

# Product Market Competition and The Boundaries of the Firm\*

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## Abstract

This paper studies the effects of product market competition on vertical integration. In a duopoly setting, each retailer is associated with a manufacturer who must decide how to allocate property rights over the retail asset. Choosing delegation of property rights over vertical integration transfers incentives from the manufacturer to the retailer, and has the benefit of facilitating the creation of value, due to the retailer's superior efficiency. On the other hand it forces the manufacturer to forfeit part of the profits. We show how competition affects the equilibrium allocation of property rights in the industry, and discuss model applications.

Keywords: Competition, Vertical Integration, Incomplete Contracts.

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# 1 Introduction

It seems that whenever a firm justifies an important strategic decision, ‘product market competition,’ or ‘increased competitive pressure’ feature chiefly among the reasons for that choice. This is particularly true regarding decisions related to vertical integration. A striking example is the case of Staples Inc., the office supply chain. Staples had initially responded to increased competition from new on-line suppliers by investing heavily in its own on-line site, which it structured as an independent entity. The recent decrease in competition which accompanied the burst of the “bubble,” however, lead Staples to reverse its strategy and to merge its on-line business with its catalog business.<sup>1</sup>

In addition to stories covered by popular media, evidence of competition influencing boundaries-of-the-firm decisions has also emerged from empirical research. Coughlan (1985) for example, using data from the international semiconductor industry, shows a negative relationship between the propensity of a firm to sell a technology in a foreign market “directly” rather than via a independent middleman, and product market competition. And in a more recent study, Slade (1998) shows a positive relationship between cross-price elasticities and delegation of the pricing decision in the retail gasoline market. So how does the product market affect the boundaries of a firm?

The main objective of this paper is to determine how competition affects the boundaries of the firm. We show that the net benefit from vertical separation<sup>2</sup> tends to increase with competition, and that there exists a threshold level of competition such that non-integration is optimal if and only if the intensity of competition is above that threshold.

The model analyzes how competition affects whether the manufacturer chooses to operate through a firm-owned outlet and hire a retail manager, or to distribute her products via an independent retailer.

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<sup>1</sup>New York Times, June 25, 2001.

<sup>2</sup>Throughout the paper we use vertical separation, non-integration, and delegation of property rights interchangeably.

In the spirit of Grossman and Hart (1986) and Hart and Moore<sup>3</sup> (1990), we assume that contracts are incomplete, and specify only who owns<sup>4</sup> the retail ‘store.’ While both manufacturers and retailers can exert effort and create value by increasing product quality and/or reducing marginal cost, their incentives to do so depend on the allocation of property rights and the resulting ability of each party to appropriate the potential returns. When ownership of the retail store (and hence *ex-post* bargaining power) is transferred from the manufacturer to the retailer, the retailer’s incentives increase at the expense of the manufacturer’s. GHM argue that ownership should be given to the most efficient agent.

There are two key assumptions in our model. First, the retailer can exert effort more efficiently than the manufacturer; and second, the retailer is wealth constrained. As discussed in Aghion and Tirole (1994), in such a context GHM’s result no longer necessarily holds. When choosing vertical separation over integration, the manufacturer takes advantage of the retailer’s superior efficiency, which facilitates value creation. This is the benefit from vertical separation. But choosing non-integration also imposes a cost to the manufacturer. It reduces the manufacturer’s *ex-post* bargaining power and forces her to forfeit part of the surplus. And the retailer’s wealth constraint prevents the manufacturer from extracting *ex-ante* the part of the surplus to be forfeited *ex-post*. Our model analyzes how product market competition affects this trade-off.

We consider a duopoly setting where two manufacturer/retailer pairs sell substitutable products, and competition is measured by the degree of substitutability between the two goods. Product market competition generates a ‘business stealing’ effect, and a ‘rent-reduction’ effect. The business stealing effect works through demand: by making demand more elastic, competition further increases demand

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<sup>3</sup>Henceforth GHM.

<sup>4</sup>Vertical separation corresponds to the case where ownership of the store is delegated to the retail manager, while integration corresponds to a situation in which the manufacturer owns the retail outlet.

for the firm with a competitive advantage<sup>5</sup>, thus augmenting the value of increasing quality and/or reducing marginal cost. With the rent-reduction effect, competition reduces price-cost margins and has a negative impact on the value of a quality increase.

The business stealing and rent-reduction effects both influence the *benefit* from vertical separation, and work in opposite directions. We show that the strength of the business stealing effect depends on how the value created by the firm relates to that created by its rival. Business stealing has a stronger impact on a firm with a competitive advantage because this advantage allows the firm to make a higher margin with each unit stolen from its competitor<sup>6</sup>. In our model, the business stealing effect is strong enough to offset the rent-reduction effect when creating value means gaining a competitive advantage, and in that case competition unambiguously augments the benefit from separation. The *cost* of choosing a non-integrated structure is affected mainly by the rent-reduction effect: competition tends to reduce profits by lowering price-cost margins, and this decreases the opportunity cost of forfeiting *ex-post* bargaining power.

Taking both benefit and cost into account, we find that the net benefit from vertical separation tends to increase with competition, regardless of the rival firm's vertical structure. At the industry level, we describe changes in the Nash Equilibrium firm structure as competition rises, where firms gradually switch to less integrated structures.

For the sake of clarity, in this paper we focus mainly on the relationship between manufacturer and retailer. However, the model is much more general than that, and can be used to analyze the effects of competition on the allocation of property rights between any inefficient principal with *ex-ante* bargaining power, and her wealth-constrained, efficient agent. This framework would apply, for

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<sup>5</sup> Competition also further reduces demand for the firm with a competitive disadvantage.

<sup>6</sup> In contrast a below-average firm charges a relatively low margin and thus has a low cost of having consumer stolen by higher quality competitors.

example, to the relationship between a venture capitalist and an entrepreneur, between a manufacturer and a supplier, or between a R&D firm and a research laboratory.

To our knowledge, aside from recent work by Grossman and Helpman (2000), who look at the effects of competition on integration between a firm and its supplier, little has been written on this subject. In addition to differences in delegation incentives,<sup>7</sup> our approach contrasts with theirs in its focus. Unlike Grossman and Helpman, we concentrate on the strategic interaction between competitors and on the endogeneity of the integration decision.

This research is also related to the literature on product market competition and incentives, which analyzes the effects of competition on managerial effort, using models of hidden information (Hart (1983), Scharfstein (1988)) and models of hidden action<sup>8</sup> (Hermalin (1992), Schmidt (1997), Raith (2001)). This literature tends to model product market competition in a simplified way which does not allow for strategic interactions between firms<sup>9</sup>. Rather it makes assumptions about the expected *effects* of competition, such as lower profits, a higher likelihood of liquidation, or an increase in aggregate supply. In contrast, following Sutton,<sup>10</sup> we argue that substitutability between products provides a good measure of the ‘toughness of competition’ in an industry. Using this measure of competition as exogenous variable, I analyze its effects on the Nash equilibrium allocation of property rights in the industry.

The paper is organized as follows. Section 2 describes the basic model. Section 3, analyzes the way in which firm structure affects the manufacturer and retailer’s relative ex-post bargaining power,

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<sup>7</sup>In contrast with our ‘property rights’ approach, Grossman and Helpman use a simple set-up where the trade-off between integration and outsourcing is that an integrated structure tends to have higher costs due lack of specialization, which has a positive effect on prices, while in the case of non-integration, a hold-up problem à la Williamson (Williamson (1975), (1985), Klein et al. (1978)) induces the supplier to produce less, which also tends to lead to higher equilibrium prices; the effects of competition on integration depend on which strategy leads to higher prices.

<sup>8</sup>See Bettignies (2001) for a literature review.

<sup>9</sup>Exception: Raith (2001).

<sup>10</sup>We refer to Sutton’s description of toughness of competition (Sutton (1992), p.9.).

their incentives, value creation and expected profits. The cost and benefit of vertical separation are discussed in section 4. In section 5, we analyze the potential Nash equilibria in firm structure and how they are affected by competition in the product market. Finally, section 6 summarizes the model, and discusses the empirical applications and how the assumptions and results fit the evidence.

