. As this falls out of the scope of this paper, I just treat  $e = 0$  as a normalization for some minimum level of effort.

When competition is intermediate ( $\theta \in \widehat{\Theta}$ ), the manager's position is no longer secure: there is a chance that performance is poor, an event in which intervention will occur and he will bear the utility loss  $L$ . Competition then provides a wedge between the manager's utility in case of effort and no effort, and thus provides him with incentives to work harder and show more initiative, much as in a typical moral hazard problem. The manager maximizes

$$\begin{aligned}\widehat{u}_m &= c \left[ \left(1 - \widehat{d}^{co}\right) \cdot B + \widehat{d}^{co} \cdot (B - L) \right] \\ &\quad + (1 - c) \cdot e \cdot \left[ \left(1 - \widehat{d}^{co}\right) \cdot B + \widehat{d}^{co} \cdot (B - L) \right] \\ &\quad + (1 - c) \cdot (1 - e) \cdot \left[ \left(1 - \widehat{d}^{sq}\right) \cdot B + \widehat{d}^{sq} \cdot (B - L) \right] - \psi_m(e).\end{aligned}$$

To understand this expression, notice that with probability  $c$  the principal is informed and imposes her preferred conservative strategy, and intervention occurs with probability  $\widehat{d}^{co}$ . With probability  $1 - c$  the principal is uninformed and the manager is granted autonomy in strategy selection: if he is informed, the manager chooses his preferred strategy, which in this case coincides with the principal's; if he remains uninformed, he sticks to the status quo. Rearranging, we arrive at

$$\widehat{u}_m = B - \left\{ [c + (1 - c) \cdot e] \cdot \widehat{d}^{co} + (1 - c) \cdot (1 - e) \cdot \widehat{d}^{sq} \right\} \cdot L - \psi_m(e).$$

The objective function of the principal becomes

$$\widehat{u}_p = c \cdot \pi^{co}(\theta) + (1 - c) \cdot e \cdot \pi^{co}(\theta) + (1 - c) \cdot (1 - e) \cdot \pi^{sq}(\theta) - \psi_p(c),$$

or

$$\widehat{u}_p = [c + (1 - c) \cdot e] \cdot \pi^{co} + (1 - c) \cdot (1 - e) \cdot \pi^{sq} - \psi_p(c).$$

Let  $\widehat{c}$  and  $\widehat{e}$  denote the optimal choices of efforts. A Nash equilibrium is given by the solution to the following system of first-order conditions:<sup>18</sup>

$$\begin{aligned}(1 - \widehat{e}) \cdot \Delta(\theta) &= \psi'_p(\widehat{c}) \\ (1 - \widehat{c}) \cdot \beta \cdot L &= \psi'_m(\widehat{e}).\end{aligned}\tag{6}$$

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<sup>18</sup>I assume that the stability condition is satisfied, i.e., if  $\psi''_p \psi''_m \geq \Delta\beta L$ .

We see immediately that  $\hat{e} > \underline{e} = 0$ . By increasing his planning effort, the manager is more likely to implement his preferred strategy when the principal is uninformed, which happens with probability  $(1 - \hat{c})$ , thus reducing the probability of intervention by  $\beta$  and saving  $\beta L$  in expectation. Since the principal's reaction function (6) is downward sloping, we can infer that  $\hat{c} < \underline{c}$ . Effort only benefits the principal (she gains  $\Delta(\theta)$  in expected profits) if the manager is uninformed (which happens with probability  $1 - \hat{e}$ ), since if the manager is informed he nevertheless implements the principal's preferred strategy. I record these findings as Result 1:

**Result 1** *When moving from weak competition to intermediate, product market competition fosters autonomy and initiative.*

When competition is intermediate, an informed manager chooses strategies in line with the interests of the principal. The goals of both parties are aligned, and hence the principal need not monitor as much as in the previous situation, but can rely more on her manager – managerial autonomy (measured as  $1 - c$ ) thus increases. Likewise, the manager knows that his principal will intervene less and hence is more willing to show initiative and go about new ways of doing things. Competition here leads to employee empowerment and makes the company more entrepreneurial and innovative. Result 1 provides support for the idea that increased competition reduces the conflict of interest between principal and manager, because it induces the manager to make better decisions. I will argue shortly that things may be different if competition increases even further.

When competition is intense ( $\theta \in \bar{\Theta}$ ) the manager's objective function becomes

$$\bar{u}_m = B - \left\{ c \cdot \bar{d}^{co} + (1 - c) \cdot e \cdot \bar{d}^{ag} + (1 - c) \cdot (1 - e) \cdot \bar{d}^{sq} \right\} \cdot L - \psi_m(e).$$

As before, an informed principal will instruct the manager to implement the conservative strategy. If, on the other hand, the manager is granted autonomy in decision making, he will choose the aggressive strategy if informed (since it is the one that minimizes the likelihood of intervention in this case) or stick to the status quo if uninformed.

