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Does Competition Favor Delegation?[1]

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Abstract

This paper studies the consequences of product-market competition on firms' decisions to delegate more or fewer decision-making responsibilities to managers. By simultaneously addressing the choice of both competitive actions and organizational design, the paper makes an attempt at bringing economic theory and management strategy closer together.

An increase in substitutability between the products of the different firms triggers a different response depending on the size of the firm: larger firms delegate more responsibility, whereas smaller firms centralize decision making. The increase in substitutability also causes some firms to exit the market, which pushes in the direction of reduced managerial autonomy. Stronger competition also leads to less discretion in markets in which the possibilities for product differentiation are important.

For a given number of firms, an increase in market size increases centralization, as the owner of the firm finds it more costly to accept rent seeking by the managers. However, this increase in market size will lead to the entry of more firms, which calls for more decentralized decision making. Under reasonable conditions, the aggregate effect leads to a U-shaped relationship where firms in both small and large markets are characterized by high levels of discretion, while there is less discretion for intermediate market sizes. Finally, a reduction in entry barriers leads unambiguously to an increase in the level of discretion given to the agent, as it results in a larger number of firms entering the market and, for a given market size, in lower concentration or expected firm-level demand, which reduces the value of having control and pushes in the direction of increased autonomy.

JEL Codes: D43, L13, L22, M21

Keywords: product-market competition, delegation, authority, oligopoly, firm organization

1 Introduction

As simple as the question 'Does competition favor delegation?' may appear, its answer proves elusive. It seems fair to say that most economists would be inclined to answer affirmatively. However, it is not hard to find anecdotal evidence to the contrary – see, for instance, the case of Jacobs Suchard as depicted in Holland (1989). It is also simple to argue for a negative relationship between product-market competition and delegation on theoretical grounds – for example, if competition calls for tighter coordination or makes it easier for principals to learn from other firms, an increase in competition should lead to less delegation.

Turning to the empirical evidence for an answer can also be frustrating: 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. (2009) 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).[1] 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, and Karuna (2008) finds evidence suggesting that stronger competition is related to stronger corporate governance (which can be interpreted as reduced autonomy).

In this paper, I try to throw some light on the circumstances under which stronger product-market competition leads firms to either increase or reduce delegation. It is also an aim of the paper to suggest new directions for further empirical research by pointing to

[1] This work underlines the importance of clarifying the type of competition firms are facing when analyzing the effect of competition on delegation practices – see below.

interactions and nonlinearities that seem to have been previously overlooked, and also by spelling out the sources of increased competition.

To address these concerns, I develop an oligopoly model of horizontal product differentiation à la Salop (1979), in which each firm is composed of a principal and an agent. The principal has a claim on her firm's cash flow and makes all entry, personnel, and pricing decisions, but can decide to grant discretion over the choice of a cost-reducing project to an agent she hires to carry out production. With each project is associated a given cost reduction, and also a private benefit for the agent. There is a conflict of interests between the principal and the agent to the extent that the latter may use his discretion to pursue objectives other than profit maximization. After a project is implemented, each firm learns the realization of its own marginal cost, which is not observed by its rivals. Firms then compete in prices.

Ex ante all cost-reducing projects look alike, but the parties can tell them apart through further investigation. Each principal must decide the level of discretion to be granted to her agent (or, conversely, the amount of control she wants to retain), which will in turn induce him to collect information or not about feasible projects. More control means the principal's preferred option will be selected and implemented more often. Control, however, has costs, both explicit and implicit. An agent who is likely to be overruled by his principal is less willing to exert effort to gather information on projects. If this effort adds value to the firm, an implicit cost of control arises due to reduced initiative on the part of the agent. But control has also explicit costs brought about by the implementation of a management control system, the choice of a monitoring technology, or simply the collection of information about projects. Competition affects this trade-off, thereby calling for modifications to the firm's delegation choices.

Increased competition may arise from different sources: an increase in market size or in product substitutability, and a reduction in entry costs. The predicted impact of increased competition on the agent's autonomy depends crucially on what triggers the change in competition.

For a given number of firms, an increase in substitutability between the products of the different firms has two opposite effects on the gain from reducing costs: a business-stealing effect (for given prices of rivals, it becomes easier to steal business from them by reducing costs and prices) and a strategic effect (an increase in substitutability leads to lower equilibrium prices and a loss of market share, which decreases a firm's gain from reducing its costs). When the strategic effect dominates, the optimal response of the principal is to increase autonomy in order to commit to higher expected costs, and thus higher prices. Given that the strategic effect is proportional to market concentration (or expected firm output), this effect is more likely to overcome the business-stealing effect for firms in more concentrated markets. A straightforward implication of this result is that larger firms react differently than smaller firms when faced with the same environmental change: the former delegate more responsibility, whereas the latter centralize decision making.

With an endogenous number of firms, a third effect appears through the change in the equilibrium number of firms. An increase in substitutability causes some firms to exit the market, making this third effect negative and reinforcing the business-stealing effect, thus making it less likely to have a positive impact of increased competition on autonomy as compared to the case with an exogenous number of firms. I also show that an increase in product substitutability leads principals to grant less autonomy in markets where the possibilities for product differentiation are important.

An increase in market size with a fixed number of firms increases the cost of the loss of control brought about by delegation and the value of a cost reduction, and thus calls for a higher level of control – or reduced autonomy. With an endogenous market structure, however, market size also affects the optimal level of discretion indirectly through the equilibrium number of firms: more firms are attracted to the market, which tends to reduce the gain from a cost reduction, and calls for more decentralized decision making. Therefore, the total effect cannot be signed a priori. Under reasonable conditions on the sensitivity of the number of firms to changes in market size, the model predicts a U-shaped relationship between competition and delegation: decentralized decision-making structures are more common in

firms in very small and very large markets.

Finally, a reduction in entry barriers leads unambiguously to an increase in the level of discretion given to the agent, as it results in a larger number of firms entering the market and, for a given market size, in lower concentration or expected firm-level demand, which reduces the costs of losing control and pushes in the direction of increased autonomy.

To the best of my knowledge, Alonso et al. (2008), De Bijl (1995), Marin and Verdier (2008a, b), Meagher and Wang (2009), and Ruzzier (2009) are the only papers in the literature that deal with the interaction between product-market competition and delegation. The modeling of the delegation problem in Marin and Verdier is similar to mine, but their focus is on the delegation of formal authority and the effects of increased international competition. Meagher and Wang, and Alonso et al. focus on different trade-offs: the former analyze the virtues of decentralization in a dynamic real-time information processing model in which delay in information processing is important, whereas the latter investigate how market conditions affect the trade-off between coordination and adaptation in a multi-market firm. In my previous work, I examine the impact of exogenous changes in competition on managerial autonomy in a context in which the agent affects not only expected profits but also their riskiness. The work of De Bijl adopts a complementary approach, focusing on the strategic impact of organizational design on market competition. The present paper is close to Raith (2003) in some respects, although Raith analyzes a different organizational problem – that of choosing the power of incentives provided to the agent.