## 2 Basic Model

### 2.1 Description and Timing of the Game

Consider two risk-neutral retailers. Retailer  $i$ ,  $i = 1, 2$ , offers a good  $i$ , produced at marginal cost  $c_i$ , of quality  $q_i$  and price  $p_i$ , and competes with retailer  $j$ ,  $j \neq i$ , for consumer. Products 1 and 2 are imperfect substitutes, and the consumer chooses between them.

Each retailer is involved in a joint venture with a risk-neutral manufacturer. For the sake of clarity, I assume throughout the text that manufacturers are female and retailers are male. Since the successful distribution of product  $i$  requires an asset owned by manufacturer  $i$  - the asset could be the product itself, office space and equipment, or a brand name, for example - the retailer must collaborate with her. Conversely the manufacturer needs a retailer to distribute her product; but she has a choice as to the structure of her distribution channel.

Indeed, **at date 0**, manufacturer  $i$  makes a decision concerning the allocation of property rights over the retailing firm: should she keep ownership of the retailing asset, essentially operate via a firm-owned outlet, and opt for an “integrated” structure? Or should she allocate property rights to the retailer and operate via an independent distributor, thereby choosing “delegation of control”?

**At date 1**, once property rights have been allocated, both manufacturers and retailers can exert effort to affect product quality and/or the marginal cost of production. Specifically, Manufacturer  $i$ ,

$i = 1, 2$ , can exert either low effort  $f_{il}$  at no cost or high effort  $f_{ih}$  at a personal cost of  $k_{im}$ . Similarly, retailer  $i$  can choose between low effort  $e_{il}$  at no cost, and high effort  $e_{ih}$  at a personal cost of  $k_{ir}$ . Naturally, we assume that quality and marginal are strictly increasing and strictly decreasing in effort, respectively:

$$q_i(f_{ih}, e_i) > q_i(f_{il}, e_i)$$

$$q_i(f_i, e_{ih}) > q_i(f_i, e_{il})$$

$$c_i(f_{ih}, e_i) < c_i(f_{il}, e_i)$$

$$c_i(f_i, e_{ih}) < c_i(f_i, e_{il})$$

Moreover we make the simplifying assumption that the effect of a player's increase in effort on quality and cost is independent of the other player's level of effort. For example, in the case of manufacturers and quality,  $q_i(f_{ih}, e_{il}) - q_i(f_{il}, e_{il}) = q_i(f_{ih}, e_{ih}) - q_i(f_{il}, e_{ih})$ .

**At date 2**, once qualities and marginal costs are determined, firms 1 and 2 compete in price. Product market competition is modeled with a Hotelling (1929) line, with the two retailers located at the extremes. Firm 1 is at  $x = 0$  while firm 2 is at  $x = 1$ .

Consumers are uniformly distributed with density 1 along the Hotelling line, and must choose whether to purchase product 1 or product 2. A consumer located at  $x$  incurs a transport cost  $tx$  for travelling to retailer 1, and a cost  $t(1 - x)$  for visiting store 2. The consumers' conditional indirect utility from choosing alternative  $i$  can be written in the following way:

$$\tilde{V}_i = \left\{ \begin{array}{ll} y + q_i - p_i - tx & i = 1 \\ y + q_i - p_i - t(1 - x) & i = 2 \end{array} \right\} \quad (1)$$

where  $y$  represents income. Parameter  $t$  is a crucial variable in our model; throughout the paper it represents a measure of product differentiation and thus of toughness of competition (or rather, lack

thereof): a low  $t$  represents low transport costs, high substitutability between products, and therefore tough price competition. *Vice versa* a high  $t$  means low degree of competition in the 2-firm industry.

We define  $\theta = \frac{1}{t}$  as a measure of toughness of competition.

A consumer located at  $x = D_1(q_1, p_1, q_2, p_2, t)$  is indifferent between store 1 and 2 if and only if  $\tilde{V}_1 = \tilde{V}_2$  or:

$$q_1 - p_1 - tx = q_2 - p_2 - t(1 - x). \quad (2)$$

Rearranging we get demands:

$$D_1(q_1, p_1, q_2, p_2, t) = x = \frac{1}{2} + \frac{(p_2 - p_1) + (q_1 - q_2)}{2t}, \quad (3)$$

and  $D_2(q_1, p_1, q_2, p_2, t) = 1 - x$ .

Retailer  $i$  chooses price<sup>11</sup> to maximize the following program:

$$\max_{p_i} [p_i - c_i] D_i(q_1, p_1, q_2, p_2, t), \quad (4)$$

with  $D_i$  defined above.

Taking the first-order conditions<sup>12</sup> (henceforth FOC) for  $p_i$ ,  $i = 1, 2$ , solving and substituting back into the profit function, we obtain expected profits in terms of qualities and marginal costs:

$$\pi_i(q_i, c_i, q_j, c_j, t) = \left[ \frac{(q_i - c_i) - (q_j - c_j)}{3} + t \right] \left[ \frac{1}{2} + \frac{(q_i - c_i) - (q_j - c_j)}{6t} \right], \quad (5)$$

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<sup>11</sup>It would make no difference if the manufacturer were to set prices in our model. We give that decision right to the retailer for convenience.

<sup>12</sup>The second order condition gives  $\frac{-1}{t}$ , which is strictly negative.



where the equilibrium price for firm  $i$  is  $p_i^* = \frac{(q_i - c_i) - (q_i - c_i)}{3} + t$ .

We define the value creation<sup>13</sup> function  $v_i$  as  $v_i = q_i(f_i, e_i) - c_i(f_i, e_i)$ , and for simplicity we write  $v_i(f_i, e_i)$ . Firm  $i$  achieves competitive advantage when it creates more value than its rival  $j$ . Through the effort levels of the manufacturer and the retailer, firm  $i$  can create value in two ways. It can either increase the benefit perceived by the consumer - described here by product quality - or reduce the marginal cost of production (or both). From our assumptions about quality and marginal cost of production, we know that higher efforts by either the manufacturer or the retailer must create more value:

$$\begin{aligned} v_i(f_{ih}, e_i) &> v_i(f_{il}, e_i), \\ v_i(f_i, e_{ih}) &> v_i(f_i, e_{il}). \end{aligned} \tag{6}$$

Moreover,  $v_i(f_{ih}, e_{il}) - v_i(f_{il}, e_{il}) = v_i(f_{ih}, e_{ih}) - v_i(f_{il}, e_{ih})$ , and  $v_i(f_{il}, e_{ih}) - v_i(f_{il}, e_{il}) = v_i(f_{ih}, e_{ih}) - v_i(f_{ih}, e_{il})$ .

Given the value created by each firm, can thus be re-write the expected profit function (5) in terms of value creation:

$$\pi_i(v_i, v_j, t) = \left[ \frac{v_i - v_j}{3} + t \right] \left[ \frac{1}{2} + \frac{v_i - v_j}{6t} \right]. \tag{7}$$

**At date 3**, demands are realized. The consumer chooses one of the two products.

**At date 4**, the good is produced and exchanged, and the retailer and manufacturer simultaneously bargain over the surplus.

## 2.2 Assumptions

**Assumption 1: Contracts are incomplete.**

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<sup>13</sup>See Besanko, Dranove and Shanley (1996), chapter 12, for an excellent description of value creation and competitive advantage.

The manufacturer (the principal) offers a contract to the retailer (the agent); in other words it is assumed that the bargaining power belongs to the manufacturers<sup>14</sup>.

In this model we argue that contracts are incomplete for several reasons. First, the retailer’s effort is not observable<sup>15</sup> and due to the innovative nature of the projects and the consequent difficulty of describing the product *ex-ante*, neither product quality nor marginal cost can be contracted upon at date 0. Second, *ex-post* demands and profits are not verifiable<sup>16</sup>. One could justify this as in Hart (1995), and argue that the retailer “has discretion over cash-flows, e.g. that he can use them for perks rather than pay them out.”

These assumptions render difficult any kind of effective long-term contract between the manufacturer and the retailer. Contracts, therefore, specify only the allocation of property rights on the retailer’s asset, and, at the end of the period, the parties bargain over the surplus from scratch.