The principal chooses  $c$  to maximize

$$\bar{u}_p = c \cdot \pi^{co}(\theta) + (1 - c) \cdot e \cdot \pi^{ag}(\theta) + (1 - c) \cdot (1 - e) \cdot \pi^{sq}(\theta) - \psi_p(c).$$

Let  $\bar{e}$  and  $\bar{c}$  denote the optimal choices of efforts. A Nash equilibrium is found by solving the following first-order conditions:<sup>19</sup>

$$\begin{aligned} (1 + \bar{e}) \cdot \Delta(\theta) &= \psi'_p(\bar{c}) \\ (1 - \bar{c}) \cdot \alpha \cdot L &= \psi'_m(\bar{e}). \end{aligned} \tag{7}$$

We see immediately that both  $\bar{e}$  and  $\bar{c}$  are strictly positive.

When times are bad (competition is tough, profits are low), the nature of the relationship between principal and manager itself changes: the principal's reaction function (7) becomes upward sloping. The principal wants to minimize the likelihood of her manager being informed when she herself is uninformed, to prevent him from implementing a bad strategy. She achieves this by increasing control and granting less autonomy – thus,  $\bar{c} > \hat{c}$ . This incentive is all the more powerful the higher the manager's own effort; hence the upward slope. The principal develops a tendency to step in during bad times, since she can no longer afford letting the manager take the wrong actions (from the organization's perspective). In fact, she monitors even more than when competition was weak, since now she has to compensate for the effort of the manager – that is,  $\bar{c} > \underline{c}$ .

For the manager the basic trade-off remains the same, since the closer the principal monitors him, the more likely it is that he will be overruled, and the less it pays to him to exert costly effort (his reaction function is downward sloping). We see immediately that  $\bar{e} > \underline{e}$ . Whether the manager exerts more or less effort than in the case of intermediate competition depends on the relative values of  $\alpha$  and  $\beta$ . For instance, if his actions have a much larger impact on the probability of high profits, the manager exerts more effort when competition is intense than when it is intermediate, because implementing the aggressive strategy has a high payoff when  $\alpha$  is relatively large.

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<sup>19</sup>The stability condition is automatically satisfied.

Result 2 restates the conclusion about the impact of a further increase in competition on managerial autonomy.

**Result 2** *When competition strengthens further from intermediate to intense, product market competition leads to less autonomy.*

The prediction that increased competition leads to less autonomy when competition is intense fits well with the empirical evidence reported in Nickell et al. (2001) that when firms are doing badly, centralization of decision-making is favored. Consistent with the argument that competition induces better choices and more delegation, the authors reason that “bad times mean a higher probability of bankruptcy and an increased threat to jobs. Almost inevitably the response of both managers and employees will be to try and lower this threat by reducing the chances of the firm going bankrupt” (pp. 5-6). They thus expect to find support for the hypothesis that prior worsening performance favors decentralization, but find exactly the opposite.

The result that autonomy decreases at high levels of competition is also consistent with the case study reported in Dill (1958). This paper presents a comparative study of environmental influences on the top-management groups of two Norwegian firms. After recording sharp differences in the degree of autonomy of first-rank managers with respect to their common superior (the owner-manager) in both firms, the author contrasts the environments in which the two groups operated, and notes that, in the two firms under analysis, “autonomy seemed to decrease whenever environmental inputs” (i.e.,  $\theta$ ), “were perceived as signs of impending conflict” (p. 438). A more important finding (to our purpose) is that, even though both firms were facing increased competition in their product markets, the firm with the lowest degree of autonomy granted to top management was the worst performer and belonged to the industry that was closest to “a period of zero profits, empty prospects for new business, and intense competition” (p. 431).

Yet another illustration of this last prediction is given by the example of Tandem Computers, Inc.<sup>20</sup> Tandem’s monopoly of fault-tolerant computers was questioned by rivals in

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<sup>20</sup>All the details of the Tandem case below come from <http://www.answers.com/topic/tandem-1?cat=biz->

the 1980s. At the same time the U.S. economy was in recession, and Tandem begun experiencing shrinking sales. In 1982, “overly aggressive sales practices”<sup>21</sup> were discovered by management – practices that led to a sales figures revision, and to charges of fraud after an investigation by the Securities and Exchange Commission. This kind of practices was countered through centralization of decision making in top management in order to improve control (Merchant, 1998, p.12). As we have stressed, bad times tilt the balance towards tighter control from the principal. In the case of Tandem, James Treybig, the president at the time, began issuing orders, created an audit team, added a layer of management to centralize the control of manufacturing and marketing, and implemented other actions that can be collectively interpreted as a more conservative strategy – like cutting back on overhead and research spending, and moving the company into new lines of business, trying to broaden the firm’s base.

To sum up, let us recall the optimal choice of monitoring effort (and hence the optimal level of autonomy granted to the manager) as a function of the strength of competition:

$$c(\theta) = \begin{cases} \underline{c} & \text{if } \theta \in \underline{\Theta} \\ \hat{c} & \text{if } \theta \in \hat{\Theta} \\ \bar{c} & \text{if } \theta \in \bar{\Theta} \end{cases}$$

We have seen that

$$\bar{c} \geq \underline{c} \geq \hat{c}.$$

The following proposition records the main finding of this paper:

**Proposition 1** *Higher degrees of managerial autonomy in decision making are more likely for intermediate levels of product-market competition.*

Notice that the reasons that induce the principal to grant little autonomy to her manager are quite different depending on whether competition is weak or intense. In the first case, 

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fin, where the original sources can be found.