The next section presents the model in detail. In Section 3 I solve for the equilibrium. Section 4 is the central part of the paper; I discuss the impact of changes in product-market competition on the delegation decisions of firms. I begin with the case with an exogenous number of firms and then turn to a situation of endogenous market structure. Section 5 concludes.

2 The model

2.1 The industry and the market

Consider a monopolistically competitive industry with differentiated brands, composed of a large number of identical potential firms. The product space is a circle with a perimeter equal to one (Salop, 1979). n firms (indexed by $i = 1, ..., n$) enter into this market and choose symmetric locations – the distance between firms is then $\frac{1}{n}$. The cost of entry is f, and there is free entry and exit.

Consumers are located uniformly around the circle with mass m. They have unit demands and incur a unit transport cost t per unit of length. Each of them is willing to buy at the smallest generalized price as long as it does not exceed the gross surplus s enjoyed when consuming the good. I assume s is sufficiently large that all consumers buy – i.e., the market is always covered.[2] Formally:

ASSUMPTION 1: $s > c_P + \sqrt{\frac{3}{2}\frac{ft}{m}}$.

c_P is a (constant) marginal cost and will be defined in the next subsection.

2.2 The organization of the firm

Each firm is composed of a risk-neutral principal-owner and an agent. The principal has a claim on her firm's cash flow and holds all formal decision rights. She makes all entry, personnel, and pricing decisions, but can delegate the choice of a cost-reducing project (see below) to an agent she hires to carry out production; i.e., the principal-owner can grant the agent some decision-making autonomy.[3]

[2] The generalized price when buying from firm i for a consumer with coordinate x is $p_i + td$, where d denotes the distance from the consumer's location to that of firm i. Notice that transport costs are linear in the distance. As usual, t could be interpreted as the utility loss consumers suffer from not consuming their preferred variety.

[3] By owner, I mean someone with (expected) profit maximization as a goal. It could be the actual owner, or any manager who has been given incentives to maximize firm profits (cf. Fershtman and Judd, 1987) or

Projects Each firm operates a constant marginal cost technology, where marginal cost is given by

$$c_i = \overline{c} - \Delta_i.$$

$\overline{c} > 0$ is the marginal cost that results if no cost-reducing project is implemented, and Δ_i is the cost reduction brought about by a project implemented by firm i (i.e., $\Delta_i = \overline{c} - c_i$).

After entry, each firm must choose between $k \geq 3$ potential cost-reducing projects. With each project is also associated a private benefit β_i for the agent. Among the projects, there is one that yields the maximum cost reduction $\left(\Delta^P\right)$, and is the principal's preferred project;[4] one that yields the highest private benefit (B), and is the agent's preferred project; and at least one that implies a sufficiently bad outcome for either party, such that picking a project at random would not be profitable for any of them. If no project is implemented the cost reduction and the private benefit are both equal to zero. The payoffs of the relevant projects can be summarized as follows.

$$\{\Delta_i, \beta_i\} = \begin{cases} \{0, 0\} & \text{if no project is implemented} \\ \left\{\Delta^P, b\right\} & \text{if the principal's preferred project is implemented} \\ \left\{\Delta^A, B\right\} & \text{if the agent's preferred project is implemented} \end{cases}$$

The principal's preferred project yields marginal cost $c_P \equiv \overline{c} - \Delta^P$, whereas the agent's preferred project yields $c_A \equiv \overline{c} - \Delta^A$. We also define $\Delta c \equiv c_A - c_P$. To have a meaningful delegation problem, I assume there is a conflict of interests between the principal and the agent.

ASSUMPTION 2: $c_P < c_A < \overline{c}$ and $B > b > 0$.

The idea here is that there is a loss of control stemming from the fact that the agent may use his discretion to pursue objectives other than cost minimization – like enhancing his career prospects, indulging in empire building, acquiring specific human capital or professional experience, and so on.

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who can divert those profits to himself (as in Hart and Holmstrom, 2008).

[4] It is straightforward to show that profits are decreasing in the marginal cost c_i. See equation (4) below.

Contracts Ex ante all projects look alike, and cannot be distinguished without further investigation.[5] Following Aghion and Tirole (1997), I further assume that project choice, though observable to an informed party, is not contractible.[6] Therefore, compensation contingent on project choice is not possible.

I focus on the case in which the formal decision right cannot be transferred to the agent. Hence, the principal always keeps the formal authority over project selection.[7] For simplicity, and because the link between incentives and competition has already been extensively studied (see Hart, 1983; Scharfstein, 1988; Hermalin 1992, 1994; Martin, 1993; Horn et al., 1994, 1995; Schmidt, 1997; Raith, 2003; and Vives, 2008), I abstract from monetary incentives.[8] The only feasible contracts between principal and agent in each firm then specify a level of discretion or autonomy, which is the probability $1 - I_i$ of letting the agent select a cost-reducing project, and a flat wage $w_i \geq 0$.[9] $I_i \in [0, 1]$ summarizes the delegation decision of principal i and represents accordingly the probability that she will impose a project choice.

This characterization of autonomy as freedom from influence fits nicely with traditional definitions of managerial autonomy, such as Dill's (1958), who judges an agent to be au-

[5] That is, the parties do not know ex ante which projects yield which payoffs.

[6] In other words, projects cannot be described ex ante and put into an enforceable contract, nor can their implementation be verified ex post.

[7] As a practical matter, the principal normally keeps the right to overrule the agent, as she can always fire him.

[8] This extreme assumption is typical in models that study optimal delegation decisions (De Bijl, 1994; Aghion and Tirole, 1997; Burkart et al., 1997; Ruzzier, 2009). A common feature in this kind of models is that all their qualitative results typically go through when the agent responds to monetary incentives, as long as he cares enough about his private benefits. The existence and magnitude of these benefits have been extensively documented (see Zingales, 1995, and the references cited therein). They are also central in Hart and Holmstrom's (2008) theory of firm scope.

