

# Mergers and Partial Ownership

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# Mergers and Partial Ownership

## Abstract

In this paper we compare the profitability of a merger to the profitability of a partial ownership arrangement and find that partial ownership arrangements can be more profitable for the acquiring and acquired firm because they can result in a greater dampening of competition. We also derive comparative statics on the prices of the acquiring firm, the acquired firm, and the outside firms. In a dual context, we show that a cross-majority owner may have incentives to sell a fraction of the shares in one of the firms he controls to a silent investor who is outside the industry. Aggregate ex post operating profit in the two firms controlled by the cross-majority shareholder then increases, such that both the cross-majority shareholder and the silent investor will be better off with than without the partial divestiture.

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# 1 Introduction

There is a vast literature on the competitive effects of mergers. In this literature, the acquiring firm is assumed to have control over both the pricing and output decisions of the acquired firm (corporate control). There is also a large literature that looks at the competitive effects of partial ownership arrangements while assuming that the acquiring firm does *not* obtain corporate control.<sup>1</sup> However, as emphasized by O'Brien and Salop (2000) in their seminal work, an acquiring firm may achieve corporate control without having obtained 100% financial control. They then proceed to link the two strands of literature by analyzing the competitive effects of partial ownership arrangements in which the acquiring firm assumes corporate control.

A main result in their model is that when an acquiring firm has control over its rival's pricing decision, but less than 100% ownership stake, the welfare effects can be worse than a complete merger. In the extreme, the acquiring firm might find it optimal not to sell the acquired firm's product so as to maximize the profit on its own product.<sup>2</sup> The intuition for O'Brien and Salop's result is that an acquiring firm with only a small financial interest in the acquired firm achieves the benefits from reduced competition when the latter charges high prices but pays only a fraction of the costs of the reduced profit in the acquired firm. There is thus a free-rider problem since the acquired firm makes a lower profit than it would otherwise make.<sup>3</sup>

Missing from their analysis, however, is a discussion of why the firms might agree to such an arrangement in the first place, and thus whether such arrangements might arise in equilibrium. In this paper, we follow O'Brien and Salop's lead by looking

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<sup>1</sup>Reynolds and Snapp (1986) and Bresnahan and Salop (1986) were the first two articles in this area. They analyze the competitive effects of partial-equity interests in competing firms under the assumption of Cournot competition in the product market. They show that the effects of a partial ownership in a rival depend critically on whether corporate control is transferred to the acquiring firm or not. See also Flath (1989; 1991), Malueg (1992), Reitman (1994), and Gilo et al (2006).

<sup>2</sup>This is formally shown by Nye (1992) in a model with Cournot competition.

<sup>3</sup>This principle of using the financial and corporate structure of a firm as a commitment device in order to affect rival firms' product-market behavior is quite general, and the model structure relates to the seminal paper on strategic delegation by Fershtman and Judd (1987). Brander and Lewis (1986) analyze how a firm may choose the financial structure (the degree of debt) as a credible commitment to engage in aggressive product market behavior in the context of Cournot competition. Showalter (1995) analyzes the choice of debt as a commitment device to nonaggressive behavior under entry accommodation and price competition (see Tirole (2006) for an overview).

at partial ownership arrangements in which the acquiring firm obtains corporate control in the acquired firm—but we differ in that we endogenize the ownership stake that maximizes the joint profits of the two firms. If these are the only firms in the market, then joint profits are clearly maximized when they merge. However, as we show, when there are more than two firms in the market, the pricing effects that result from a partial ownership arrangement can dampen competition and be sufficiently strong that the arrangement actually yields a higher joint profit for the two firms. Moreover, we show that the other owners of the acquired firm (silent investors) benefit from the transaction, as do also the other firms in the market.

To put this in a dual context, we show that a cross-majority owner may have incentives to sell a fraction of the shares in one of the firms he controls to a silent investor who is outside the industry. We show that this may be profitable under price competition, and that there need not be a free-riding problem. Since the joint profit of the firms that are controlled by the cross-majority shareholder increases, the cross-majority shareholder and the silent investor will be better off with than without the partial divestiture. The other firms in the market will respond by increasing their prices and will also benefit. A partial divestiture will thus be detrimental to those consumers that buy either from the firm where the partial divestiture is undertaken or from the rival firms. Consumers that buy from the firm in which the cross-majority shareholder still holds all the financial interests are, however, better off.

The rest of the paper proceeds as follows. In the next section, we specify a general set-up and derive preliminary results. We then provide an example in section 3 using a Salop circle model of demand to show that partial ownership arrangements can be optimal – and indeed are always optimal – in the example. In section 4, we apply the model to observations in the pay-TV market in Scandinavia. Section 5 concludes.