<sup>21</sup>For example, some shipments had been recorded that were not actually completed until after midnight of the last day of the year.

there is no loss of managerial initiative from retaining control, as the manager cannot be induced to exert effort in any case. Hence the degree of control chosen by the principal hinges only on the profit gains to be had from choosing a better way of doing things. In a situation of intense competition, granting autonomy to the manager is costly because his interests become so antinomic in this case. Trusting the manager with limited autonomy reduces his initiative, but when competition is intense, the cost of the control loss takes the ascendancy over that of reduced planning effort. With an intermediate level of competition the threat of a potential intervention is just enough to align the interests of the manager with those of the organization without pushing him to take value-reducing risks.

Simple comparative statics show that autonomy ( $1 - c$ ) is decreasing in  $\Delta$ ; i.e., the principal centralizes decision making more when the stakes are higher. Autonomy does not depend on  $L$  when competition is weak, but is positively (negatively) related to the manager's utility loss when competition is intermediate (intense). The reason is simple. A larger  $L$  gives an increased incentive to the manager's planning effort. When his interests are aligned with those of the organization, the principal grants more autonomy; when interests are in conflict, more control is the optimal organizational response.

Similarly, larger  $\alpha$  or  $\beta$  may imply larger expected private benefits for the manager. When competition is intense, a larger  $\alpha$  has two opposite effects: on the one hand, it decreases the principal's expected profit gain  $\Delta$ , and hence her monitoring effort (check condition [1]); on the other hand, an increase in  $\alpha$  implies larger expected private benefits for the manager, and thus increased planning effort on his side. This, in turn, provides incentives for lower autonomy given the upward slope of the principal's reaction function. With  $\beta$  the second effect is no longer present, and the first effect reverses sign: an increase in  $\beta$  increases the principal's stake. Therefore, a larger  $\beta$  points unambiguously in the direction of reduced autonomy for the manager.

When competition is intermediate, a larger  $\beta$  increases both the principal's and the manager's expected gains, and the effect of an increase in  $\beta$  on autonomy cannot be signed a priori. The manager's expected utility loss is not affected by  $\alpha$  when competition is

intermediate, but the principal's expected profits depend negatively on this parameter. An increased  $\alpha$  then leads to an unambiguous increase in the degree of autonomy granted to the manager in this case.

Finally, the degree of autonomy granted to the manager depends also on the level of competition within each interval of  $\Theta$ . Notice that, in all cases,  $sign(\partial c/\partial\theta) = sign(\partial\Delta/\partial\theta)$ , and that this sign is ambiguous. In Appendix B, I provide two examples where an unambiguous prediction obtains.

## 4 Concluding remarks

In this paper, I have built a model where changes in product-market competition affect the degree of decision-making autonomy granted to rent-seeking managers within the firm. An argument that comes up repeatedly in the literature is that competition, by posing a more severe threat to the survival of the firm, would lead to more congruent decision making by managers and hence to more delegation. The main contribution of this paper is to challenge this view by demonstrating that the threat posed by competition can also lead to reduced congruence of interests.

A basic insight of the delegation literature is that delegation increases with congruence among the objectives of the parties; that is, more congruence leads to more autonomy for the manager.<sup>22</sup> By making congruence endogenous, I have been able to show that the relationship between the strength of competitive forces and congruence need not be monotonic, even if there is a monotonic relationship between congruence and delegation. At low levels of competition, an increase in competitive forces may increase congruence and thus lead to more autonomy: because the manager faces costs from poor performance, which becomes more likely, he might take decisions more in line with the interests of the firm. At higher levels of competition, a further increase in competition may decrease congruence (and hence autonomy) if the manager is led to gamble to avoid bad performance and the concomitant

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<sup>22</sup>See, for instance, Aghion and Tirole (1997).

loss of private benefits – when the likelihood of intervention is high, the manager has little else to lose by choosing such a behavior.<sup>23</sup> Therefore, I have concluded that higher degrees of manager autonomy in decision making were more likely for intermediate levels of competition.

Grossman and Helpman (2002) and Marin and Verdier (2008a,b) come to similar conclusions in different setups. In Grossman and Helpman (2002) the decision to delegate or not (i.e., to outsource or integrate) strikes a balance between the extra governance costs implied by a vertically integrated structure and the transaction costs associated with searching for a business partner and dealing with incomplete contracts. If one identifies outsourcing with an extreme type of delegation of formal authority to the manager, the authors show that there are cases where outsourcing can emerge in equilibrium only for intermediate values of competition. Marin and Verdier (2008a,b) develop a theory in which the firm responds to changes in its market environment through changes in the allocation of formal decision-making power within the firm. They show that, as competition strengthens, the conflict of interests between the principal and the agent worsens, leading the principal to intervene more in decision making because the cost of the loss of control is larger. Increased monitoring, however, reduces the initiative of the agent, and when competition is intermediate it might be in the interest of the principal to delegate formal authority to the agent to preserve the agent's initiative, rather than keeping control and extracting only minimum effort from him.