[9] Private benefits could be sufficiently large to render incentive contracts unprofitable (as in Acemoglu et al., 2007), the agent might be infinitely averse to income risk (Aghion and Tirole, 1997), the principal's profits could be nonverifiable (Mello and Ruckes, 2006), or fixed wages may be due to union influence (De Bijl, 1994). In any case, a flat wage results. Leonard (1990) shows that actually fixed wages are the norm for lower levels in the hierarchy. Assuming that the wage must always be positive is done for the sake of simplicity, and is actually stronger than necessary.

tonomous with respect to the principal "to the extent that he [...] [is] independent in formulating tasks or in carrying through courses of action" – as well as with the more modern notions of real authority (Aghion and Tirole, 1997) and effective control rights (Burkart et al., 1997).

2.3 Delegation decisions, information gathering and project choice

Each principal simultaneously chooses $I_i \in [0,1]$ at cost $\frac{I_i^2}{2}$, and communicates it to her agent.[10] This choice is unobservable to outsiders – that is, principals and agents in other firms. I interpret I_i as a nonverifiable information gathering effort: if principal i exerts effort I_i, she learns all projects' payoffs with probability I_i, and nothing with probability $1 - I_i$.[11] No commitment problem arises regarding the choice of I_i, even if it were only an informal promise, since without information a principal would not want to interfere with the agent's decision. $1 - I_i$ then measures the extent of the agent's discretion.

I_i could alternatively be interpreted literally as a probability of intervention or interference in the agent's operations determined by costly actions on the part of the principal, like the implementation of a management control system (Merchant, 1998), the choice of a monitoring technology (as in Crémer, 1995) or an ownership structure (as in Burkart et al., 1997), or any other organizational feature that does not change frequently and can act as a credible commitment. For the sake of concreteness, I will follow the information gathering interpretation in what follows.

Given his principal's delegation decision, each agent chooses whether or not to collect information (i.e., his decision variable is $e_i \in \{0,1\}$) on the payoffs of all available projects at personal cost $\psi > 0$. His choice is not observable, and can be regarded as a noncontractible firm-specific investment (cf. Burkart et al., 1997).[12]

[10] Any increasing and convex cost-of-effort function would do – I have chosen this simple formulation to obtain closed-form solutions.

[11] This information-acquisition technology is familiar from Aghion and Tirole (1997).

[12] Notice that there is no randomness in the agent's information gathering, given his effort. This binary formulation for the agent's effort is chosen for tractability and because the main focus of the paper is on

Since the principal holds the formal decision right, she will exercise it every time she is informed, and her preferred project will be implemented. On the other hand, given that choosing at random is not profitable, an uninformed principal will delegate project choice to the agent – who then enjoys real authority or decision-making autonomy. In the case the agent is also uninformed, both parties agree not to undertake any project. But if the agent is informed, he chooses and implements his preferred project.

2.4 Price competition

After a project is implemented, each firm learns the realization of its own marginal cost c_i, which is not observed by its rivals. Firms then compete in prices. The principal in each firm is in charge of pricing decisions, which are taken simultaneously by all principals at this stage. I assume that c_P is such that a symmetric interior equilibrium obtains in the pricing game – broadly speaking, it should not be much lower than $\overline{c}$, to ensure that a firm has only two effective competitors: its two closest rivals. Formally, I make the following assumption.

ASSUMPTION 3: $\overline{c} - c_P \leq \frac{2t}{\overline{n}}$.

$\overline{n} = \frac{(s-c_P)m}{f}$ is the maximum equilibrium number of firms, and is obtained from the zero profit condition $\frac{(s-c_P)m}{n} - f = 0$, where the first term on the left-hand side is each firm's maximum expected profit in a symmetric equilibrium. Assumption 3 ensures that it is not profitable for firm i to sell to customers located further from it than its immediate neighbors.

2.5 Timing

Summing up, the timing of the game is as follows:

1. All firms make their entry decisions simultaneously.

2. All the principals simultaneously make their delegation decisions.

autonomy or discretion $1 - I$.

3. All the agents choose simultaneously whether or not to collect information.

4. Each firm selects and implements a cost-reducing project.

5. Marginal costs are realized (each firm observes only its own realization).

6. Firms compete in the product market by simultaneously choosing prices.

7. Consumers choose from which firm to purchase and payoffs accrue.

3 Equilibrium

In this section, I solve for a symmetric equilibrium of the previous game by backward induction.

3.1 Pricing game

I first look for a symmetric Nash equilibrium in prices for a given number of firms n and given marginal costs $\{c_i\}_{i=1,\dots,n}$.[13] At date 7, all firms have set their prices. Suppose firm i has chosen price p_i. A consumer located at a distance $x \in \left(0, \frac{1}{n}\right)$ from firm i is indifferent between purchasing from firms i and $i+1$ if

$$p_i + tx = p_{i+1} + t\left(\frac{1}{n} - x\right).$$

Solving for x,

$$x = \frac{p_{i+1} - p_i}{2t} + \frac{1}{2n}.$$

Analogously, for a consumer located at $x' \in \left(0, \frac{1}{n}\right)$ from firm i between firms i and $i-1$, we can compute

$$x' = \frac{p_{i-1} - p_i}{2t} + \frac{1}{2n}.$$

The total demand faced by firm i is just m times $x + x'$, or

$$q_i = D_i\left(p_i, p_{-i}\right) = m\left\{\frac{1}{n} + \frac{1}{2t}\left[\left(p_{i+1} - p_i\right) + \left(p_{i-1} - p_i\right)\right]\right\}.$$

[13] Remember marginal costs are private information of each firm.

At date 6, each firm chooses its price to maximize expected profits π_i. Firms know their own realized cost c_i and, in equilibrium, every other firm's expected cost $E(c)$ (and thus expected price $E(p)$). Therefore, firm i maximizes

$$\begin{aligned}
\pi_i &= E[(p_i - c_i) q_i] \\
&= (p_i - c_i) E(q_i) \\
&= (p_i - c_i) m \left\{ \frac{1}{n} + \frac{1}{2t} [(E(p) - p_i) + (E(p) - p_i)] \right\} \\
&= (p_i - c_i) m \left[\frac{1}{n} + \frac{1}{t} (E(p) - p_i) \right]. \qquad (1)
\end{aligned}$$

Differentiation of (1) with respect to p_i leads to

$$p_i(c_i, E(p)) = \frac{t}{2n} + \frac{E(p) + c_i}{2} \qquad (2)$$

In a symmetric equilibrium, we must have

$$E(p) = \frac{t}{2n} + \frac{E(p) + E(c)}{2}$$

or

$$E(p) = \frac{t}{n} + E(c) \qquad (3)$$

Substituting (3) and (2) in (1) yields the unique Nash equilibrium in prices:[14]

$$\begin{aligned}
p_i(c_i, E(c)) &= \frac{t}{n} + \frac{E(c) + c_i}{2} \\
\pi_i(c_i, E(c)) &= mt \left[\frac{1}{n} + \frac{1}{2t} (E(c) - c_i) \right]^2. \qquad (4)
\end{aligned}$$