## **2 The model and preliminary results**

There are three firms in the market. We focus on a setting in which a firm acquires an ownership stake in one of its rivals and obtains control over the rival's pricing decision. Without loss of generality, let firm 1 be the acquiring firm, firm 2 be the

firm whose pricing decision is now controlled by firm 1, and firm 3 be the outside firm, whose response to the acquisition of firm 2 by firm 1 will be key to the analysis. The consumers perceive the goods produced by the three firms as differentiated.

To focus on market power effects only, we assume there are no realized cost savings as a result of the acquisition. We also assume that firms compete by simultaneously choosing prices. Let  $\Pi_i(p)$  denote firm  $i$ 's profit as a function of the vector of prices, where  $p = (p_1, p_2, p_3)$ , and let  $\beta \leq 1$  denote the ownership stake in firm 2 that is acquired by firm 1. Then, given our assumption on corporate control, it follows that in the ensuing pricing game, firm 1 will choose  $p_1$  and  $p_2$  to maximize

$$\max_{p_1, p_2} \Pi_1(p) + \beta \Pi_2(p), \quad (1)$$

and firm 3 will choose  $p_3$  to maximize

$$\max_{p_3} \Pi_3(p).$$

We assume that profits are continuous and differentiable, and that all second-order conditions are satisfied. We further make the standard assumption that own-pricing effects dominate cross-pricing effects, and that pricing decisions are strategic complements (a la Bulow et al, 1985), i.e., that reaction functions are upward sloping.<sup>4</sup>

With these assumptions, we obtain the following comparative-static result.

**Proposition 1** *Suppose products 1 and 2 are symmetrically differentiated and have identical costs of production. Fix firm 3's price at  $p_3$ . Then, for  $\beta$  sufficiently close to one, firm 1's profit-maximizing choice of  $p_1$  ( $p_2$ ) is increasing (decreasing) in  $\beta$ .*

**Proof:** See the appendix.

General comparative static results are difficult to obtain when products are differentiated. Nevertheless, with enough symmetry and for  $\beta$  sufficiently close to one, Proposition 1 offers some insight into how firm 1's profit-maximizing prices may vary as a function of  $\beta$ . As firm 1's ownership share of firm 2 increases, relatively more

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<sup>4</sup>More formally, let  $\Omega_{12}(p, \beta) \equiv \Pi_1(p) + \beta \Pi_2(p)$ . Then, for all  $\beta \leq 1$  and  $i, j = 1, 2, i \neq j$ , we assume  $\partial^2 \Omega_{12} / \partial p_1^2 < 0$ ,  $\partial^2 \Omega_{12} / \partial p_i \partial p_j > 0$ ,  $\partial^2 \Omega_{12} / \partial p_2^2 < 0$ ,  $\partial^2 \Pi_3 / \partial p_3^2 < 0$ , and  $\partial^2 \Pi_3 / \partial p_3 \partial p_i > 0$ .

weight is put on  $\Pi_2$  in the maximand of (1). Since  $\Pi_2$  is increasing in  $p_1$ , it follows that all else being equal (i.e., holding  $p_2$  and  $p_3$  constant)  $p_1$  will be *increasing* in  $\beta$ . Similarly, as firm 1's ownership share of firm 2 increases, relatively less weight is placed on  $\Pi_1$  in the maximand of (1). Since  $\Pi_1$  is increasing in  $p_2$ , it follows that all else being equal (i.e., holding  $p_1$  and  $p_3$  constant),  $p_2$  will be *decreasing* in  $\beta$ .

The condition in Proposition 1 that  $\beta$  be sufficiently close to one ensures that when  $p_2$  is allowed to vary, the above effect of  $\beta$  on  $p_1$  continues to hold, and similarly that when  $p_1$  is allowed to vary, the above effect of  $\beta$  on  $p_2$  continues to hold.

The net implication of these findings is that by acquiring less than 100% of firm 2, firm 1 can credibly commit to setting a higher  $p_2$  and a lower  $p_1$  than the prices that would maximize firm 1 and 2's joint profit for any given  $p_3$ . Whether this will induce more or less aggressive behavior from firm 3 is the main question we address.

## 2.1 The trade-off of partial ownership

A trade-off arises if the commitment would induce less aggressive behavior on the part of firm 3. In this case, purchasing less than 100% of firm 2 will yield a favorable response by firm 3, but will come at the expense of not fully internalizing the pricing externalities between products 1 and 2. To capture the essence of this trade-off, we now allow  $p_3$  to vary and let  $p_1^*(\beta)$ ,  $p_2^*(\beta)$ , and  $p_3^*(\beta)$  denote the Bertrand-Nash equilibrium prices as a function of  $\beta$ . We want to know whether the joint-profit maximization of firm 1 and 2's profit always occurs at  $\beta = 1$ , as is implicitly assumed in the merger literature, or whether it can occur at some  $\beta < 1$ . Thus, consider

$$\max_{\beta} \Pi_1(p_1^*(\beta), p_2^*(\beta), p_3^*(\beta)) + \Pi_2(p_1^*(\beta), p_2^*(\beta), p_3^*(\beta)),$$

which yields the following first-order condition

$$\left( \frac{\partial \Pi_1}{\partial p_1} + \frac{\partial \Pi_2}{\partial p_1} \right) \frac{dp_1^*}{d\beta} + \left( \frac{\partial \Pi_1}{\partial p_2} + \frac{\partial \Pi_2}{\partial p_2} \right) \frac{dp_2^*}{d\beta} + \left( \frac{\partial \Pi_1}{\partial p_3} + \frac{\partial \Pi_2}{\partial p_3} \right) \frac{dp_3^*}{d\beta}. \quad (2)$$