Whoever possesses the control rights over the retailer’s asset can use this asset in any manner they choose. The allocation of control rights is chosen by the manufacturers as they have all *ex-ante* bargaining power. There are two possible allocations of control rights in this model: either manufacturer  $i$  allocates the property rights over retailer  $i$ ’s project to herself, or she delegates the control rights to manager/retailer  $i$ . We refer to the former case as *manufacturer-control* and to the latter case as *retailer-control*.

**Assumption 2:**  $t > \max(|v_i - v_j|)$ .

This assumption is sufficient to ensure that equilibrium prices (see (7)) are strictly positive, and

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<sup>14</sup>Here we implicitly assume that the investor offers the contract to one entrepreneur, but many other entrepreneurs have potentially interesting projects to offer.

<sup>15</sup>The manufacturer’s investment in the project could be verifiable (if it involves cash or access to a plant or production facility), or non-verifiable (e.g. human capital investment such as financial or legal expertise, or brand name). In our basic framework (where investors have ex-ante bargaining power) the two cases are identical.

<sup>16</sup>See Hart and Moore (1998), Bolton and Scharfstein (1990), and Fluck (1998) for other models where this assumption is made.

there are strictly dominating strategies for effort choices, for all agents in the date 1 subgames. We restrict our attention to strictly dominating strategies for simplicity and ease of presentation. However, the cost in terms of loss of generality is little. In fact, a previous version of this paper<sup>17</sup> contained a more general model with continuous effort choices and no restrictions. The results were almost identical to the ones found in this paper, but the generality of the model made presentation much more difficult. As we shall see in section 3.3, our focus implies very simple results in the date 1 subgames.

**Assumption 3: The retailers are wealth constrained.**

This simply means that their income can never be negative. It is most important in our framework because it prevents the manufacturer from extracting any *ex-ante* rents. Here, any *ex-post* bargaining power and associated *ex-post* rents relinquished by the manufacturer are forfeited for good and cannot be retrieved with *ex-ante* transfers from the retailer (because that would imply negative income for him). This assumption appears to be relevant empirically, in the fast food industry for example. As discussed in section 6, Kalnins and Lafontaine (1999) analyze McDonald’s franchises and find evidence of both *ex-post* and *ex-ante* rents left to franchisees, and argue that wealth constraints prevent McDonald’s from extracting all *ex-ante* rents.

**Assumption 4: Retailers are more efficient than manufacturers in their investment in effort, and  $v_i(f_{il}, e_{ih}) \geq v_i(f_{ih}, e_{il}), k_{ir} \leq k_{im}$ .**

We claim that the total surplus is larger when high effort is exerted by the retailer than when it is exerted by the manufacturer:

$$\pi_i(v_i(f_{il}, e_{ih}), v_j, t) - k_{ir} \geq \pi_i(v_i(f_{ih}, e_{il}), v_j, t) - k_{im}, \quad (8)$$

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<sup>17</sup>Copies of that version of the paper are available upon request.

or:

$$\pi_i(v_i(f_{il}, e_{ih}), v_j, t) - \pi_i(v_i(f_{ih}, e_{il}), v_j, t) \geq k_{ir} - k_{im}, \quad (9)$$

where the profit functions are defined as in (7).

The retailer is more efficient if the value created when he exerts high effort is sufficiently higher than that created when the manufacturer exerts high effort ( i.e. if the left-hand side is sufficiently large), or if his cost of effort is sufficiently low relative to that of the manufacturer (i.e. if the right hand side is sufficiently small), or both. We illustrate these with two empirically relevant examples.

*Example 1: Contact with the retailer has more impact on the consumers' perceived benefit than does manufacturer's effort*<sup>18</sup>.

This could be true from hairdressing chains, or gas stations, for example. One may care more about the benefit provided by the hairdresser (hair cutting skills, politeness, good conversation) than about the brand name. Similarly one may care more about the quality of services provided by the operator of a gas station (ancillary services such as car repair or food, friendliness) than whether it is BP gas or Exxon gas.

*Example 2: The retailer has superior information about market size*<sup>19</sup>.

The retailer may possess information that is unavailable to the manufacturer, and may be able to use his information to target his effort to situations where it is relevant. The manufacturer who cannot target this information essentially has a higher cost of effective effort. The manager of a supermarket or grocery store in a particular neighborhood may have knowledge of local tastes and successful products

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<sup>18</sup>The simplest way to model this would be to assume that  $k_{ir} = k_{im}$ ,  $e_{ih} = f_{ih}$ ,  $e_{il} = f_{il}$ , and  $v_i(f_i, e_i) = q_i(f_i, e_i) - c = f_i + ze_i - c$ , with  $z > 1$ .

<sup>19</sup>I thank an anonymous referee for this suggestion. Assume for example that  $v_i(f_{il}, e_{ih}) = v_i(f_{ih}, e_{il})$ , but that whether there exists a market for the good produced is uncertain: with probability  $\lambda$ , market demand is as we have described it so far, but with probability  $(1 - \lambda)$ , it equals zero. Then the retailer, who knows when a market exists, only exerts effort a fraction  $\lambda$  of the time, whereas the manufacturer must exert effort at all times to have the same expected benefit. This is equivalent to having  $k_{ir} = \lambda k_{im}$ , which implies that inequality (9) holds.

(e.g. organic food), and may target his effort to provide these products. In contrast, the supermarket chain management would waste much investment on products for which there is no market in that particular location.

Alternatively, a car dealer may be able to distinguish between potential buyers and “tire-kickers,” who enjoy wandering in car dealerships but have no intention of buying. While the dealer uses his information and focuses on true potential buyers, investments made by the car manufacturer, such as advertising and decorum, are partially wasted on the tire-kickers<sup>20</sup>.

We argue that both examples are relevant, and in what follows we assume<sup>21</sup> that  $v_i(f_{il}, e_{ih}) \geq v_i(f_{ih}, e_{il})$ , and  $k_{ir} \leq k_{im}$ .

### 3 Property Rights, *Ex-Post* Surplus, and *Ex-Ante* Investment Decisions

Due to contractual incompleteness, only residual control rights over the retail asset are written in the *ex-ante* contract. The parties - the manufacturer and the retailer - negotiate over the surplus *ex-post*, at date 4, given the allocation of property rights specified *ex-ante*. The allocation of control rights at date 0 affects the allocation of *ex-post* bargaining power amongst different parties. This in turn affects the parties incentives to exert effort at date 1, the overall value created by the firm, and the expected date 4 payoffs. Manufacturers take this process into account when making their decision at date 0.

We analyze each allocation decision in turn<sup>22</sup>. We define  $U_i^{mr}$  as the payoff to manufacturer  $i$  when

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<sup>20</sup>I thank Keith Head for suggesting this example.

<sup>21</sup>These are stronger assumptions than need be for condition (9) to hold. The strength of these assumptions simplifies presentation, but as discussed in section 5.5, the same overall result would obtain with weaker assumptions, as long as they satisfy (9).

<sup>22</sup>In this model we focus on the allocation of control over the retailing asset, and do not consider the possibility of

the retailer owns the project (the first letter,  $m$ , in the superscript refers to the type of agent whose payoff we are considering, and the second letter,  $r$ , refers to the type of agent who has control over the project). Using the same notation we also define  $U_i^{mm}$ ,  $U_i^{rm}$ , and  $U_i^{rr}$ .

### 3.1 The Case of Manufacturer-Control

If ownership of retailing firm  $i$  is given to manufacturer  $i$  at date 0, then the retailer has no control over distribution and thus no bargaining power *ex-post*. He consequently cannot extract any rent and receives nothing at date 4. The investor on the other hand receive the full amount of the payoff.

#### Investment by the Retailer

If manufacturer  $i$  keeps the property rights to himself, retailer  $i$  anticipates that he will have no bargaining power *ex-post* and thus will get no reward:  $U_i^{rm} = 0$ . Since effort is costly, zero effort,

$$e_i = 0, \tag{10}$$

is a strictly dominating strategy.