3.2 Project selection and implementation

The agent will choose $e_i = 1$ if and only if

$$w_i + I_i b + (1 - I_i) B - \psi \geq w_i + I_i b + (1 - I_i) 0 \Longleftrightarrow 1 - \frac{\psi}{B} \geq I_i. \qquad (5)$$

To interpret this, notice that the agent's wage is independent of effort, that the agent receives private benefits b when the principal imposes her preferred project (which happens with

[14] See Raith (2003) for the case of quadratic transport costs.

probability I_i), and that by exerting effort the agent receives B instead of 0 when he enjoys discretion (which happens with probability $1 - I_i$), but has to face the cost of effort ψ.

The principal's expected payoff when she chooses control effort I_i and pays wage w_i to her agent is

$$\Pi_i(w_i, I_i) = I_i \cdot \pi_i(c_P, E(c)) + (1 - I_i) \cdot \pi_i(c_A, E(c)) - \frac{I_i^2}{2} - w_i \tag{6}$$

if the agent gathers information ($e_i = 1$) and

$$\widetilde{\Pi}_i(w_i, I_i) = I_i \cdot \pi_i(c_P, E(c)) + (1 - I_i) \cdot \pi_i(\overline{c}, E(c)) - \frac{I_i^2}{2} - w_i \tag{7}$$

if the agent makes no effort ($e_i = 0$). With probability I_i, the principal is informed and can instruct the agent to implement her preferred project, which results in expected profits of $\pi_i(c_P, E(c))$ from the market game. With the complementary probability, the principal is uninformed and grants the agent autonomy in decision making – the resulting expected profits are $\pi_i(c_A, E(c))$ when the agent implements his preferred project [cf. (6)], and $\pi_i(\overline{c}, E(c))$ when the agent is uninformed and implements no project [cf. (7)].

Each principal's problem is to decide the level of discretion to be granted to her agent, which will in turn induce him to collect information or not. To focus on equilibria in which all agents gather information, I assume that the agent's effort is valuable, i.e., that he can add value through his firm-specific investment.[15] A contract (w_i, I_i) is then incentive feasible if it satisfies the incentive constraint (5) and ensures the agent's participation:

$$w_i + I_i b + (1 - I_i) B - \psi \geq 0 \Longleftrightarrow w_i + I_i b + (1 - I_i) B \geq \psi. \tag{8}$$

The principal therefore maximizes $\Pi_i(w_i, I_i)$ subject to (5), (8), and $w_i \geq 0$. It is easy to see that the optimal wage will be equal to 0. It is also straightforward to show that (5) implies (8) since $I_i b$ and w_i are nonnegative. Assume for the moment that (5) is not binding, which will be the case for ψ low enough and for B high enough. Given expectations $E(c)$ about

[15] The case in which $e_i = 0$ for all i is solved in the same fashion as with $e_i = 1$, with $\overline{c}$ replacing c_A, and can be analyzed by checking comparative statics with respect to Δc (by defining $\Delta \overline{c} = \overline{c} - c_P$).

the other firms' costs, maximization of (6) with respect to I_i yields the following first-order condition:

$$I_i = m\Delta c\left(\frac{1}{n} + \frac{E(c)}{2t} - \frac{c_A + c_P}{4t}\right). \tag{9}$$

Expected costs of rivals in a symmetric equilibrium with informed agents are

$$E(c) = I \cdot c_P + (1 - I) \cdot c_A = c_A - I \cdot \Delta c. \tag{10}$$

In a symmetric equilibrium, all firms choose the same level of discretion, i.e., $I_i = I$ for all i. Substituting (10) in (9) and solving for I results in the following proposition.

Proposition 1 *The unique symmetric Nash equilibrium in delegation decisions has each firm choosing a level of autonomy* $1 - I$*, where*

$$I = \frac{m\Delta c\,(4t + n\Delta c)}{2n\left(2t + m\,(\Delta c)^2\right)} = \frac{\Delta c}{2}\left[\frac{\frac{4t}{n} + \Delta c}{\frac{2t}{m} + (\Delta c)^2}\right]. \tag{11}$$

Remark When, contrary to what we have assumed, (5) is binding, the level of autonomy is determined by the incentive compatibility constraint; i.e., $1 - I = \frac{\psi}{B}$. An implicit cost of control arises because principals have to choose a level of control that is lower than the unconstrained optimum in order to keep their agents motivated to show initiative. A measure of this cost is given by the Lagrange multiplier associated with (5). This "shadow price" of initiative can be written as

$$\mu = \frac{4t\,(n\psi + B\,(m\Delta c - n)) - mn\,(\Delta c)^2\,(B - 2\psi)}{4bnt},$$

and it can be shown that μ responds to changes in competition in exactly the same way as I in (11).[16] This is hardly surprising: any increase in competition that calls for reduced autonomy (or increased control) will make the cost of extracting the agent's effort more costly when (5) is binding. For the sake of brevity, we shall focus on the case of a nonbinding incentive constraint in what follows.

[16] Proofs are available from the author upon request.

3.3 Entry decision

Now we can introduce (11) in (6) to get an expression for the firm's expected profits after entering the market:

$$\Pi = \frac{m\left(32t^3 + mn\left(\Delta c\right)^4\right)}{16n^2t\left(2t + m\left(\Delta c\right)^2\right)} \tag{12}$$

At date 1, firms enter until (12) equals the entry cost f. With free entry, the equilibrium number of firms entering the market is given by[17]

$$n^* = \frac{4\sqrt{2}\sqrt{m}t^{\frac{3}{2}}}{\sqrt{16ft\left(2t + m\left(\Delta c\right)^2\right) - m^2\left(\Delta c\right)^4}}. \tag{13}$$

4 Product-market competition and decision-making autonomy

4.1 Exogenous number of firms

Changes in various parameters of the model can be interpreted as an increase in competition. With an exogenous number of firms, a reduction in market size m or an increase in the number of firms n result in a less concentrated market – which may be construed as a more competitive market. A reduction in transport costs t (i.e., an increase in substitutability) reduces prices and profits, and can also be regarded as a strengthening of competition. By simply differentiating (11) with respect to m, n and t, we can assess the impact of these parameter changes on the equilibrium choice of I – which the following two propositions summarize.