Substituting the first-order conditions from the pricing game, (2) reduces to

$$(1 - \beta) \left( \frac{\partial \Pi_2}{\partial p_1} \frac{dp_1^*}{d\beta} + \frac{\partial \Pi_2}{\partial p_2} \frac{dp_2^*}{d\beta} \right) + \left( \frac{\partial \Pi_1}{\partial p_3} + \frac{\partial \Pi_2}{\partial p_3} \right) \frac{dp_3^*}{d\beta}. \quad (3)$$

Suppose for the moment that firm 3's price is independent of  $\beta$ , so that  $\frac{dp_3^*}{d\beta} = 0$  for all  $\beta \leq 1$ . Then, it follows immediately from (3) in this case that  $\beta = 1$  is a local maximum. And, indeed, it is a global maximum as firm 1 obviously cannot do any better than to acquire all of firm 2 in this case. Notice, however, that if at  $\beta = 1$ ,  $\frac{dp_3^*}{d\beta} < 1$ , then it cannot be profit maximizing for firm 1 to acquire all of firm 2. This follows because then the first-order condition as given in (3) would be negative.

More generally, even if  $\frac{dp_3^*}{d\beta} = 0$  at  $\beta = 1$ , so that  $\beta = 1$  is a local maximum, it need not follow that  $\beta = 1$  is a global maximum. In the case of the Hotelling demand that we consider in the next section, for example,  $\frac{dp_3^*}{d\beta} = 0$  at  $\beta = 1$ , and yet, as we will show, the global maximum always occurs at  $\beta < 1$ . In this case, it turns out that firm 3's price is decreasing in  $\beta$  when evaluated at  $\beta < 1$ , implying that firm 1 faces an unfortunate trade-off. When  $\beta < 1$ , an increase in  $\beta$  reduces the distortion between  $p_1$  and  $p_2$  (the joint profit of firms 1 and 2 will be higher for any given  $p_3$ ) but increases competition with firm 3. In contrast, a decrease in  $\beta$  dampens competition with firm 3, but increases the distortion between  $p_1$  and  $p_2$ .

**Proposition 2** *A sufficient condition for partial ownership of firm 2 to be more profitable for firm 1 than a complete merger is  $\frac{dp_3^*}{d\beta}|_{\beta=1} < 0$ . A necessary condition for partial ownership to be more profitable for firm 1 is  $\frac{dp_3^*}{d\beta} < 0$  for some  $\beta \leq 1$ .*

Proposition 2 implies that knowing whether an increase in  $\beta$  increases or decreases firm 3's equilibrium price is key in determining whether partial ownership of firm 2 can be more profitable for firm 1 than a complete merger. Unfortunately, since we would normally expect firm 1's price to be increasing in  $\beta$  and firm 2's price to be decreasing in  $\beta$ , and since all prices are assumed to be strategic complements, the net effect on firm 3's price of an increase in  $\beta$  cannot be determined in general.

We will now show in what follows, using a fully-specified model of demand in which consumers are located around a unit circle and buy at most one product, that the effect of the increase in firm 2's price always outweighs the effect of the decrease in firm 1's price, such that firm 1 always wants to acquire less than 100% of firm 2.

### 3 Salop circle model of demand

We consider a circular city model a-la Salop (1979) with a uniform distribution of consumers, a perimeter equal to 1, and a unitary density of consumers around the circle.<sup>5</sup> The three firms are located equidistantly from each other, and for simplicity all marginal and fixed costs are set to zero. Throughout we restrict our analysis to outcomes with full market coverage (all consumers buy from one of the firms) and in which all three firms are active in the market. We assume quadratic transportation costs such that the location of a consumer who is indifferent between buying from firm  $i$  and  $j$  is given by  $tx^2 + p_i = t\left(\frac{1}{3} - x\right)^2 - p_j$ . This yields the following demands:

$$q_i(p) = \frac{1}{3} - 3 \frac{2p_i - (p_j + p_k)}{2t}, \quad (4)$$

where  $i, j, k = 1, 2, 3$ ,  $i \neq j \neq k$ , and  $p = (p_1, p_2, p_3)$  is the vector of prices.