#### Investment by the Manufacturer

In the case of manufacturer-control, she reaps all the *ex-post* expected benefits. Taking effort levels by other players,  $e_i$ ,  $f_j$ , and  $e_j$ , as given, she chooses the high effort if and only if:

$$U_i^{mm}(f_{ih}, e_i, f_j, e_j, t) - k_{im} \geq U_i^{mm}(f_{il}, e_i, f_j, e_j, t), \tag{11}$$

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the retailer owning the the manufacturer's asset. This possibility is ruled out in our model by our wealth constraint assumption, which is discussed in section 2.2. The manufacturer has no incentive to allocate the control rights over his own asset to the retailer since the retailer, being wealth constrained, would not be able to compensate him (at date 0) for it.

which we can re-write as:

$$\pi_i(v_i(f_{ih}, e_i), v_j, t) - \pi_i(v_i(f_{il}, e_i), v_j, t) \geq k_{im}. \quad (12)$$

### 3.2 The Case of Retailer-Control

If at date 0 the investor allocates the residual control rights to the retailer, both parties have bargaining power when dividing the surplus at date 4. The retailer has power because he can threaten to not distribute the products (in which case no transaction occurs), since he owns the retail outlet. The manufacturer also has power *ex-post*, even though the retailer controls the retail outlet, because she owns an asset which is indispensable to the realization of the value of the project. During bargaining, she could for example threaten to stop supplying the product to the retailer, or to remove her brand from the products. The bargaining process in that case results in both parties receiving half<sup>23</sup> of the payoff. They split the surplus equally *ex-post*, and so they have the same expected benefit,  $\frac{1}{2}\pi_i(v_i(f_i, e_i), v_j(f_j, e_j), \theta)$ .

#### Investment by the Manufacturer

In the case of retailer control, the manufacturer prefers to exert low effort, taking effort levels by other players as given, if and only if:

$$U_i^{mr}(f_{il}, e_i, f_j, e_j, t) > U_i^{mr}(f_{ih}, e_i, f_j, e_j, t) - k_{im}, \quad (13)$$

if and only if:

$$\frac{1}{2} [\pi_i(v_i(f_{ih}, e_i), v_j, t) - \pi_i(v_i(f_{il}, e_i), v_j, t)] < k_{im}. \quad (14)$$

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<sup>23</sup> As noted in Aghion and Tirole (1994), a sequential bargaining process à la Rubinstein (1982) for example, would lead to such a 50:50 split.

### Investment by the Retailer

Taking effort levels by other players as given, the retailer chooses high effort if and only if:

$$U_i^{rr}(f_i, e_{ih}, f_j, e_j, t) - k_{ie} > U_i^{rr}(f_i, e_{il}, f_j, e_j, t), \quad (15)$$

or, more specifically, if and only if:

$$\frac{1}{2} [\pi_i(v_i(f_i, e_{ih}), v_j, t) - \pi_i(v_i(f_i, e_{il}), v_j, t)] > k_{ir}. \quad (16)$$

### 3.3 Strictly Dominating Strategies and Date 1 Subgames

We already know that low effort is a strictly dominating strategy for the retailer when property rights are allocated to the manufacturer. In fact, it is also possible to have strictly dominating strategies for each player given any allocation of control. This is true as long as conditions (12), (14), and (16) hold for all possible actions chosen by other players.

**Lemma 1** *For values of  $t > \underline{t}$  where  $\underline{t} = \max(|v_i - v_j|)$ , given any technology  $v(f, e)$  such that the conditions described in (6) hold, there exists a set of values for variables  $f_h, f_l, k_m, e_h, e_l, k_e$ , such that 1) in the case of manufacturer-control, high effort and low effort are strictly dominating strategies for the manufacturer and the retailer, respectively; and 2) in the case of retailer-control, low effort and high effort are strictly dominating strategies for the manufacturer and the retailer, respectively.*

**Proof.** See appendix. ■

In this paper we focus on values of  $t > \underline{t}$  and on sets of variables  $f_h, f_l, k_m, e_h, e_l, k_e$ , such that lemma 1 holds. When investments in effort are made at date 1, there are four possible subgames, corresponding



to the manufacturers' delegation decision at date 0. There exists a unique Nash equilibrium in each of the subgames, in which each player chooses his/her strictly dominating strategy:

In *Subgame 1*, where both manufacturers delegated ownership rights at date 0, the NE is one in which both manufacturers choose low effort and both retailers choose high effort. Both firms thus create the same value for their product:  $v_1(f_l, e_h) = v_2(f_l, e_h)$ .

In *Subgame 2*, where manufacturer 1 delegated ownership, but manufacturer 2 chose integration at date 0, the NE is one where the vertically separated firm 1 has its retailer exerting high effort and the manufacturer exerting low effort, while the vertically integrated firm 2 has the retailer choosing low effort and the manufacturer choosing high effort. The value created by firm 1 is  $v_1(f_l, e_h)$ , while that created by firm 2 is  $v_2(f_h, e_l)$ .

In *Subgame 3*, where manufacturer 2 delegated ownership, but manufacturer 1 chose integration at date 0, the NE is one where firm 2 has its retailer exerting high effort and the manufacturer exerting low effort, while 1 has the retailer choosing low effort and the manufacturer choosing high effort. The value created by firm 2 is  $v_2(f_l, e_h)$ , while that created by firm 1 is  $v_1(f_h, e_l)$ .

In *Subgame 4*, where neither manufacturer delegated, the NE is one in which both manufacturers choose high effort and both retailers choose low effort. Both firms thus create the same value for their product:  $v_1(f_h, e_l) = v_2(f_h, e_l)$ .

## 4 Property Rights Allocation

Before coming to the crux of our analysis by examining manufacturer  $i$ 's optimal delegation decision, let us describe two important assumptions<sup>24</sup> of our model.

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<sup>24</sup>These assumptions are relaxed in section 5.5.

Let  $v_{iXY}$  denote the value created by firm  $i$ , given that it has structure  $X$  while his rival has structure  $Y$ . A firm's structure can be either delegated (denoted  $D$ ), or integrated (denoted  $I$ ). If, for example, firm 1 has a delegated structure while firm 2 is integrated, then the value created by firm 1 would be  $v_{1DI}$

Given manufacturer  $j$ 's choice  $Y = D, I$ , manufacturer  $i$  prefers to give control rights to the retailer if and only if  $U_i^{mr}(v_{iDY}, v_{jYD}, t) \geq U_i^{mm}(v_{iIY}, v_{jYI}, t) - k_{im}$ , or:

$$\frac{1}{2}\pi_i(v_{iDY}, v_{jYD}, t) \geq \pi_i(v_{iIY}, v_{jYI}, t) - k_{im}, \quad (17)$$

As should be clear from equation (7), profit functions in our model depend on the difference in value created, i.e. on the competitive (dis)advantages. Taking this into account, and rearranging, we can re-write (17) as follows:

$$\frac{1}{2} [\pi_i(v_{iDY} - v_{jYD}, t) - \pi_i(v_{iIY} - v_{jYI}, t)] - \left[ \frac{1}{2}\pi_i(v_{iIY} - v_{jYI}, t) - k_{im} \right] \geq 0. \quad (18)$$

Condition (18) highlights both the benefit and cost from choosing a vertically separated structure over integration. It is optimal to choose separation if and only if the benefit minus the cost is positive.

The first term in condition (18) measures the **benefit from vertical separation**. It represents the extent to which a manufacturer can improve efficiency by granting more *ex-post* bargaining power to the more efficient retailer. The extent of this efficiency advantage on the part of the retailer is such that even though the retailer's increased incentives and efforts are obtained at the expense of lower effort by the manufacturer - whose *ex-post* bargaining power decreases - overall, vertical separation increases the value created by the firm. Second, this increase in value in turn increases profits. Relinquishing

property rights to the retailer allows the manufacturer to take advantage of the former's superior efficiency. It is this increased efficiency which leads to higher profits.

The second factor in condition (18) is the **opportunity cost of vertical separation**. When the manufacturer relinquishes property rights over retailing to the retailer, she gives up *ex-post* bargaining power to the retailer who is able to extract half of the expected *ex-post* surplus, or  $\frac{1}{2}\pi_i(v_{iIY} - v_{jYI}, t) - k_{im}$ .

## 5 The Effects of Product Market Competition

### 5.1 Competition, Market Power, and Business Stealing

What happens to the optimal vertical structure of a firm as the degree of competition in the product market changes? To answer this question we must analyze the effects of a change in the toughness of competition on optimality condition (18). What does "increased competition" mean in our model? What are the direct effects of a fall in transport cost? Essentially two factors can be isolated when the transport cost decreases: competition affects both profit margins and demands.