Proposition 2 *With an exogenous number of firms, an increase in competition, as measured by a reduction in market size m or an increase in the number of firms n, leads unambiguously to an increase in the agent's autonomy $1 - I$.*

[17] Assumptions 1 and 3 guarantee that $16ft\left(2t + m\left(\Delta c\right)^2\right) - m^2\left(\Delta c\right)^4 > 0$, and therefore $n^* > 0$.

The intuition for this result is straightforward. Conditional on the agent exerting effort, both a reduction in market size given n, and an increase in the number of firms given m, simply reduce expected firm output and thus the benefit of reducing marginal costs – rent seeking by agents is less costly and principals can afford a higher level of agent's autonomy. Evidence of a positive relationship between the number of firms and managerial autonomy is provided in Acemoglu et al. (2007) and Bloom et al. (2009).

A market can also be said to be more competitive when transport costs are lower or product substitutability is higher. The next proposition summarizes the impact of a reduction in t on the optimal level of discretion granted to the agent.

Proposition 3 *An increase in substitutability (a reduction in t) increases the agent's autonomy (reduces I) in more concentrated markets (i.e., those with* $\frac{m}{n} > \frac{1}{2\Delta c}$*), but decreases his discretion in more dispersed markets (where* $\frac{m}{n} < \frac{1}{2\Delta c}$*).*

To build intuition for this result, let us plug (2) in (1) to get

$$\pi_i\left(c_i, E\left(p\right)\right) = \frac{m}{4t}\left(E\left(p\right) - c_i + \frac{t}{n}\right)^2$$

and use it to compute the value Ω of a cost reduction from c_A to c_P, which is also the marginal benefit from increased control (that is, the benefit of having the principal rather than the agent decide):

$$\begin{aligned}\Omega &\equiv \pi_i\left(c_P, E\left(p\right)\right) - \pi_i\left(c_A, E\left(p\right)\right) \\ &= \frac{m}{4t}\Delta c\left[2\left(E\left(p\right) + \frac{t}{n}\right) - \left(c_A + c_P\right)\right]. \end{aligned} \tag{14}$$

By Assumption 3, $\Omega > 0$: hence, a reduction in marginal cost increases expected profits.

The total effect of a change in t on Ω is $\frac{\partial \Omega}{\partial t} + \frac{\partial \Omega}{\partial E(p)}\frac{\partial E(p)}{\partial t}$, and can be decomposed in two separate effects of different sign. The direct effect is a *business-stealing effect*, and thanks to Assumption 3, $\frac{\partial \Omega}{\partial t} < 0$. Increased substitutability makes the demand faced by a firm more elastic, and, for given prices set by its rivals, makes it easier for each firm to steal business from the others by reducing costs and prices. A reduction in t increases then value of a cost reduction, and leads each firm to give less discretion to the agent.

The indirect effect of a change in t is a *strategic effect*. An increase in substitutability leads to lower equilibrium prices [cf. (3)], and a reduction in $E(p)$ decreases a firm's gain from reducing its cost. Because the reaction curves are upward sloping, a fall in $E(p)$ implies a decrease in p_i, but a less than proportional one [compare (2) and (3)] – therefore, firm i loses market share and has less to gain from a cost reduction, which points in the direction of increased autonomy. Therefore, $\frac{\partial \Omega}{\partial E(p)} \frac{\partial E(p)}{\partial t} > 0$.

When the strategic effect dominates, an increase in competition reduces the value of a cost reduction, and the optimal response of the principal is to reduce the probability of intervention (or increase autonomy) in order to commit to higher expected costs, and thus higher prices [see (3)]. The principal delegates more to be less aggressive in the marketplace. Hands-off management (giving subordinates great discretion) is indicative of a soft competitor.[18]

Given that the strategic effect is proportional to market concentration (or expected firm-level output) $\frac{m}{n}$, this effect is more likely to overcome the business-stealing effect for firms in more concentrated markets.[19] Indeed, as Proposition 3 shows, an increase in competition through greater product substitutability leads to increased autonomy when $\frac{m}{n} > \frac{1}{2\Delta c}$. On the other hand, for low values of $\frac{m}{n}$, the business-stealing effects dominates, an increase in competition raises the value of a cost reduction, and the firm grants less discretion to the agent in order to be more aggressive in pricing.[20]

A firm can be said to have a centralized decision-making structure if it is likely that a decision will be made by someone at the top rather than by someone at lower levels of the hierarchy. According to this definition, $I_k > I_l$ implies that firm k is more centralized than firm l, and conversely, that firm l is more decentralized than firm k. A straightforward corollary then follows from Proposition 3:

Corollary 1 *Larger firms tend to react to increased competition by implementing a more*

[18] See De Bijl (1995) for an opposite result in a Hotelling model in which the agent can choose product location.

[19] Hence, the strategic effect can also be considered a scale effect (cf. Raith, 2003).

[20] The same result obtains in the case of quadratic transport costs.

decentralized decision-making structure, whereas smaller firms tend to become more centralized.

In other words, when faced with the same environmental change, larger firms react differently than smaller firms: the former delegate more responsibility, whereas the latter centralize decision making. An increase in substitutability can enhance or diminish the relative profitability of centralization; the corollary tells us that the latter case is more likely when scale is larger. A proper test of this prediction (or that of Proposition 3) would require the inclusion of interaction terms in a regression of delegation on competition. I am aware of no empirical study that attempts this, but the dynamics of firm organization depicted in the corollary are broadly consistent with stylized facts presented in Colombo and Delmastro (1999).[21] Unfortunately, the authors do not explore the factors underlying those dynamics.

4.2 Endogenous number of firms

So far, we have taken the number of firms in the market to be exogenous. However, changes in competition also lead to changes in the number of firms through the free entry and exit of competitors – that is, market structure is endogenous. Knowing already how the degree of autonomy varies with competition parameters m and t, we can now analyze how the endogenous number of firms is affected by them, and also by the entry cost f. Taking partial derivatives on (13), and using Assumptions 1 and 3 to sign the derivatives, it is straightforward to show that:

$$\begin{aligned} \frac{\partial n^*}{\partial m} &> 0, \\ \frac{\partial n^*}{\partial t} &> 0, \text{ and} \\ \frac{\partial n^*}{\partial f} &< 0. \end{aligned}$$

[21] Marin and Verdier (2008a) interact competition and market size (which for given n, as assumed here, covaries perfectly with firm output $\frac{m}{n}$), and find that competition fosters delegation in larger markets (and hence, larger firms).