At stage 1 of the game, firm 1 must decide how much of firm 2 to acquire (alternatively, with a straightforward change in notation, one can think of firm 1 as owning all the shares in firm 2 and deciding whether to undertake partial divestiture by selling some of the shares to a third party). We assume for now that with any acquisition, firm 1 will obtain corporate control over firm 2, meaning that it will control not only its own pricing decision but also the pricing decision for product 2.

At stage 2, firms 1 and 3 compete in prices to maximize their *ex post* profit

$$\max_{p_1, p_2} \underbrace{p_1 q_1(p)}_{\pi_1} + \beta \underbrace{p_2 q_2(p)}_{\pi_2}, \quad (5)$$

$$\max_{p_3} p_3 q_3(p). \quad (6)$$

Solving the first-order conditions from (5) and (6) yield the stage 2 reaction functions

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<sup>5</sup>The Hotelling and Salop frameworks have become the standard tools for analyzing media economics, see e.g. Anderson and Coate (2005), Gabszewicz et al (2004) and Peitz and Valletti (2008). One reason for this is that unitary demand seems reasonable in the media industry (people watch either zero or one TV channel at any given time, or choose either cable or satellite, etc).



$$\begin{aligned}
p_1 &= \frac{t}{18} + (1 + \beta) \frac{p_2}{4} + \frac{p_3}{4}, \\
p_2 &= \frac{t}{18} + \left( \frac{1 + \beta}{\beta} \right) \frac{p_1}{4} + \frac{p_3}{4}, \\
p_3 &= \frac{t}{18} + \frac{p_1 + p_2}{4},
\end{aligned}$$

from which it follows that  $\partial p_1 / \partial \beta = p_2 / 4 > 0$  and  $\partial p_2 / \partial \beta = -p_1 / (4\beta^2) < 0$ . The price charged by firm 3 depends on  $\beta$  indirectly, through the rivals' prices  $p_1$  and  $p_2$ .

Solving the three reaction functions simultaneously yields equilibrium prices

$$p_1^* = \frac{10\beta(5 + \beta)t}{9D}, \quad p_2^* = \frac{10(1 + 5\beta)t}{9D}, \quad \text{and} \quad p_3^* = \frac{16\beta t}{3D}, \quad (7)$$

where  $D = 36\beta - 5(1 - \beta)^2$  is strictly positive in the relevant area (see below).

If firm 1 acquires all of firm 2, then firm 1 will fully internalize the fact that a higher price on good 1 increases demand for good 2, and vice versa. In this case, it follows from (7) that  $p_1^* = p_2^* = 5t/27 > p_3^* = 4t/27$ . However, if firm 1 divests itself of some shares in firm 2, or does not purchase all of firm 2's shares in the first place, it will have incentives to increase the price of good 2 above  $5t/27$  in order to sell more of good 1. By acquiring less than 100% of firm 2, firm 1 thus gives a credible signal to firm 3 that it will charge a higher price on good 2. This tends to increase firm 3's price, such that we find that both  $dp_2^*/d\beta < 0$  and  $dp_3^*/d\beta < 0$ .

However, the same need not be true for  $p_1^*$ . The reason is that firm 1 will be more inclined to set a higher price on good 1 to boost demand for good 2 the larger is its financial interests in firm 2. This effect explains why  $dp_1/d\beta > 0$  if  $\beta > 0.66$ .<sup>6</sup>

Substituting the prices in (7) into (4) yields  $q_2(p) = 5(3\beta - 1)/D$ . If firm 1's financial interest in firm 2 is sufficiently small, firm 1 will set  $p_2$  such that firm 2 will face no demand. Hence, to ensure that  $q_2(p) \geq 0$  (and also that  $D > 0$ ), we assume

$$\beta \geq \bar{\beta} = \frac{1}{3}.$$

At stage 1 firm 1 chooses how much of firm 2 to acquire in order to maximize the joint profit on products 1 and 2 given the equilibrium stage 2 prices in (7)

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<sup>6</sup>For  $\beta < .66$ , the decrease in firm 3's price that occurs for an increase in  $\beta$  is sufficiently strong to induce firm 1's price on good 1 also to decrease in  $\beta$ , implying that in this case,  $dp_1/d\beta < 0$ .

$$\pi_1 + \pi_2 = \frac{25t}{81} \left( 1 + (1 - \beta)^2 \frac{(36\beta - 79(1 - \beta)^2)}{D^2} \right). \quad (8)$$

It follows immediately that partial ownership of firm 2 is more profitable for firms 1 and 2 than full ownership as long as  $36\beta > 79(1 - \beta)^2$ , i.e. as long as  $\beta > \tilde{\beta} \approx 0.52$ . Solving for the acquisition share that maximizes the two firms' joint profit yields

$$\beta^* = 1 - \frac{6\sqrt{2} - 2}{17} \approx 0.619. \quad (9)$$

**Proposition 3** *Partial ownership by firm 1 is more profitable for firms 1 and 2 than a complete merger for all  $\beta \in [\tilde{\beta}, 1)$ . Their joint profits are maximized at  $\beta = \beta^*$ .*

The key to this result is the effect an increase in ownership has on the price of firm 3's product. Since  $dp_3^*/d\beta < 0$ , it follows that relative to the case of a merger between firms 1 and 2, firm 3's price will be higher when firm 1 does not own all of firm 2 but nevertheless has corporate control. A higher price on firm 3's product benefits firms 1 and 2, and this benefit is enough to more than offset the gain firms 1 and 2 could have achieved by merging and thereby fully coordinating their prices.