The first factor affects the competing firms' price-cost margins, a measure of their market power. As the transport cost falls and consumers can travel more easily, they become more sensitive to prices and qualities, thus forcing firms to compete more fiercely and to lower their margins. We call this the **rent-reduction effect**.

The second factor tends to affect demand when competing firms offer different qualities. Consider a scenario where a particular firm, say firm 1, has a quality advantage over its competitor, firm 2. As long as transport cost  $t$  is positive, firm 2 still makes a positive profit, even though it is lower than that of firm 1. As the toughness of competition increases and  $t$  falls, consumers become more sensitive

to the fact that firm 1 has superior quality, and the difference in demands between the two firms rises. Firm 1 is able to steal business from the lower quality firm. This is the **business stealing effect**.

In what follows we analyze how these two factors combine to affect both the benefit and the cost of vertical separation.

## 5.2 Competition and the Benefit from Vertical Separation

### Rival $j$ Plays “Integration”

Given that her rival  $j$  plays “integration,” manufacturer  $i$ ’s benefit from choosing delegation over integration can be obtained from (18), replacing  $Y$  by  $I$ :

$$B_{i/Y=I} = \frac{1}{2} (\pi_{iDI} (v_{iDI} - v_{jID}, t) - \pi_{iII} (v_{iII} - v_{jII}, t)). \quad (19)$$

where  $v_{iII} - v_{jII} = 0$ . How does competition affect  $B_{i/y=I}$ ?

*Competition increases the rise in profits which results from gaining a competitive advantage:*

$$\frac{\partial [\pi_{iDI} - \pi_{iII}]}{\partial t} < 0.$$

Why is this the case? When rival  $j$  chooses integration, picking separation is a way for manufacturer  $i$  to gain a competitive advantage - by creating more value than its rival - and to increase demand to a higher level. Competition, by making consumers more sensitive to quality and price advantages, increases that demand advantage. Thus, the business stealing effect of competition tends increase the difference in profits  $\pi_{iDI} - \pi_{iII}$ .

In contrast, the rent reduction effect of competition has a negative impact on  $\pi_{iDI} - \pi_{iII}$ : an equal reduction in price induces  $\pi_{iDI}$  to fall more than  $\pi_{iII}$  because it is multiplied by a higher demand.

Let  $\pi_{iXY} = (p_{iXY} - c_{iXY}) D_{iXY}$ , where  $X, Y = D, I$ . Then we can present the business stealing and market power effects as follows:

$$\frac{\partial [\pi_{iDI} - \pi_{iII}]}{\partial t} = (p_{iDI} - c_{iDI}) \frac{\partial D_{iDI}}{\partial t} + \frac{\partial (p_i - c_i)}{\partial t} (D_{iDI} - D_{iII}), \quad (20)$$

where  $\frac{\partial (p_i - c_i)}{\partial t} = \frac{\partial (p_{iDI} - c_{iDI})}{\partial t} = \frac{\partial (p_{iII} - c_{iII})}{\partial t}$  in our model. As explained,  $(p_{iDI} - c_{iDI}) \frac{\partial D_{iDI}}{\partial t} < 0$  and  $\frac{\partial p_i}{\partial t} (D_{iDI} - D_{iII}) > 0$ , and so the sign of (20) may appear ambiguous. As we show in the appendix, however, when an increase in quality induces a firm to gain a competitive advantage, as is the case here, the positive business stealing effect of competition is large enough to offset the negative market power effect; which leads to the result stated above in italics.

We summarize these results in the following lemma:

**Lemma 2** *When rival  $j$  is integrated, product market competition increases manufacturer  $i$ 's benefit from a switch to a non-integrated structure. This because it raises the value of the competitive advantage obtained by relying more on the retailer's superior efficiency relative to the manufacturer.*

**Proof.** See appendix. ■

### Rival $j$ Plays "Separation"

Given that her rival  $j$  plays "separation," manufacturer  $i$ 's benefit from choosing delegation over integration can be obtained from (18), replacing  $Y$  by  $D$ :

$$B_{i/Y=D} = \frac{1}{2} (\pi_{iDD} (v_{iDD} - v_{jDD}, t) - \pi_{iID} (v_{iID} - v_{jDI}, t)). \quad (21)$$

where  $v_{iDD} - v_{jDD} = 0$ .

*Competition reduces the rise in profits which results from improved improved quality:*

$$\frac{\partial [\pi_{iDD} - \pi_{iID}]}{\partial t} > 0.$$

As in the case where rival  $j$  plays integration, the impact of competition can be divided into two opposing factors, the business stealing effect and the market power effect, represented in (22) by the first and second factor, respectively:

$$\frac{\partial [\pi_{iDD} - \pi_{iID}]}{\partial t} = -(p_{iID} - c_{iID}) \frac{\partial D_{iID}}{\partial t} + \frac{\partial (p_i - c_i)}{\partial t} (D_{iDD} - D_{iID}). \quad (22)$$

When rival  $j$  chooses a vertically separated structure, for manufacturer  $i$  picking integration means facing a quality disadvantage and lower demand. Increased competition accentuates the demand disadvantage and allows rival  $j$  to steal business from  $i$ . Vertical separation, which allows  $i$  to avoid this cost, becomes relatively more attractive:  $-(p_{iID} - c_{iID}) \frac{\partial D_{iID}}{\partial t} < 0$ . The market power effect is the same as before: an equal reduction in price induces  $\pi_{iDD}$  to fall more than  $\pi_{iID}$  because it is multiplied by a higher demand.

The sign of (22) is positive when rival  $j$  plays separation. Unlike the previous scenario, in this case, the business stealing effect is not large enough to offset the market power effect. We show in the appendix that in this model, the market power effect is the same regardless of the rival manufacturer's choice; moreover,  $\frac{\partial D_{iDI}}{\partial t} = -\frac{\partial D_{iID}}{\partial t}$ . The difference between (20) and (22) comes from price-cost margin differences: the margin obtained when a firm has a quality advantage is larger than the one chosen by a firm with a quality disadvantage, so  $(p_{iDI} - c_{iDI}) > (p_{iID} - c_{iID})$ . This explains why the business stealing effect is larger in the former case than in the latter one.

We summarize these results in the following lemma:

**Lemma 3** *When rival  $j$  chooses a vertically separated structure, product market competition decreases manufacturer  $i$ 's benefit from a switch to a non-integrated structure. Switching to non-integration enables firm  $i$  to eliminate its competitive disadvantage and to achieve competitive parity with its rival. The value of achieving competitive parity decreases with competition.*

**Proof.** See appendix. ■

### 5.3 Competition and the Cost of Vertical Separation

How does product market competition affect the cost of vertical separation? Whether rival  $j$  chooses  $D$  or  $I$ , manufacturer  $i$ 's profits if she chooses integration fall with competition, thus lowering the cost of delegation,  $\frac{1}{2}\pi_{iIY}(v_{iIY} - v_{jYI}, t)$ .

**Lemma 4** *Regardless of rival  $j$ 's action, manufacturer  $i$ 's cost of vertical separation decreases with the degree of competition.*

**Proof.** See appendix. ■

### 5.4 Overall Effect of Competition, and Equilibrium Firm Structure at the Industry Level

We have shown that *when rival  $j$  plays integration*, competition in the product market raises manufacturer  $i$ 's benefit from vertical separation while reducing its cost, thereby increasing its net benefit. Moreover we show in the appendix that this net benefit is negative at low levels of competition but becomes positive at the degree of competition rises above a threshold  $\theta_I$ .