De Bijl (1995) also looks at the connection between competition and delegation, although he emphasizes how the extent of an agent's real authority can be chosen strategically to influence the market strategy and actions of the firm. In a recent paper, Alonso et al. (2008) link organizational design to market demand, and discuss how demand conditions affect the decision to centralize or decentralize price setting in a firm that sells a single product in two markets. Chang and Harrington (2003) develop a computational model of competing multiunit firms, and show that centralization outperforms decentralization when competition is intense and consumers search and compare stores, because competition magnifies the early

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<sup>23</sup>As Merchant (1998) noticed, in this case “controls are necessary to guard against the possibilities that people will do something the organization does not want them to do or fail to do something they should”.

organizational learning advantage of centralization.

Schmidt (1997) and Aghion et al. (1999) also work on the idea that increased competition increases the likelihood of liquidation, and that this might induce the agent to work harder. When the agent's actions improve cash flows in the sense of first-order stochastic dominance (FOSD), these authors show that this effort is normally valuable for the principal. As we have discussed here, the argument does not necessarily carry over to the case of actions whose effect on cash flows cannot be ranked according to FOSD. More generally, I have looked at the impact of competition on the trade-off between loss of control and better information under delegation. Recent models that emphasize this trade-off include De Bijl (1994), Aghion and Tirole (1997), Baker et al. (1999), and Dessein (2002).

The model I have introduced is highly stylized and involves several admittedly ad hoc assumptions. Condition (1), in particular, deserves further comment, as it is crucial for the results. This assumption of second-order stochastic dominance implies that there is no trade-off between risk and return (more risk implies ever lower returns), and may seem extreme, but the essential feature it tries to capture is that at some point risk becomes excessive (in the sense of destroying profits), not that risk is always bad. All that is needed for the main insight to go through is that there exist some strategy which involves excessive risk, and which is tempting for the manager to pick when facing a large enough threat on his position.

It seems natural to assume that to achieve very high probabilities of a high profit, some expected return will have to be given up. For instance, assume that there were a continuum of projects, indexed by their probability  $g$  of achieving an intermediate level of profits, and that the probability of high profits is given by a decreasing and concave function  $h(g)$ . Expected profits turn out to be concave in  $g$ . For high levels of  $g$ , increasing expected profits requires accepting higher risks and hence a higher probability of a high state of nature (that is, reducing  $g$ ). On the other hand, there is a maximum attainable expected return, and in order to obtain still higher probabilities of the high state (i.e., reduce  $g$  even further), the firm needs to accept a reduced expected profit. With intense competition the manager would chose to go beyond the level of  $g$  that maximizes expected profit.

I have chosen particularly extreme assumptions for the parties preferences in order to stress the role of incumbency rents. The manager cannot be motivated and just cares about private benefits; the principal, on the other hand, is a risk-neutral residual claimant and does not enjoy any private benefit. Naturally, the manager could care somewhat about profits if he responded to monetary incentives, and the principal could care about poor performance somewhat if he incurred a utility loss in this case (or if there were, say, bankruptcy costs). The only thing that truly matters is that the manager cares relatively more than the principal about the occurrence of poor performance.<sup>24</sup> In other words, the key is that the threat to incumbency rents posed by increased competition has different impacts on different hierarchical levels. For instance, if performance pay is more prominent in higher levels, in the sense that it constitutes a larger fraction of total compensation, then the threat to rents should matter more at lower levels.<sup>25</sup> On the other hand, it seems reasonable to argue that shareholders care about profits and are willing to shut down if the business is bad, while managers have something to lose. This argument works even if managers do respond to incentives.

The model presented here has left the market game unspecified. Raith (2003) underscores the importance of treating market structure as endogenous and analyzing firms' incentive provisions within an explicit model of market interaction. It would be interesting to know how this concern extends to the case of firms' delegation decisions.<sup>26</sup>

I have concentrated on the role of competition as a disciplining device in a context in which managers figure out what to do and do it. Needless to say, there are other channels through which competition can affect the choice between centralization and decentralization. Competition could have other influences on the trade-off between loss of control and better

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<sup>24</sup>Nickell et al. (1997) state: "For the manager, bankruptcy is a serious threat because of the loss of her job and its associated (quasi-) rents as well as the threat to her reputation. In the presence of limited liability, bankruptcy per se poses a much lesser threat to the owners of the company".

<sup>25</sup>A justification in the example of a multidivisional firm might be that a manager whose division is shut down loses everything, whereas the CEO still has many other divisions under his supervision.