Substituting the joint-profit maximizing ownership share,  $\beta = \beta^*$ , into the equilibrium prices in (7) yields the following comparative-static result on firm prices:

**Proposition 4** *At the optimal ownership share  $\beta = \beta^*$ , firm 1 sets a lower price on product 1 and a higher price on product 2, and firm 3 sets a higher price on product 3, relative to the prices that would have occurred had firms 1 and 2 fully merged.*

Since prices are observable, the result in Proposition 4 gives rise to a testable prediction: starting from a situation in which firm 1 initially owns all of firm 2, suppose firm 1 optimally divests some of its shares of firm 2. Then, we would expect the prices of products 2 and 3 to increase and the price of product 1 to decrease.

For completeness, we now consider the effect of partial ownership on the firms' operating profits. Substituting  $p_1^*$ ,  $p_2^*$ , and  $p_3^*$  into each firm's profit yields

$$\pi_2 = \frac{50t(1 + 5\beta)(3\beta - 1)}{9D^2}, \quad (10)$$

$$\pi_1 = \frac{50t(3 - \beta)(5 + \beta)\beta^2}{9D^2}, \quad \text{and} \quad \pi_3 = \frac{256t\beta^2}{3D^2}.$$

It is straightforward to show from (10) that the profits earned on products 1 and 3 are decreasing in  $\beta$ , whereas the profit earned on product 2 is increasing in  $\beta$ .

### 3.1 Fight for corporate control

We have shown that it is optimal for firm 1 to engage in only a partial acquisition of firm 2, under the assumption that it will control all pricing decisions. Therefore, two important questions are: how reasonable is this assumption, and will the owners of the remaining shares have an incentive to try to wrest this control from firm 1?

Although having the incentive to fight ex post for corporate control of firm 2's pricing decisions does not necessarily mean these other owners will be successful, nevertheless, the partial acquisition of firm 2 might be more appealing to firm 1 if these other owners did not have such incentives. In this subsection, we investigate whether and under what conditions firm 1 can expect a subsequent fight for control.

Assume for the moment that these other owners are able to wrest corporate control of firm 2's pricing decision. Then stage two prices will be chosen to maximize

$$\begin{aligned}\max_{p_1} &= p_1 q_1(p) + \beta p_2 q_2(p), \\ \max_{p_2} &= (1 - \beta) p_2 q_2(p), \\ \max_{p_3} &= p_3 q_3(p).\end{aligned}$$

Solving for the equilibrium prices and equilibrium profits yields

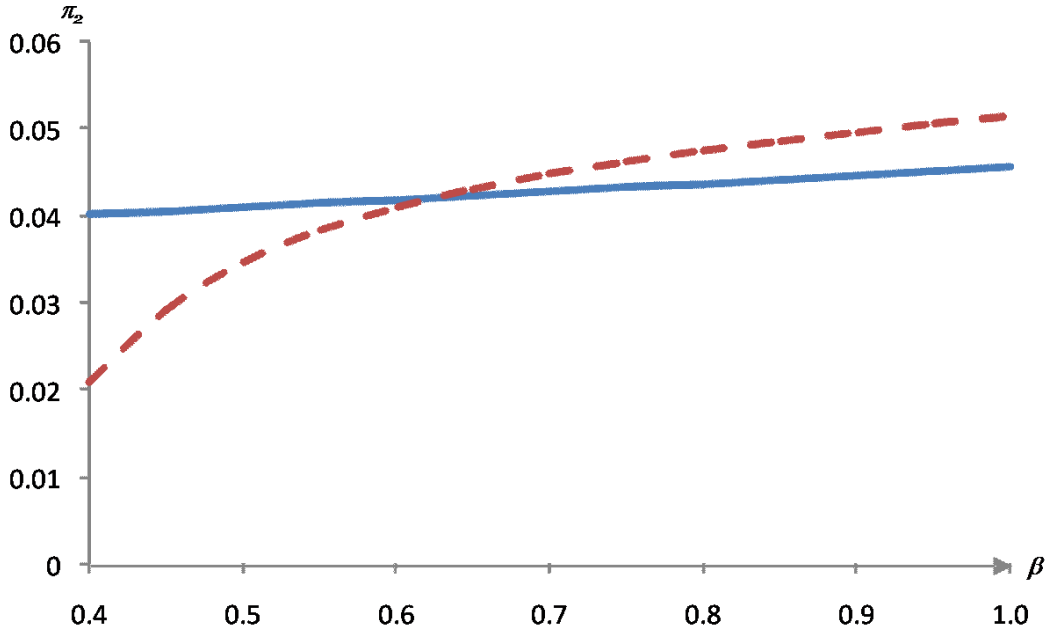
$$\begin{aligned}p_1 &= \frac{2t(5 + \beta)}{9(10 - \beta)} \geq p_2 = p_3 = \frac{10t}{9(10 - \beta)}, \\ \pi_{12} &= \frac{2t(53 + 39\beta - 3(1 - \beta)^2)}{27(10 - \beta)^2}, \quad \tilde{\pi}_2 = \frac{100t}{27(10 - \beta)^2}, \quad \pi_3 = \frac{100t}{27(10 - \beta)^2},\end{aligned}\quad (11)$$