*When rival  $j$  plays non-integration*, competition lowers  $i$ 's cost of delegation but has an ambiguous effect on the benefit. We show however that the net benefit from delegation tends to increase with

competition and that there is a threshold level  $\theta_D$  such that manufacturer  $i$  delegates if and only if the degree of competition  $\theta$  is greater than  $\theta_D$ . These results imply the following proposition:

**Proposition 1** *For a given firm structure  $Y = I, D$  chosen by rival  $j$ , there exists a threshold degree of differentiation  $t_Y$ , and a corresponding level of competition  $\theta_Y$  such that it is optimal for manufacturer  $i$  to choose a vertically separated firm structure if and only if the degree of competition in the product market  $\theta$  is greater than  $\theta_Y$ .*

**Proof.** See appendix. ■

The equilibrium allocation of property rights in the industry follow directly from proposition 1, and, as expected, depends on the level of competition in the product market. The general result is that competition leads to more delegation from manufacturers to retailers, i.e. less integrated firm structures. The following proposition states this idea more formally:

**Proposition 2** *As competition in the product market intensifies, the Nash equilibrium in the industry first switches from one where neither manufacturer choose an integrated structure for her firm, to one of two potential Nash equilibria where one of the manufacturers delegates while the other does not. As competition intensifies even more, a second switch occurs, leading to a new Nash equilibrium where both manufacturers choose a vertically separated structure.*

**Proof.** Follows directly from proposition 1. ■

## 5.5 The Importance of the Wealth Constraint and Superior Retailer Efficiency

What would happen if assumption 3 and/or assumption 4 were relaxed? They are essential in our model, because without them, the analysis of the effects of competition on the boundaries becomes a very simple, less economically interesting exercise.



### **Relaxing the wealth constraint assumption.**

When the retailers are not wealth constrained, the optimal allocation of property rights is one which maximizes total *ex-post* surplus. The manufacturer maximizes total *ex-post* surplus, even if that implies relinquishing *ex-post* bargaining power and a fraction of that surplus - as would be the case if, for example, delegation of control is the choice which maximizes surplus. This is because when the retailer is not wealth constrained, the manufacturer can allocate control to the most efficient economic agent, provide optimal incentives, and extract ex-ante (via a payment at date 0) all of the surplus that will be generated *ex-post*. This is a well-known result from Grossman and Hart (1986). Control would then go to the economic agent whose investment is most efficient in terms of total surplus. In our model, given assumption 4 holds, the retailer is more efficient than the manufacturer, and thus should be given ownership of the project. Accordingly, if retailers were not wealth constrained, vertical separation would always dominate integration, regardless of the degree of competition.

### **Relaxing the retailer efficiency assumption.**

If we relax assumption 3, and assume that the manufacturer is more efficient than the retailer, then the former does not need the latter and should always keep ownership to herself. In that case, integration always dominates vertical separation, regardless of the degree of competition.

What if condition (9) holds, but  $v_i(f_{il}, e_{ih}) < v_i(f_{ih}, e_{il})$ , and  $k_{ir} \leq k_{im}$ ? In this case, relative to the one assumed in the model, benefits and costs of delegation are inverted: the cost of delegation is that it leads to a decrease in value created by the firm, while the potential<sup>25</sup> benefit is associated with a more than proportional decrease in costs. It can be shown<sup>26</sup> that the overall effects of competition are the same as in the more standard case analyzed earlier in the paper.

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<sup>25</sup> Only if  $\frac{1}{2}\pi_i(v_i(f_{ih}, e_{il}) - v_j(f_{jl}, e_{jh})) > k_{im}$ .

<sup>26</sup> Proof available upon request.

Instead of assuming superior retailer efficiency, we could simply ignore the manufacturer's actions. Indeed a special case of our model would be one where the manufacturer actions have no effect on the model, i.e.  $v_i(f_{il}, e_i) = v_i(f_{ih}, e_i)$  and  $k_{im} = 0$ . All the main results of the paper still hold under this simplification. We keep the more general specification in this paper because we feel that the benefits on presentation of using the simpler model do not outweigh the loss of generality that would result from this. The general model where both manufacturer and retailer exert effort has the added benefit of allowing the reader to relate to the recent literature on the theory of the firm (GHM, etc.) which uses a similar specification.

## 6 Summary and Discussion

This paper studies the effects of competition on a firm's forward integration decision. In a duopoly setting where two retailers sell competing products, each retailer is associated with a manufacturer who must decide whether to own the retail outlet, or to operate at arms' length with an independent retailer. While both retailers and manufacturers can exert effort to affect product quality and/or marginal cost, the retailer can create value more efficiently than the manufacturer. When property rights are transferred from manufacturer to retailer, the latter's incentives to exert effort increase at the expense of the former's. Since the retailer has an efficiency advantage, this results in a net creation of value. This is the source of benefits from delegation. Choosing a vertically separated firm structure also has a cost to the manufacturer in that it transfers ex-post bargaining power to the retailer and forces her to forfeit part of the profits. We show that competition, through its *business stealing* and *rent-reduction* effects<sup>27</sup>, tends to improve the efficiency of the retailer's actions relative to

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<sup>27</sup> The *business stealing* and *market power* effects have been discussed by Anderson and de Palma (1992), and Anderson, de Palma and Thisse (1992, p.230) in a Logit framework. And in a recent paper on competition and managerial incentives,

the manufacturer's, thus increasing the benefit from vertical separation. Competition also reduces the cost of delegation by reducing profits, and thus, overall, a higher degree of competition in the industry leads to less integrated firm structures.

Note that even though in this model we have focused on the manufacturer's forward integration decision, the same results would be obtained in an upstream integration framework. It would be simple to replicate these results in a model where the manufacturer must decide whether to integrate upstream or to outsource its inputs. As matter of fact, our model applies to any relationship between an inefficient principal with bargaining power, and her wealth-constrained, efficient agent. As mentioned in the introduction, the model would apply to the relationship between a venture capitalist and an entrepreneur, between a manufacturer and a supplier, or between a R&D firm and a research laboratory for example. Moreover, evidence of a link between competition and the allocation of control rights is not confined to issues of downstream integration. There is evidence in the entrepreneurship literature that venture capitalists take competition into account when allocating control rights between themselves and their entrepreneur (Kaplan and Stromberg (2000)). Finally, our results are not particular to the Hotelling framework of competition used in our model. In a previous version of this paper, the ideas were presented in a logit framework, and similar results were obtained.

An obvious potential application of this model is retail contracting. Most of the recent theoretical literature on retail contracting has focused on the strategic behavior of manufacturers in oligopoly contexts<sup>28</sup>. The argument is that since prices are strategic complements, when firms compete in price they try to commit to raise prices to relieve price competition and increase profits. Delegating

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Raith (2001) mentions these two effects in the context of a Salop (1979) circle. In his classic principal-agent model however, the two effects always exactly offset each other, thus producing a zero net effect; competition in his model plays a role via its effect on the equilibrium number of firms in the industry. In our model, the two effects are presented more explicitly, and their impact on the benefit and cost of vertical separation can be analyzed separately. We show why and when the net effect is positive, or negative.

<sup>28</sup>See for example Bonnano and Vickers (1988), Gal-Or (1991), Rey and Stiglitz (1995), and Shaffer (1991).

pricing to the retailer has the benefit of offering such a credible commitment device. These theories explain Slade's (1998) empirical findings by claiming that incentives for delegating the pricing decision (franchising) diminish with product differentiation when the benefit from relieving price competition falls. This line of research, however, explains the effects competition on price delegation. In contrast, our model focuses on vertical integration as defined by ownership and control delegation.

The retail contracting literature has also relied on the traditional principal/agent model to explain franchising decisions. In the traditional model a risk-averse manager (the agent) exerts an effort which is not observable to the owner (the principal). In this framework, the principal must typically consider the trade-off between incentives and risk. He can provide a compensation scheme in which the agent's pay depends on an imperfect measure of his performance. In this case the manager has an incentive to work hard, but more incentive means more income risk for the agent, leading to a negative impact on his utility, given that he is risk averse. Thus the principal wants to provide his agent with incentives, while being careful not to expose him to too much risk<sup>29</sup>.

One concern about the principal/agent paradigm comes from the fact that it predicts that each contract will be unique, taking into account the particularities of each agent. Slade (1998) argues that "such fine tuning, however, is rarely observed in practice, probably because it is too costly. Instead, most manufacturers employ a limited set of contracts, often just two - an integrated and a separated contract." Our model addresses this issue. Like Slade we claim that, as a result of transaction costs, complete contracts of the type proposed in the traditional literature are prohibitively costly, and make incomplete contracting ubiquitous. In an incomplete contracting framework, the allocation of property rights between economics agents takes on a central role. As a result, in our model the manufacturer

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<sup>29</sup>Interesting work has also been done on double-sided moral hazard, with applications to sharecropping (Reid (1977), Eswaran and Kotwal (1985)), and to franchising (Lal (1990)).

has a choice between two contractual arrangements - integration or vertical separation - just like in practice.