<sup>26</sup>Marin and Verdier (2008a,b) and Ruzzier (2008) make a start along these lines.

information under delegation. If competition increases the value of the manager's information, stronger competition should favor delegation. If, on the other hand, an increase in the number of firms provides more public information to the principal, she would need to rely less on the private knowledge of the manager as competition strengthens.<sup>27</sup> Competition may also affect the trade-off between adaptation and coordination. A more competitive environment might require tighter coordination, pushing for centralization, or make quick adaptation to local conditions more important and foster managerial autonomy.

No doubt, this is ultimately an empirical matter. First, there is the question of whether competition and delegation are related in the way predicted by the different theories. Only then comes the more difficult matter of distinguishing between different observationally-equivalent explanations. As discussed in the Introduction, the existing empirical evidence is scarce and inconclusive. Moving forward, this paper suggests that looking for nonlinearities can be important in future empirical work, and that studies focusing on a simple linear relation between competition and delegation might be providing a misleading or incomplete picture.

My results seem to suggest that one needs also to control for financial position and performance in regressions of delegation on competition. Marin and Verdier (2008a), for instance, find that firms in more profitable markets (as measured by firms' cash flows) are more likely to delegate authority when faced with tougher competition. In his case study of two Norwegian firms, Dill (1958) documents that the more centralized one was the firm facing more competition and performing poorly. Consistent with the results in Nickell et al. (2001), Khandwalla (1973) finds that delegation is more likely in more profitable firms. Which way does causality run? Do more profitable firms find it easier to delegate? Or do more decentralized firms perform better? These are all interesting questions begging for an answer.

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<sup>27</sup>See Acemoglu et al. (2007).

## Appendix A

Assume there are two players, the principal and the manager, and two periods. The manager does not respond to monetary incentives, and the principal cannot make any commitments concerning the manager's tenure – i.e., once period 1 is over, she will keep the incumbent manager if and only if this raises expected profits.

In period 1, everything is as in the main text. The manager chooses his planning effort, and the principal decides how closely to monitor him. Given the outcome of these efforts, a strategy is implemented that yields profits  $\pi_1$  at the end of period 1. These profits can take three values:

$$\pi_1 = \begin{cases} \pi_H \\ \pi_M \\ \pi_L \end{cases}$$

where  $\pi_H > \pi_M > \pi_L$ . The probabilities of each value are given by the strategy that is implemented by the organization.

Let  $R_2$  denote the expected second-period profit if the firm keeps the incumbent manager at the end of period 1.  $R_2$  is taken to be an increasing function of  $\pi_1$ . The implicit assumption here is that there is no strategy selection in period 2. Once implemented, a given strategy remains in place for the two periods. Assume also that  $\pi_2 = 0$  is the firm's certain profit in period 2 if it shuts down and fires the manager.

Define  $\pi^I$  by  $R_2(\pi^I) = 0$ . Given that the firm can observe  $\pi_1$  once it is realized, the manager is fired if and only if  $\pi_1 < \pi^I$ . As before, let  $\underline{\theta}$  be defined by  $\pi_L(\underline{\theta}) = \pi^I$ ,  $\widehat{\theta}$  by  $\pi_M(\widehat{\theta}) = \pi^I$ , and  $\bar{\theta}$  by  $\pi_H(\bar{\theta}) = \pi^I$ . It is clear that  $\underline{\theta} < \widehat{\theta} < \bar{\theta}$ . We have

$$\begin{aligned} \theta \in \underline{\Theta} &\equiv [0, \underline{\theta}] : \pi^I \leq \pi_L < \pi_M < \pi_H \\ \theta \in \widehat{\Theta} &\equiv \left( \underline{\theta}, \widehat{\theta} \right] : \pi_L < \pi^I \leq \pi_M < \pi_H \\ \theta \in \bar{\Theta} &\equiv \left( \widehat{\theta}, \bar{\theta} \right] : \pi_L < \pi_M < \pi^I \leq \pi_H \end{aligned}$$

and  $d^k(\theta)$  is exactly as in the main text. The analysis then carries on along the same lines.

## Appendix B

In this appendix, I elaborate a bit more on the sources of uncertainty on profits, and explicitly model market games that yield reduced-form profit functions consistent with (2) and (3). Results are, of course, in accord with Proposition 1. Although I have given it the interpretation of ‘competition’,  $\theta$  is, strictly speaking, a parameter that could represent anything that has a negative effect on profitability in the basic model. By making the market game explicit, we will be able to ascribe a more precise meaning to  $\theta$ .

For the purposes of this appendix, assume that the firm runs a constant marginal cost technology, and must incur a sunk cost before entering the market. Additionally, the manager’s actions determine a cost parameter  $C \in \{C_L, C_M, C_H\}$ , with  $C_L < C_M < C_H$ , that is independent of the level of competition  $\theta$ . The strategy that is implemented determines the probabilities of each cost level as in section 2 – for example, if the firm implemented the conservative strategy, we would have

$$\begin{aligned}\Pr(C = C_L) &= \frac{1}{3} - \alpha, \\ \Pr(C = C_M) &= \frac{1}{3} + \alpha + \beta, \text{ and} \\ \Pr(C = C_H) &= \frac{1}{3} - \beta.\end{aligned}$$