where  $\pi_{12}$  is the profit from product 1 and  $\beta$  share of the profit from product 2,  $\tilde{\pi}_2$  is  $(1 - \beta)$  share of the profit from product 2, and  $\pi_3$  is the profit from product 3.

Comparing the overall value of firm 2 (i.e.,  $\beta p_2 q_2(p) + (1 - \beta) p_2 q_2(p)$ ) with and without the transfer of corporate control to firm 1 yields the following result.

**Proposition 5** *There is no incentive for the non-firm 1 owners to fight ex-post for corporate control of firm 2's pricing decision as long as  $\beta \in [\hat{\beta}, 1)$ , where  $\hat{\beta} \approx 0.623$ .*

This result is illustrated in Figure 1, where the broken line shows the value of firm 2 when firm 1 has corporate control and the solid line shows the value of firm 2 when firm 1 does not have corporate control. The  $\beta$  that maximizes the ex post joint profit of firm 1 and firm 2,  $\beta = \beta^* \approx 0.619$  (c.f. Proposition 3), is slightly below the level that would induce a fight by the non-firm 1 owners,  $\beta = \hat{\beta} \approx 0.623$ . As a consequence, the other owners of firm 2 would have an incentive to try to capture corporate control of firm 2 if firm 1 were to acquire  $\beta = \beta^*$ . To avoid this, firm 1 may simply prefer to acquire a larger ownership share  $\beta$ , such that  $\beta \geq \hat{\beta} > \beta^*$ .



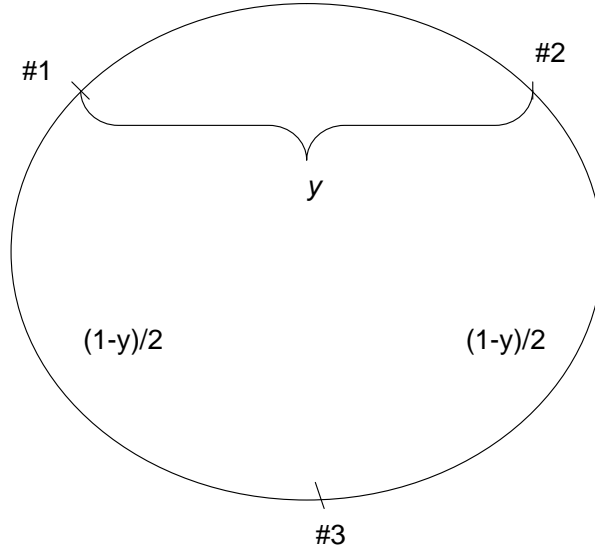
**Figure 1:** *Firm 1's ownership share and the possibility of fight for corporate control.*

As discussed in the introduction, much of the partial-ownership literature assumes quantity competition in the product market. However, it is straightforward to show that the result in Proposition 5 that the joint profit of firms 1 and 2 is higher when firm 1 partially owns firm 2 holds only under price competition. Hence, price competition (or more precisely, strategic complements) is a necessary condition.

### 3.2 Asymmetric location

We have assumed that the firms were symmetrically located along the Salop circle. Suppose instead, as in Figure 2, that the distance between firms 1 and 2 is  $y$ , and the distance between firms 2 and 3 and 1 and 3 is  $(1 - y)/2$ . Then, assuming all firms are active and there is complete market coverage, we have for  $i, j = 1, 2, i \neq j$ ,

$$q_i(p) = \frac{1 + y}{4} - \frac{p_i(1 + y) - p_j(1 - y) - 2yp_3}{2ty(1 - y)} \quad \text{and} \quad q_3(p) = \frac{1 - y}{2} - \frac{2p_3 - (p_i + p_j)}{t(1 - y)}. \quad (12)$$



**Figure 2:** *Asymmetric localization.*

Under the assumption that firm 1 has control over both its own and firm 2's pricing decisions, the stage 2 equilibrium prices are given by

$$p_1 = \frac{\beta(4 - (1 - y)(1 - \beta))}{2D_y(3 + y)^{-1}(1 - y)^{-1}}ty, \quad p_2 = \frac{4 - (1 - \beta)(y + 3)}{2D_y(3 + y)^{-1}(1 - y)^{-1}}ty, \quad (13)$$

and

$$p_3 = \frac{8y(3 - y)\beta - (1 - \beta)^2(1 - 3y)(1 - y)}{4D_y}t(1 - y), \quad (14)$$

where the denominator  $D_y$  is given by  $D_y \equiv 24y\beta - (1 - \beta)^2(1 - y)(2 - y)$ .