The empirical literature on retail contracting shows ample evidence of a relationship between product market competition and manufacturers' integration decision. As mentioned in the introduction, using data from the international semiconductor industry, Coughlan (1985) shows a negative relationship between the propensity of a firm introducing a new technology in a foreign market to sell it "directly" rather than via an independent middleman, and the degree of substitutability among products. Slade (1998) shows a positive relationship between cross-price elasticities and delegation of the pricing decision in the retail gasoline market. In a more recent study, using automobile franchise contracts, Arruñada, Garicano and Vasquez (2001) provide evidence of a significant relationship between the degree of competition in the market and the manufacturer's control rights relative to the dealer's. Finally, casual observation of the data can provide interesting, if less rigorous, insights. Looking at the sectoral statistics in Lafontaine (1992), for example, one finds that within the restaurant market, the proportion of franchised outlets varies considerably from one sub-category to another: in the hamburger sub-market, franchised outlets represent an impressively high 78.2%, whereas in the arguably much more differentiated sub-market of "full-menu" restaurants, this number falls to 51.5%.

In addition to the link between competition and downstream integration and the issue of contractual incompleteness, the main assumptions of our model seem well documented in the empirical franchising literature. First, Allocating *ex-ante* bargaining power to the manufacturer rather than to the franchisee, is a pervasive assumption in the theoretical literature. Second, our assumption of a wealth constraint on the part of the retailer, crucial in our model because it generates a cost of delegation (without it franchising would always be optimal), is documented in Kaufmann and Lafontaine (1994). In a study of McDonald's franchises, they find evidence of both *ex-ante* and *ex-post* rents left

to McDonald's franchisees, and argue that wealth constraints prevent McDonald's from extracting all *ex-ante* rents. This is the same result as in our model. Third, the retailer market expertise in our model plays an important role, because it is his superior knowledge and consequent efficiency which generates the benefit from delegation. Kalnins and Lafontaine (1999) show that the retailer's market expertise plays a significant role in a manufacturer franchising decision: they present evidence that franchisors tend to allocate new franchises to owners who already manage units in markets where on-the-ground knowledge is important. Finally, investment by the franchisor appears to be negatively correlated with the propensity to franchise: Lafontaine (1992), for example, finds a negative relationship between the amount of training offered by franchisor and the propensity to contract out.

Aside from the link between competition and forward integration, two other predictions of our analysis are supported by empirical evidence on franchising. Lafontaine and Slade (1997) show for example that outlet size is positively correlated with company ownership. If outlet size measures profits, this finding is in line with our prediction that delegation of control should be a decreasing function of profits. Also, our model offers an explanation of the stylized fact that franchisors mix company owned and franchised outlets<sup>30</sup>, where the degree of competition in each sub-market determines the franchisor's optimal mix. A McDonald's restaurant in a differentiated sub-market with few other fast-food restaurants around is more likely to be company owned than one which faces fierce competition from Wendy's and Burger King across the street.

Finally, despite the encouraging evidence discussed above, the specificities of this model have not yet been tested, and more empirical work needs to be done on the subject. For example, is more investment on the part of the retailer associated with less investment on the part of the manufacturer? Moreover does an increase in the degree of competition generate a change in this trade-off? How does

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<sup>30</sup>See Brickley and Dark (1987), Lafontaine and Slade (1997), and Norton (1988).

this model compare to the traditional principal/agent framework, or the strategic motives models, in explaining in the effects of competition on issues of vertical integration? These questions are left for future research.

# A Appendix

## A.1 Proof of Lemma 1

### Strategies for the manufacturer

Let  $\Delta v_1 = v_i(f_{ih}, e_i) - v_j$ , be the difference in value created by firms  $i$  and  $j$  when manufacturer  $i$  chooses high effort, given  $e_i, e_j, f_j$ . Similarly, let  $\Delta v_2 = v_i(f_{il}, e_i) - v_j$ . From (6), we know that  $\Delta v_1 > \Delta v_2$ .

Let  $\Pi_{12} = \pi_i(v_i(f_{ih}, e_i), v_j, t) - \pi_i(v_i(f_{il}, e_i), v_j, t)$ . Using (7), we can write:

$$\Pi_{12} = \frac{\Delta v_1 - \Delta v_2}{3} + \frac{\Delta v_1^2 - \Delta v_2^2}{18t} = \frac{\Delta v_1 - \Delta v_2}{3} \left[ 1 + \frac{\Delta v_1 + \Delta v_2}{6t} \right] \quad (23)$$

We will show that for all  $t > \underline{t}$  where  $\underline{t} = \max(|v_i - v_j|)$ ,  $\min \Pi_{12} > \frac{1}{2} \max \Pi_{12}$ . This in turn implies that there exists a value of  $k_{im}$  such that  $\min \Pi_{12} > k_{im} > \frac{1}{2} \max \Pi_{12}$ , and such that inequalities (12) and (14) hold.

Given the symmetry between firms  $i$  and  $j$ , we must have either  $\Delta v_1 > 0$  and  $\Delta v_2 \geq 0$ , or  $\Delta v_1 \leq 0$  and  $\Delta v_2 < 0$ .

Let  $\Delta v_1(+)> 0$  and  $\Delta v_2(+)\geq 0$ .

Obviously in that case  $\Pi_{12}$  strictly decreases with  $t$ , and  $\Pi_{12}$  is maximized when  $t \rightarrow \underline{t}$ . When  $t$  tends to infinity and  $\Pi_{12}$  tends to  $\frac{\Delta v_1 - \Delta v_2}{3}$ .

Let  $\Delta v_1(-)\leq 0$  and  $\Delta v_2(-)< 0$ . In that case,  $\Delta v_1(-) + \Delta v_2(-)\leq 0$ ,  $\Pi_{12}$  strictly increases with  $t$ , and tends towards  $\frac{\Delta v_1 - \Delta v_2}{3}$  when  $t$  tends to infinity.

Thus, we can write that  $\max \Pi_{12} < \frac{\Delta v_1(+)-\Delta v_2(+)}{3} \frac{4}{3}$ , since  $t > \max(|v_i - v_j|)$  and  $\Delta v_1(+), \Delta v_2(+)\leq \max(|v_i - v_j|)$ . Similarly we can write  $\min \Pi_{12} > \frac{\Delta v_1(-)-\Delta v_2(-)}{3} \frac{2}{3}$ .



Since for any given  $e_i$ ,  $\Delta v_1(+)-\Delta v_2(+)=\Delta v_1(-)-\Delta v_2(-)=v_i(f_{ih},e_i)-v_i(f_{il},e_i)$ , for all  $t > \underline{t}$  there exists a value of  $k_{im}$  such that  $\min \Pi_{12} > k_{im} > \frac{1}{2} \max \Pi_{12}$ , and such that inequalities (12) and (14) hold.

### Strategies for the retailer

Let  $\Delta v_3 = v_i(f_i, e_{ih}) - v_j$ , be the difference in value created by firms  $i$  and  $j$  when manufacturer  $i$  chooses high effort, given  $e_i, e_j, f_j$ . Similarly, let  $\Delta v_4 = v_i(f_i, e_{il}) - v_j$ . From (6), we know that  $\Delta v_3 > \Delta v_4$ .