As in the previous subsection, the impact of increased competition on the agent's discretion depends crucially on which parameter change is triggering the increase in competition.

4.2.1 A reduction in the entry cost

A market that has lower entry costs (i.e., smaller f) is more competitive in the sense that the number of entering firms is larger and prices are lower. It is straightforward to show the following.

Proposition 4 *With an endogenous number of firms, an increase in competition, as measured by a decrease in the entry cost f, leads unambiguously to an increase in the level of discretion given to the agent.*

Proof. With n endogenous, totally differentiating (11) with respect to f leads to

$$\frac{dI}{df} = \frac{\partial I}{\partial f} + \frac{\partial I}{\partial n}\frac{\partial n^*}{\partial f}.$$

We already know that $\frac{\partial n^*}{\partial f} = -\frac{32\sqrt{2}\sqrt{m}t^{\frac{5}{2}}\left(2t+m(\Delta c)^2\right)}{\left(16ftm(\Delta c)^2+32ft^2-m^2(\Delta c)^4\right)^{\frac{3}{2}}} < 0$, thanks to Assumption 3. Differentiating (11) with respect to f and n we obtain $\frac{\partial I}{\partial f} = 0$ and $\frac{\partial I}{\partial n} < 0$. Therefore $\frac{dI}{df} > 0$. ■

All else equal, very competitive markets, in the sense of low f, are characterized by more decentralized firms. The intuition behind Proposition 4 is simple: an increase in competition due to a reduction in entry barriers (lower f) results in a larger number of firms entering the market and, for a given market size, in lower concentration, which increases the agent's autonomy (cf. Proposition 2). Supporting evidence is presented in Acemoglu et al. (2007) and Bloom et al. (2009).[22]

[22] Although these authors do not include some measure of entry costs as a regressor, changes in f can be tied to changes in the Lerner index, which they use as a measure of competition. The effect of the latter on delegation documented in both studies is consistent with Proposition 4.

4.2.2 An increase in product substitutability

An increase in substitutability (i.e., a reduction in t) reduces the profit margin and therefore decreases the number of entering firms – perceived possibilities for differentiation are reduced. Focusing once again on Ω, the value of a cost reduction, it is straightforward to show that with an endogenous number of firms there is a third effect of t on this gain that runs through the change in the equilibrium number of firms. This *change-in-the-number-of-firms effect* is negative and reinforces the business-stealing effect, making it less likely to have a positive impact of increased competition on autonomy as compared to the case with an exogenous number of firms. For a given market size, $\frac{\partial n^*}{\partial t} > 0$ implies that a reduction in t leads to an increase in market concentration, which pushes in the direction of reduced autonomy according to Proposition 2. The following proposition summarizes this discussion.

Proposition 5 *An increase in competition, as measured by a reduction in the transport cost t, is less likely to lead to more agent discretion in the case of an endogenous number of firms than in the case of an exogenous market structure.*

Proof. With an endogenous number of firms $n^*(t)$, the total effect of a change in t on $\Omega = \Omega(t, n^*(t))$ can be decomposed in three separate effects: a business-stealing effect, $\frac{\partial \Omega}{\partial t}$; a strategic effect, $\frac{\partial \Omega}{\partial E(p)} \frac{\partial E(p)}{\partial t}$; and a change-in-the-number-of-firms effect, $\frac{d\Omega}{dn} \frac{\partial n^*}{\partial t}$:

$$\frac{d\Omega}{dt} = \frac{\partial \Omega}{\partial t} + \frac{\partial \Omega}{\partial E(p)} \frac{\partial E(p)}{\partial t} + \frac{d\Omega}{dn} \frac{\partial n^*}{\partial t} = \frac{\partial \Omega}{\partial t} + \frac{\partial \Omega}{\partial E(p)} \frac{\partial E(p)}{\partial t} + \left(\frac{\partial \Omega}{\partial n} + \frac{\partial \Omega}{\partial E(p)} \frac{\partial E(p)}{\partial n} \right) \frac{\partial n^*}{\partial t}. \tag{15}$$

We already know that $\frac{\partial \Omega}{\partial t} = \frac{m\Delta c}{4t} \left\{ \left[c_A + c_P - 2\left(E(p) + \frac{t}{n} \right) \right] \frac{1}{t} - \frac{2}{n} \right\} < 0$ and $\frac{\partial \Omega}{\partial E(p)} \frac{\partial E(p)}{\partial t} = \frac{m}{n} \frac{1}{2t} > 0$ from the discussion in subsection 4.1. We have that $\frac{\partial \Omega}{\partial n} = -\frac{m\Delta c}{2n^2} < 0$, $\frac{\partial \Omega}{\partial E(p)} \frac{\partial E(p)}{\partial n} = -\frac{m}{2n^2} < 0$, and $\frac{\partial n^*}{\partial t} = \frac{2\sqrt{2}\sqrt{m}\sqrt{t}\left(32ftm(\Delta c)^2 + 32ft^2 - 3m^2(\Delta c)^4\right)}{\left(16ftm(\Delta c)^2 + 32ft^2 - m^2(\Delta c)^4\right)^{\frac{3}{2}}} > 0$. Therefore, the third term in (15) is negative and reinforces the business-stealing effect, thus proving the result. ■

Another way to look at this is to consider directly the effect of changes in t on the probability of intervention I. With an endogenous market structure, it can be written as

$$\frac{dI}{dt} = \frac{\partial I}{\partial t} + \frac{\partial I}{\partial n} \frac{\partial n^*}{\partial t}.$$

Given that $\frac{\partial n^*}{\partial t} > 0$ and $\frac{\partial I}{\partial n} < 0$ from the proof of Proposition 4, increased product substitutability calls for reduced agent discretion in firms in dispersed markets (i.e., those with $\frac{m}{n} < \frac{1}{2\Delta c}$), as in the case with an exogenous number of firms, since in these markets $\frac{\partial I}{\partial t} < 0$. In concentrated markets, on the other hand, the negative indirect effect through the equilibrium number of firms now opposes a positive direct effect, and the predicted impact of a reduction in t is ambiguous. Notice, however, that for t large enough, the direct effect $\frac{\partial I}{\partial t} = \frac{m(\Delta c)^2(2m\Delta c - n)}{n\left(2t + m(\Delta c)^2\right)^2}$ is close to zero, implying that the total effect is likely to be negative. Hence,

Proposition 6 *Stronger competition, as measured by an increase in product substitutability, leads principals to grant less autonomy in markets where the possibilities for product differentiation are important.*

4.2.3 An increase in market size

A market that is larger is also more competitive in the sense that more firms enter and prices are lower. The impact of market size on autonomy becomes ambiguous when we allow for an endogenous number of firms. The direct effect of m on the probability of intervention is positive (cf. Proposition 2), but with an endogenous market structure, market size also affects I indirectly through the equilibrium number of firms. This second effect is negative, and thus the total effect cannot be signed a priori.