Using equations (13) and (14), profits for the three firms can be expressed as

$$\pi_1 = \frac{ty\beta^2(1 + 3y - \beta(1 - y))(3 + y - \beta(1 - y))}{4D_y^2(3 + y)^{-2}(1 - y)^{-1}},$$

$$\pi_2 = \frac{(\beta(1-3y) - y)((1-\beta)y - 3\beta - 1)yt}{4D_y^2(3+y)^{-2}(1-y)^{-1}},$$

and

$$\pi_3 = \frac{t((1-\beta)^2(1-3y)(1-y) - 8y\beta(3-y))^2(1-y)}{8D_y^2}.$$

At stage 1, firm 1 chooses  $\beta$  to solve  $\max_{\beta}(\pi_1 + \pi_2)$ , which yields

$$\beta^*(y) = 1 \text{ for } y \leq 1/5,$$

$$\beta^*(y) = 1 - \frac{4y(1-5y) + 2\sqrt{2y(5y-1)(1+y)(6-3y^2+y)}}{3(1-y)(y^2+5y+2)} \text{ for } y \geq 1/5.$$

Intuitively, if  $y \leq 1/5$ , products 1 and 2 are such close substitutes that firm 1 prefers to have complete financial control over both firms. However, if the goods are poorer substitutes, firm 1 maximizes the joint profit by acquiring only a fraction of firm 2, the less so the greater is  $y$ . This is illustrated by the solid curve in Figure 3.

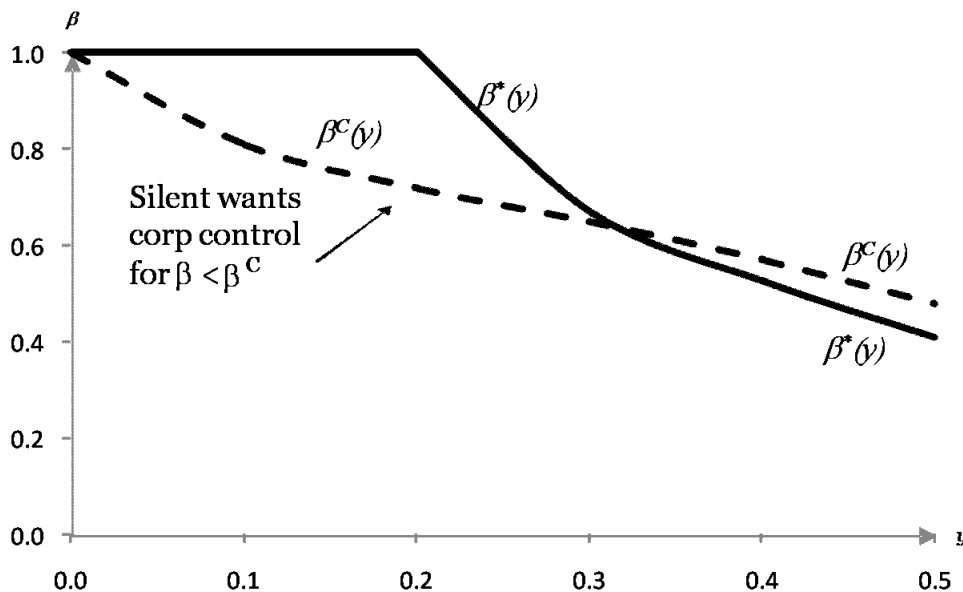
If the other firm 2 owners acquire corporate control in firm 2, we find that

$$\pi_2 = \frac{(1-y^2)(y+3)^4 yt}{8(6+17y-2\beta-3(1-\beta)y+3y^2+(1-\beta)y^2)^2}.$$

The dotted curve  $\beta^C(y)$  in Figure 3 shows the combinations of  $y$  and  $\beta$  where the other owners of firm 2 are just indifferent to fighting for corporate control. If firm 1's share is less than  $\beta^C(y)$ , the other owners will fight for control, but will otherwise prefer that control rest with firm 1. By choosing  $\beta = \beta^C(y)$  for  $y > y^\# \approx 0.32$  and  $\beta = \beta^*(y)$  for  $y < y^\#$ , firm 1 can thus avoid a struggle for corporate control.