Let  $\Pi_{34} = \pi_i(v_i(f_i, e_{ih}), v_j, t) - \pi_i(v_i(f_i, e_{il}), v_j, t)$ . Using (7), we can write:

$$\Pi_{12} = \frac{\Delta v_3 - \Delta v_4}{3} + \frac{\Delta v_3^2 - \Delta v_4^2}{18t} = \frac{\Delta v_3 - \Delta v_4}{3} \left[ 1 + \frac{\Delta v_3 + \Delta v_4}{6t} \right] \quad (24)$$

Since  $t > \max(|v_i - v_j|)$ , we can write  $\min \Pi_{34} > \frac{\Delta v_3(-) - \Delta v_4(-)}{3} \frac{2}{3}$ , or  $\min \Pi_{34} > \frac{v_i(f_i, e_{ih}) - v_i(f_i, e_{il})}{3} \frac{2}{3} > 0$ . Therefore there exists a value of  $k_{ir}$  such that  $\min \Pi_{34} > k_{ir}$ , and such that inequality (16) holds. Thus, for all  $t > \underline{t}$  where  $\underline{t} = \max(|v_i - v_j|)$ , given any technology  $v(f, e)$  such that the conditions described in (6) hold, there exists a set of values for variables  $f_h, f_l, k_m, e_h, e_l, k_e$ , such that inequalities (12), (14) and (16) hold. ■

## A.2 Proof of Lemma 2

**Proof that  $\frac{\partial[\pi_{iDI} - \pi_{iII}]}{\partial t} < 0$ :**

We know from (20) that:

$$\frac{\partial[\pi_{iDI} - \pi_{iII}]}{\partial t} = p_{iDI} \frac{\partial D_{iDI}}{\partial t} + \frac{\partial p_i}{\partial t} (D_{iDI} - D_{iII}).$$

Using (5) we can re-write this as:

$$\frac{\partial [\pi_{iDI} - \pi_{iII}]}{\partial t} = \left( t + \frac{(v_{iDI} - v_{iID})}{3} \right) \left( -\frac{(v_{iDI} - v_{iID})}{6t^2} \right) + 1 \left( \left( \frac{1}{2} + \frac{(v_{iDI} - v_{iID})}{6t} \right) - \frac{1}{2} \right), \quad (25)$$

where the first term represents the business stealing effect, while the second measures the rent-reduction effect. It should be clear from (25) that the business stealing effect dominates, and after simplification we obtain:

$$\frac{\partial [\pi_{iDI} - \pi_{iII}]}{\partial t} = -\frac{(v_{iDI} - v_{iID})}{18t^2} < 0. \quad (26)$$

■

### A.3 Proof of Lemma 3

**Proof that  $\frac{\partial [\pi_{iDD} - \pi_{iID}]}{\partial t} > 0$ :**

We know from (22) that:

$$\frac{\partial [\pi_{iDD} - \pi_{iID}]}{\partial t} = -p_{iID} \frac{\partial D_{iID}}{\partial t} + \frac{\partial p_i}{\partial t} (D_{iDD} - D_{iID}).$$

Using (5) we can re-write this as:

$$\frac{\partial [\pi_{iDI} - \pi_{iII}]}{\partial t} = - \left( t - \frac{(v_{iDI} - v_{iID})}{3} \right) \left( \frac{(v_{iDI} - v_{iID})}{6t^2} \right) + 1 \left( \frac{1}{2} - \left( \frac{1}{2} - \frac{(v_{iDI} - v_{iID})}{6t} \right) \right), \quad (27)$$

where the first term represents the business stealing effect, while the second measures the rent-reduction effect. It should be clear from (22) that in this case the business stealing effect is dominated

because  $p_{iD}$  is not large enough. After simplification we obtain:

$$\frac{\partial [\pi_{iDI} - \pi_{iII}]}{\partial t} = \frac{(q_{iDI} - q_{iID})}{18t^2} > 0. \quad (28)$$

■

#### A.4 Proof of Lemma 4

If rival  $j$  chooses integration, i.e.  $y = I$ , equilibrium qualities are equal,  $v_{iIy} = v_{jyI}$ , and  $\pi_{iII} = \frac{t}{2}$ . Obviously the profit function increases with the degree of product differentiation and thus decreases with competition.

If rival  $j$  chooses non-integration, i.e.  $y = D$ , and the cost of delegation is:

$$\frac{1}{2}\pi_i(v_{iID}, v_{jDI}, t) = \frac{1}{2} \left[ \frac{v_{iID} - v_{jDI}}{3} + t \right] \left[ \frac{1}{2} + \frac{v_{iID} - v_{jDI}}{6t} \right] \quad (29)$$

Since by assumption,  $v_{iID} - v_{jDI} < 0$ , we must have the cost  $\frac{1}{2}\pi_i(v_{iID}, v_{jDI}, t)$  increasing in  $t$ , i.e. decreasing with competition. ■

#### A.5 Proof of Proposition 1

**If rival  $j$  plays integration**,  $i$ 's benefit increases and her cost decreases with competition; therefore her net benefit from choosing vertical separation strictly increases with competition.

The net benefit is negative when  $t$  tends to infinity: the cost is unbounded, whereas the benefit hits a lower bound. Using (5) and rearranging, we can express the benefit as:

$$B_{i/y=I} = \frac{1}{2} \left( \frac{v_{iDI} - v_{jID}}{3} + \frac{(v_{iDI} - v_{jID})^2}{18t} \right), \quad (30)$$

which tends to  $\frac{v_{iDI} - v_{iID}}{6}$ . So net benefit must be negative when  $t$  is large.

The net benefit is positive when the degree of competition is high ( $t \rightarrow \frac{v(f_l, e_h) - v(f_h, e_l)}{3}$ ): the benefit tends to  $\frac{v(f_l, e_h) - v(f_h, e_l)}{4}$  while the cost tends to  $\frac{v(f_l, e_h) - v(f_h, e_l)}{12} - k_{im}$ . The net benefit when  $t \rightarrow \frac{v(f_l, e_h) - v(f_h, e_l)}{3}$  is thus  $\frac{v(f_l, e_h) - v(f_h, e_l)}{6} + k_{im}$ . If rival  $j$  plays integration, there must exist a threshold level of product differentiation  $t_I$  and an associated degree of competition  $\theta_I = \frac{1}{t_I}$  such that it is optimal for player  $i$  to choose separation if and only if  $t \leq t_I$ .

**If rival  $j$  plays non-integration**, competition has an ambiguous effect on  $i$ 's benefit from vertical separation, but we now show that overall, the net benefit from choosing vertical separation still strictly increases with competition over most values of  $t$  such that  $t > \frac{v(f_l, e_h) - v(f_h, e_l)}{3}$ , and that there exists a threshold level of competition  $\theta_D = \frac{1}{t_D}$  such that  $NB_{i/y=D}$  is positive for all  $\theta \geq \theta_D$ , and negative otherwise.. Using (18), we can write the net benefit from delegation of property rights as follows:

$$NB_{i/y=D} = \frac{1}{2}\pi_{iDD} - \pi_{iID}(v_{iID} - v_{jDI}, t) \quad (31)$$

Using (5) to re-write  $\pi_{iID}$  and substituting  $\pi_{iDD}(\theta) = \frac{t}{2}$ , we can express (31) as:

$$NB_{i/y=D} = -\frac{t}{4} + \frac{v_{iID} - v_{jDI}}{3} - \frac{(v_{iID} - v_{jDI})^2}{18t}. \quad (32)$$

Differentiating with respect to  $t$  gives:

$$\frac{d(NB_{i/y=D})}{dt} = -\frac{1}{4} + \frac{(v_{iID} - v_{jDI})^2}{18t^2} < 0 \text{ iff} \quad (33)$$

$$t > \frac{\sqrt{2}}{3}(v_{iID} - v_{jDI}). \quad (34)$$

So  $NB_{i/y=D}$  strictly increases with competition  $\theta = \frac{1}{t}$  when  $t > \frac{\sqrt{2}}{3}(v_{iID} - v_{jDI})$ , but decreases with competition when competition is very high and near its upper bound, i.e. when  $\frac{1}{3}(v_{iID} - v_{jDI}) < t \leq \frac{\sqrt{2}}{3}(v_{iID} - v_{jDI})$ .

However, it is easily shown that  $NB_{i/y=D}$  is strictly positive when  $t = \frac{\sqrt{2}}{3}(v_{iID} - v_{jDI})$  and when  $t \rightarrow \frac{v(f_i, e_h) - v(f_h, e_i)}{3}$ . This implies that there exists a threshold degree of differentiation  $t_D$ , and an associated level of competition  $\theta_D = \frac{1}{t_D}$  such that  $NB_{i/y=D}$  is positive for all  $\theta \geq \theta_D$ , and negative otherwise. ■

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