### Uncertainty on fixed cost

We begin by considering the case in which the manager’s actions determine a fixed cost that the firm has to incur prior to participating in the market. This implies that the firm’s profit function is additively separable in  $C$  and  $\theta$ , and can now be expressed as

$$\pi(C, \theta) = R(\theta) - C, \tag{8}$$

where  $R$  denotes the profits from participating in the product market,  $C$  is the (realized) fixed cost, and  $\theta \in \Theta = [0, \bar{\theta}]$  is a parameter measuring the degree of competition in the

product market.<sup>28</sup> I assume again that competition destroys profits, that is,  $\partial R/\partial\theta < 0$ . Notice that there are many market games that yield a reduced-form profit function like  $R(\theta)$ ; consider the following examples, that also allow attaching a more precise meaning to the idea of “more competition”. Once the cost parameter is realized at date 3, the principal takes all pricing and quantity decisions at date  $3\frac{1}{2}$ . In all the examples, firm 1 is like the one considered in the main text.

**Example 1 (Hermalin, 1992)** Assume that firms compete à la Cournot in a duopoly with linear demand:

$$D(p) = A - p.$$

Firm 1 has known marginal costs  $\kappa$ . Firm 2 is manager-owned and its known marginal cost is  $\frac{1}{\theta}$ ; hence, a higher  $\theta$  implies a more competitive rival – one that has lower marginal costs. The profit of firm 1 is

$$\pi(C, \theta) = R(\theta) - C = \frac{(A - 2\kappa + 1/\theta)^2}{9} - C.$$

It is easily verified that  $\partial R/\partial\theta < 0$ , as claimed.

**Example 2** Consider the following Dixit-Stiglitz-Spence model of monopolistic competition with a large number of firms. Firms in the market produce each a differentiated good with a marginal cost  $\kappa$ . The demand function facing firm 1 is approximately:

$$q_1 = A \cdot p_1^{-1/(1-\theta)}$$

where  $\theta \in [0, 1]$  measures the degree of substitutability between the products. If  $\theta$  is close to one, the goods are nearly perfect substitutes, which implies that the market is highly competitive. If it is close to zero, products are regarded as very different, and hence each firm enjoys a high monopoly power. Profits of firm 1 are given by

$$\pi(C, \theta) = R(\theta) - C = (1 - \theta) \cdot \theta^{\theta/(1-\theta)} \cdot A \cdot \kappa^{-\theta/(1-\theta)} - C.$$

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<sup>28</sup>Notice that  $R$  is independent of actions, and that  $C$  is independent of competition.  $R$  could also denote revenues, and  $C$  the total cost of a fixed-size project.

One can check that for  $\kappa \geq 1$ ,  $R(\theta)$  satisfies  $\partial R/\partial\theta < 0$ .

**Example 3 (Schmidt, 1997)** Assume market structure is one of Cournot oligopoly with an exogenous number of  $\theta$  competitors. Higher  $\theta$  implies more competition in the sense of an increased number of rivals. Demand is once again linear:

$$D(p) = A - p.$$

All firms have the same constant marginal cost technology, with cost parameter  $\kappa$ . The profits of firm 1 are

$$\pi(C, \theta) = R(\theta) - C = \left( \frac{A - \kappa}{1 + \theta} \right)^2 - C.$$

It is straightforward to verify that  $\partial R/\partial\theta < 0$ .

Strategies are now to be broadly interpreted as sets of actions that, if implemented, lead to a certain probability distribution of costs. Under each of the alternatives, expected costs are given by

$$\begin{aligned} E_{sq}[C] &= \frac{1}{3}C_L + \frac{1}{3}C_M + \frac{1}{3}C_H, \\ E_{co}[C] &= \left( \frac{1}{3} - \alpha \right) C_L + \left( \frac{1}{3} + \alpha + \beta \right) C_M + \left( \frac{1}{3} - \beta \right) C_H, \\ E_{ag}[C] &= \left( \frac{1}{3} + \alpha \right) C_L + \left( \frac{1}{3} - \alpha - \beta \right) C_M + \left( \frac{1}{3} + \beta \right) C_H. \end{aligned}$$

The strategy that maximizes expected profits minimizes expected costs. Let  $\pi_H \equiv \pi(C_L, \theta)$ ,  $\pi_M \equiv \pi(C_M, \theta)$ , and  $\pi_L \equiv \pi(C_H, \theta)$ . Plugging (8) into (1),  $\Delta(\theta)$  turns out to be independent of the competition parameter:

$$\begin{aligned} \Delta(\theta) &= (\alpha + \beta)\pi_M - (\alpha\pi_H + \beta\pi_L) \\ &= (\alpha + \beta)(R(\theta) - C_M) - (\alpha(R(\theta) - C_L) + \beta(R(\theta) - C_H)) \\ &= \alpha C_L + \beta C_H - (\alpha + \beta)C_M \\ &\equiv \delta. \end{aligned} \tag{9}$$

Given (1),  $\delta$  is strictly positive – the ranking of strategies in terms of second-order stochastic dominance is unchanged. Expected costs are lowest under the conservative strategy, and this is then the principal’s preferred course of action.