To explore the conditions under which the effect of changing m is of either sign, recall Ω [cf. equation (14)], the gain from reducing marginal costs. The following Proposition shows how it depends on market size, and provides a simple condition under which the effect of a larger market size on autonomy can be signed.

Proposition 7 *With an endogenous number of firms $n^*(m)$,:*

- *the total effect of a change in m on $\Omega = \Omega(m, n^*(m))$ can be decomposed in two separate effects of different sign: a cake-size effect, $\frac{\partial \Omega}{\partial m} > 0$, and a number-of-diners effect, $\frac{d\Omega}{dn}\frac{\partial n^*}{\partial m} < 0$; and*

- *if* $-\frac{\partial^2 n^*}{\partial m^2} < \frac{1}{m}\frac{\partial n^*}{\partial m}$, *increased competition, as measured by an increase in market size, leads to increased autonomy in larger markets, but to reduced autonomy in smaller markets.*

Proof. Differentiating Ω with respect to m yields

$$\frac{d\Omega}{dm} = \frac{\partial \Omega}{\partial m} + \frac{d\Omega}{dn}\frac{\partial n^*}{\partial m} = \frac{\partial \Omega}{\partial m} + \left(\frac{\partial \Omega}{\partial n} + \frac{\partial \Omega}{\partial E\left(p\right)}\frac{\partial E\left(p\right)}{\partial n}\right)\frac{\partial n^*}{\partial m}$$

where

$$\frac{\partial \Omega}{\partial m} = -\frac{\Delta c}{4t}\left[c_A + c_P - 2\left(E\left(p\right) + \frac{t}{n}\right)\right] > 0$$

thanks to Assumption 3,

$$\frac{\partial \Omega}{\partial n} = -\frac{m\Delta c}{2n^2} < 0,$$

$\frac{\partial n^*}{\partial m} = \frac{2\sqrt{2}t^{\frac{3}{2}}\left(32ft^2 + m^2(\Delta c)^4\right)}{\sqrt{m}\left(16ftm(\Delta c)^2 + 32ft^2 - m^2(\Delta c)^4\right)^{\frac{3}{2}}} > 0$ thanks to Assumption 3, and, using (3),

$$\frac{\partial \Omega}{\partial E\left(p\right)}\frac{\partial E\left(p\right)}{\partial n} = -\frac{m}{2t}\frac{t}{n^2} = -\frac{m}{2n^2} < 0,$$

which proves the first part. To prove the second part, we just need to show that Ω is a concave function of m. The second derivative of Ω with respect to m can be written as

$$-\underbrace{\frac{1+\Delta c}{2n^2}}_{(+)}\left(\underbrace{\frac{\partial n^*}{\partial m}}_{(+)} + \underbrace{m}_{(+)}\frac{\partial^2 n^*}{\partial m^2}\right);$$

therefore $\frac{d^2\Omega}{dm^2} < 0$ if and only if $-\frac{\partial^2 n^*}{\partial m^2} < \frac{1}{m}\frac{\partial n^*}{\partial m}$, which is the condition stated in the Proposition. ■

In the short run (i.e., with a fixed number of firms), only the (direct) *cake-size effect* appears: an increase in market size (the 'cake') increases the gain from reducing costs, and hence leads to reduced autonomy for the agent (cf. Proposition 2). In the longer run, the increase in m attracts more firms (the 'diners') to the market, and the consequent increase in n tends to reduce that gain – thus calling for more decentralized decision making (*the number-of-diners effect*). Which effect will prevail is uncertain, and depends crucially on the sensitivity of the number of firms to market size.

Although we cannot exclude a priori cases in which $\frac{\partial^2 n^*}{\partial m^2} > 0$, economic sense tells us that $\frac{\partial^2 n^*}{\partial m^2} < 0$; n^* should be an increasing and concave function of m. According to Proposition 7, Ω is a concave function of m provided $\frac{\partial^2 n^*}{\partial m^2}$ is not too negative – i.e., provided n^* is not too concave. Therefore, under a mild condition on the concavity of n^* we can be sure that the indirect, number-of-diners effect will eventually overturn the cake-size effect for m large enough.[23] In that case, the model predicts a U-shaped relationship between competition (market size) and autonomy: decentralized decision-making structures should be more common in firms both in very small and very large markets. Indirect evidence of a such nonmonotonic relationship between competition and delegation is presented in Karuna (2008).

5 Concluding remarks

A central concern for organizational economics and industrial organization lies with the structure of organizations and the behavior of organizational participants, and particularly with the need to identify ways in which environmental factors constrain both. Dill (1958) argued long time ago that the delegation of authority ("the autonomy of managerial personnel") is influenced by the structure of the firm's environment. For instance, it has been recently suggested that increasing competition in the markets is forcing firms to adopt leaner structures, delegate authority and responsibility down the hierarchy, empower their employees, and so on.

Interestingly, the relationship between competition and delegation (or autonomy) has not received much attention from the theoretical literature, and when it has, the conclusions have not been clear-cut. This paper has studied how oligopolistic firms optimally respond to increased competition by adapting their internal organization. It has shown how each

[23] Notice incidentally that $-\frac{\partial^2 n^*}{\partial m^2} < \frac{1}{m}\frac{\partial n^*}{\partial m}$ holds in the standard formulation of the Salop model. I have not been able to prove this is always true here, but I know of no case in which it is not. The formula for $\frac{\partial^2 n^*}{\partial m^2}$ would seem to indicate that it could violate the condition, but only if Δc is large. This situation is likely to lead to a violation of Assumption 3.

firm modifies the level of discretion or autonomy in decision making that is granted to subordinates according to changes in market size, product substitutability, and entry costs that can be interpreted as an increase in competition. These different sources of increased competition affect differently the relative profitability of delegation, thus providing different predictions on the relationship between competition and autonomy. These predictions, in turn, invite further empirical work – which has been of limited scope so far, and has provided mixed answers to the question of whether competition favors delegation.

By simultaneously addressing "the choice of both competitive actions and organizational design" (Spulber, 1992), this paper has made an attempt at bringing economic theory and management strategy closer together. By treating market structure as endogenous, it has shown that the predictions concerning competition and delegation can be different from the case where market structure is taken as given – suggesting in passing that there might be a difference in the short- and long-run responses of organizational design to increased product-market competition.