The assumption that competition destroys profits implies that stronger competition makes poor performance more likely for a given fixed cost  $C$ . Notice that our previous partition of  $\Theta$  is still valid:

$$\begin{aligned}\pi_L(\underline{\theta}) = 0 &\iff R(\underline{\theta}) = C_H \\ \pi_M(\widehat{\theta}) = 0 &\iff R(\widehat{\theta}) = C_M \\ \pi_H(\overline{\theta}) = 0 &\iff R(\overline{\theta}) = C_L\end{aligned}$$

Now we have that for every  $\theta \in \underline{\Theta}$ ,  $\pi(C_L, \theta) > \pi(C_M, \theta) > \pi(C_H, \theta) \geq 0$ ; for all  $\theta \in \widehat{\Theta}$ ,  $\pi(C_L, \theta) > \pi(C_M, \theta) \geq 0 > \pi(C_H, \theta)$ ; and for every  $\theta \in \overline{\Theta}$ ,  $\pi(C_L, \theta) \geq 0 > \pi(C_M, \theta) > \pi(C_H, \theta)$ . As in the main text, we will say that competition is weak whenever  $\theta \in \underline{\Theta}$ ; intermediate, when  $\theta \in \widehat{\Theta}$ ; and intense, when  $\theta \in \overline{\Theta}$ . I compute the likelihood of intervention for every level of competition as before:

	conservative	status quo	aggressive
$\theta \in \underline{\Theta}$	$\underline{d}^{co} = 0$	$\underline{d}^{sq} = 0$	$\underline{d}^{ag} = 0$
$\theta \in \widehat{\Theta}$	$\widehat{d}^{co} = \frac{1}{3} - \beta$	$\widehat{d}^{sq} = \frac{1}{3}$	$\widehat{d}^{ag} = \frac{1}{3} + \beta$
$\theta \in \overline{\Theta}$	$\overline{d}^{co} = \frac{2}{3} + \alpha$	$\overline{d}^{sq} = \frac{2}{3}$	$\overline{d}^{ag} = \frac{2}{3} - \alpha$

Recall that  $\underline{d}^{sq}$  denotes the probability that realized profits fall short of the threshold  $\pi^I$  when competition is weak and the status quo prevails, and that all other probabilities in the table are defined accordingly. The strategy that minimizes the likelihood of intervention is the same as in the more general case of Section 3, and the manager will choose in the same manner if granted autonomy.

To obtain explicit solutions for the planning and monitoring efforts, assume that  $\psi_j(x) = \frac{x^2}{2}$  and that parameter values are such that we have interior solutions.<sup>29</sup> Given the assumptions, all the expressions for  $u_p$  and  $u_m$ , and the first-order conditions that I have derived in

<sup>29</sup>Essentially,  $\delta < 1$ ,  $\alpha L < 1$ , and  $\beta L < 1$ .

the general case continue to be valid when I replace  $\pi^k(\theta)$  with  $E_k[\pi(C, \theta)] = R(\theta) - E_k[C]$ ,  $k = sq, co, ag$ , and  $\Delta(\theta)$  with  $\delta$ . We thus obtain the following:<sup>30</sup>

$$\theta \in \underline{\Theta} \begin{cases} \underline{c}^F = \delta \\ \underline{e}^F = 0 \end{cases}$$

$$\theta \in \widehat{\Theta} \begin{cases} \widehat{c}^F = \frac{(1-\beta L)}{1-\delta\beta L} \delta \\ \widehat{e}^F = \frac{(1-\delta)\beta L}{1-\delta\beta L} \end{cases}$$

$$\theta \in \overline{\Theta} \begin{cases} \overline{c}^F = \frac{(1+\alpha L)}{1+\delta\alpha L} \delta \\ \overline{e}^F = \frac{(1-\delta)\alpha L}{1-\delta\alpha L} \end{cases}$$

Simple computations show that

$$\overline{c}^F > \underline{c}^F > \widehat{c}^F,$$

and

$$\begin{aligned} \overline{e} > \widehat{e} > \underline{e} &\iff \alpha > \beta \\ \widehat{e} > \overline{e} > \underline{e} &\iff \alpha < \beta, \end{aligned}$$

just as in section 3. Notice that, within intervals, efforts do not depend on competition (see, however, the following subsection).

## Uncertainty on marginal costs

Assume, as in the preceding subsection, that the firm runs a constant marginal cost technology, and must incur a sunk cost  $f$  before entering the market, but now  $f$  is certain and the implemented strategy results in a probability distribution on marginal cost  $C$ . Once the marginal cost  $C$  is realized and observed by all (including the competitors), the principal takes all product-market decisions. For the sake of concreteness, let us use the simple setup of Example 2 (a Cournot duopoly with linear demand).<sup>31</sup> The rival's marginal cost is  $\frac{1}{\theta}$

<sup>30</sup>The superscript  $F$  indicates that we are in the case in which the manager's actions affect the fixed cost.