References

Acemoglu, Daron, Philippe Aghion, Claire Lelarge, John Van Reenen, and Fabrizio Zilibotti (2007). "Technology, Information and the Decentralization of the Firm", *The Quarterly Journal of Economics*, vol. 122(4) (November): 1759-1799.

Aghion, Philippe, and Jean Tirole (1997). "Formal and Real Authority in Organizations", *The Journal of Political Economy*, vol. 105(1) (February): 1-29.

Alonso, Ricardo, Wouter Dessein, and Niko Matouschek (2008). "Organize to Compete", unpublished manuscript, University of Southern California, University of Chicago, and Northwestern University, December.

Bloom, Nick, Rafaella Sadun, and John van Reenen (2009). "The Organization of Firms Across Countries", unpublished manuscript, Stanford University and London School of Economics, April.

Burkart, Mike, Denis Gromb, and Fausto Panunzi (1997). "Large Shareholders, Monitoring, and the Value of the Firm", *The Quarterly Journal of Economics*, vol. 112(3) (August): 693-728.

Caroli, Eve, and John van Reenen (2001). "Skill-Biased Organizational Change? Evidence from a Panel of British and French Establishments", *The Quarterly Journal of Economics*, vol. 116(4) (November):

1449-1492.

Colombo, Massimo G., and Marco Delmastro (1999). "Some Stylized Facts on Organization and its Evolution", *Journal of Economic Behavior & Organization*, vol. 40(3) (November): 255-274.

Crémer, Jacques (1995). "Arm's Length Relationships", *The Quarterly Journal of Economics*, vol. 110(2) (May): 275-295.

De Bijl, Paul (1994). "Delegation of Responsibility in Organizations", CentER Discussion Paper no. 9469, CentER for Economic Research, Tilburg University.

De Bijl, Paul (1995). "Strategic Delegation of Responsibility in Competing Firms", CentER Discussion Paper no. 9533, CentER for Economic Research, Tilburg University.

Dill, William R. (1958). "Environment as an Influence on Managerial Autonomy", *Administrative Science Quarterly*, vol. 2(4) (March): 409-443.

Fershtman, Chaim, and Kenneth L. Judd (1987). "Equilibrium Incentives in Oligopoly", *The American Economic Review*, vol. 77(5) (December): 927-940.

Hart, Oliver (1983). "The Market Mechanism as an Incentive Scheme", *The Bell Journal of Economics*, vol. 14(2) (Autumn): 366-382.

Hart, Oliver, and Bengt Holmstrom (2008). "A Theory of Firm Scope", unpublished manuscript, Harvard University and MIT, December.

Hermalin, Benjamin E. (1992). "The Effects of Competition on Executive Behavior", *The RAND Journal of Economics*, vol. 23(3) (Autumn): 350-365.

Hermalin, Benjamin E. (1994). "Heterogeneity in Organizational Form: Why Otherwise Identical Firms Choose Different Incentives for Their Managers", *The RAND Journal of Economics*, vol. 25(4) (Winter): 518-537.

Holland, Philip (1989). "Jacobs Suchard: Reorganizing for 1992", Harvard Business School Case 9-489-106.

Horn, Henrik, Harald Lang, and Stefan Lundgren (1994). "Competition, Long Run Contracts and Internal Inefficiencies in Firms", *European Economic Review*, vol. 38(2): 213-233.

Horn, Henrik, Harald Lang, and Stefan Lundgren (1995). "Managerial Effort Incentives, X-Inefficiency and International Trade", *European Economic Review*, vol. 39(1): 117-138.

Karuna, Christo (2008). "Industry Product Market Competition and Corporate Governance", unpublished manuscript, The Paul Merage School of Business, University of California at Irvine, June.

Khandwalla, Pradip N. (1973). "Effect of Competition on the Structure of Top Management Control", *The Academy of Management Journal*, vol. 16(2) (June): 285-295.

Leonard, Jonathan S. (1990). "Executive Pay and Firm Performance", *Industrial and Labor Relations Review*, vol. 43(3) (February): 13S-29S.

Marin, Dalia, and Thierry Verdier (2008a). "Corporate Hierarchies and the Size of Nations: Theory and Evidence", Discussion Paper No. 227, Governance and the Efficiency of Economic Systems, February.

Marin, Dalia, and Thierry Verdier (2008b). "Power Inside the Firm and the Market: A General Equilibrium Approach", *Journal of the European Economic Association*, vol. 6(4) (June): 752-788.

Martin, Stephen (1993). "Endogenous Firm Efficiency in a Cournot Principal-Agent Model", *Journal of Economic Theory* 59(2): 445-450.

Meagher, Kieron, and Wen Wang (2009). "Firm Organization and Market Structure: Centralization vs. Decentralization", unpublished manuscript, University of New South Wales, January.

Mello, Antonio S., and Martin E. Ruckes (2006). "Team Composition", *Journal of Business*, vol. 79(3): 1019-1039.

Merchant, Kenneth A. (1998). *Modern Management Control Systems*, Prentice Hall, New Jersey.

Nickell, Stephen J., Daphne Nicolitsas, and Malcolm Patterson (2001). "Does Doing Badly Encourage Management Innovation?", *Oxford Bulletin of Economics and Statistics*, vol. 63(1) (February): 5-28.

Raith, Michael (2003). "Competition, Risk, and Managerial Incentives", *The American Economic Review*, vol. 93(4) (November): 1425-1436.

Ruzzier, Christian A. (2009). "Product-Market Competition and Managerial Autonomy", Working Paper 09-082, Harvard Business School, January. Available at SSRN: http://ssrn.com/abstract=1259860.

Salop, Steven C. (1979). "Monopolistic Competition with Outside Goods", *Bell Journal of Economics* vol. 10(1) (Spring): 141-156.

Scharfstein, David (1988). "Product-Market Competition and Managerial Slack", *The RAND Journal of Economics* 19(1): 147-155.

Schmidt, Klaus M. (1997). "Managerial Incentives and Product Market Competition", *The Review of Economic Studies*, vol. 64(2) (April): 191-213.

Spulber, Daniel F. (1992). "Economic Analysis and Management Strategy: A Survey", *Journal of Economics & Management Strategy*, vol. 1(3) (Fall): 535-574.

Vives, Xavier (2008). "Innovation and Competitive Pressure", *Journal of Industrial Economics*, vol. 56(3) (September): 419-469.

Zingales, Luigi (1995). "Inside Ownership and the Decision to Go Public", *The Review of Economic Studies*, vol. 62(3) (July): 425-448.