<sup>31</sup>Notice that  $\pi(C, \theta)$  could come from a different market game as long as firms are allowed to have different marginal costs.

(remember that it is manager-owned or entrepreneurial in the sense of Hart, 1983). Profits of the firm are given by

$$\pi(C, \theta) = \frac{(A - 2C + 1/\theta)^2}{9} - f.$$

Notice that this profit function is no longer separable in  $C$  and  $\theta$ . Expected profits are

$$E[\pi(C, \theta)] = \Pr(C = C_L) \cdot \pi(C_L, \theta) + \Pr(C = C_M) \cdot \pi(C_M, \theta) + \Pr(C = C_H) \cdot \pi(C_H, \theta).$$

To simplify notation, let  $\pi_H(\theta) \equiv \pi(C_L, \theta)$ ,  $\pi_M(\theta) \equiv \pi(C_M, \theta)$ , and  $\pi_L(\theta) \equiv \pi(C_H, \theta)$ . It is clear that  $\pi_H(\theta) > \pi_M(\theta) > \pi_L(\theta)$ , for all  $\theta$ , as assumed. Let also  $\pi^k(\theta) \equiv E_k[\pi(C, \theta)]$ ,  $k = sq, ag, co$ . Expected profits under each of the alternative strategies are

$$\pi^{sq}(\theta) = \frac{1}{3}\pi_H(\theta) + \frac{1}{3}\pi_M(\theta) + \frac{1}{3}\pi_L(\theta), \quad (10)$$

$$\pi^{co}(\theta) = \left(\frac{1}{3} - \alpha\right)\pi_H(\theta) + \left(\frac{1}{3} + \alpha + \beta\right)\pi_M(\theta) + \left(\frac{1}{3} - \beta\right)\pi_L(\theta), \quad (11)$$

$$\pi^{ag}(\theta) = \left(\frac{1}{3} + \alpha\right)\pi_H(\theta) + \left(\frac{1}{3} - \alpha - \beta\right)\pi_M(\theta) + \left(\frac{1}{3} + \beta\right)\pi_L(\theta). \quad (12)$$

$\Delta(\theta)$  is defined as in (9), and I continue to assume it is positive. Therefore the principal's preferred strategy is 'conservative'. We can partition the support of  $\theta$  in the same way as we did in Section 2 to find that the manager's preferred strategy is the same as before for every level of competition.

Using  $\psi_j(x) = \frac{x^2}{2}$  and assuming once again interior solutions, we can plug (10), (11), and (12) into the first-order conditions derived in Section 3 to compute the optimal levels of planning and monitoring efforts (and hence, of autonomy granted to the manager) for each level of competition. These are given by the following:<sup>32</sup>

$$\theta \in \underline{\Theta} \begin{cases} \underline{c}^M = \Delta(\theta) = \frac{4}{9}[(\alpha + \beta)C_M^2 - (\alpha C_L^2 + \beta C_H^2) + (A + 1/\theta)\delta] \\ \underline{e}^M = 0 \end{cases}$$

$$\theta \in \hat{\Theta} \begin{cases} \hat{c}^M = \frac{(1-\beta L)}{1-\beta L\Delta(\theta)}\Delta(\theta) \\ \hat{e}^M = \frac{(1-\Delta(\theta))\beta L}{1-\beta L\Delta(\theta)} \end{cases}$$

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<sup>32</sup>The superscript  $M$  indicates that we are in the case in which the manager's actions affect the marginal cost.

$$\theta \in \bar{\Theta} \left\{ \begin{array}{l} \bar{c}^M = \frac{(1+\alpha L)}{1+\alpha L\Delta(\theta)} \Delta(\theta) \\ \bar{e}^M = \frac{(1-\Delta(\theta))\alpha L}{1-\alpha L\Delta(\theta)} \end{array} \right.$$

Contrary to the case in which the strategy chosen determined the fixed cost, in the present situation the degree of autonomy granted to the manager depends on the level of competition within each interval of  $\Theta$ . Indeed, using the implicit function theorem on the system of first-order conditions we find that

$$\begin{array}{l} \frac{\partial c}{\partial \theta} \Big|_{\theta \in \Theta} = \frac{\partial \Delta / \partial \theta}{\psi_p''} \\ \frac{\partial c}{\partial \theta} \Big|_{\theta \in \hat{\Theta}} = \frac{\psi_m''(1-p)}{\psi_p''\psi_m'' - \beta L \Delta} \frac{\partial \Delta}{\partial \theta} \\ \frac{\partial c}{\partial \theta} \Big|_{\theta \in \bar{\Theta}} = \frac{\psi_m''(1+p)}{\psi_p''\psi_m'' + \alpha L \Delta} \frac{\partial \Delta}{\partial \theta} \end{array}$$

Notice that, in all cases,  $sign(\partial c / \partial \theta) = sign(\partial \Delta / \partial \theta)$ . Computing the right-hand side derivative,  $\partial \Delta / \partial \theta = -\frac{4}{9} \frac{\delta}{\theta^2} < 0$ . Therefore, autonomy (as measured by  $1 - c$ ) increases with competition *within intervals*.

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