We can summarize these results as follows:

**Proposition 6** *If products 1 and 2 are sufficiently close substitutes that  $y \leq 0.2$ , then firm 1 prefers to have full financial control over both firms. Otherwise firm 1 prefers to purchase less than 100% of the shares in firm 2. If products 1 and 2 are sufficiently poor substitutes that  $y > y^\#$ , then firm 1 will purchase the number of shares in firm 2 that maximizes the joint value of the two firms, and the other owners of firm 2 (silent investor) will have no incentive to fight for corporate control.*



*Figure 3: Asymmetric location; corporate and financial control.*

## 4 The market for pay-TV in Scandinavia

Demand and supply conditions in the Norwegian and Swedish markets for pay-TV broadcasting are similar along many dimensions. In both countries there are two providers offering pay-TV-subscriptions via satellite (Canal Digital and Viasat), and for the majority of households the only alternative to satellite subscription is the digital terrestrial platform (DTT). Within this platform, there is only one firm in each of the Scandinavian countries (RTV in Norway and Boxer in Sweden) However, despite these similarities, the price pictures in Norway and Sweden differ markedly.

Table 1 provides two illustrations of this. First, we see that the subscription fee at RTV is significantly higher than at Boxer (only a small portion of the price difference can be explained by the generally higher price level in Norway compared to Sweden). Second, we see that Canal Digital charges a lower price than its DTT competitor in Norway but a higher price than its DTT competitor in Sweden. A similar pattern holds for the prices charged by Viasat relative to RTV and Boxer.

It is not surprising that Canal Digital (and Viasat) has a higher subscription fee than Sweden's Boxer. Indeed, this is consistent with the general view that a large

fraction of the customers in Sweden consider the DTT platform as inferior to the satellite platform. The reason is because of limits in the number of channels that may be provided in premium packages via DTT (as well as limits in the ability to provide HDTV-quality). But why, then, is RTV more expensive than satellite in Norway? And why is DTT so much more expensive in Norway than in Sweden?

Norway	Price RTV	Relative price CD/RTV
	\$ 490	0.62
Sweden	Price Boxer	Relative price CD/Boxer
	\$ 210	1.87

**Table 1:** *Yearly pay-TV prices (subscription fees) in Norway and Sweden.*

We suggest that the difference in ownership structures in the two countries may provide an explanation. Important in this respect is the fact that Boxer is an independently-owned company, while the Norwegian telecommunications incumbent Telenor owns 100% of the shares in Canal Digital and 33.3% of the shares in RTV.

Let us first assume (we think erroneously) that Telenor has no corporate control in RTV, and thus is a passive investor in that company. In this case, one would expect the financial interests in RTV will give Telenor an incentive to raise the price of Canal Digital in Norway relative to Sweden, since some of the profit associated with reduced sales of Canal Digital in Norway will be recaptured through Telenor's stake in RTV. However, this prediction is inconsistent with the above observation, since we then should expect the price for satellite access to be relatively higher than for DTT access in Norway compared to Sweden. Neither can Telenor's partial financial interest in RTV explain why RTV charges a much higher price than Boxer.

The assumption that Telenor is a passive investor in RTV also does not seem likely to hold because the other two shareholders in RTV, NRK and TV2, the largest broadcasters in Norway, have no experience with operating distribution platforms.



This suggests that Telenor to a large extent will likely be able to control RTV's competitive decision making, including pricing decisions. At the outset one might think that NRK and TV2 would be unwilling to let Telenor have corporate control, since Telenor also owns the competitor Canal Digital. However, as shown above—and this is one of the main points of our analysis—it is precisely in such a situation that it might be suboptimal for NRK and TV2 to fight for corporate control.

Suppose, therefore, that Telenor has corporate control in RTV as well as in Canal Digital. Then Telenor will have an incentive to increase RTV's price in order to reduce the competitive pressure on Canal Digital. If Telenor owned 100 % of the shares in both companies, Telenor would induce RTV and Canal Digital to set the same (high) prices, other things being equal. However, since Telenor only has 33% of the shares in RTV, it will have incentives to set a higher price for the services offered by RTV than for the services offered by Canal Digital in Norway (c.f Proposition 2 above). This might be true even if consumption of the former has a lower perceived quality. Our model can therefore shed some light on the price patterns in Table 1.

By its very nature, we cannot directly compare the actual outcome in Scandinavia with a counterfactual case where Telenor has a larger partial financial interest in RTV. However, the digital terrestrial platform was established in 2007, and prior to this the analogue terrestrial platform was the only alternative to direct-to-home satellite access for the majority of households. The analogue terrestrial platform in Norway was owned by Telenor. Hence, when this platform was replaced with the digital terrestrial platform, Telenor's financial stake in the only alternative to the satellite platform was significantly reduced. Consistent with our model, the data reveals that subsequent to the introduction of the DTT platform in Norway, Canal Digital reduced its prices, and has become relatively more aggressive than Viasat.

The case at hand also has similarities with a recent merger case in the UK (The BSkyB/ITV case). In 2006, the largest pay-TV provider BSkyB announced that it had acquired 17.9 per cent of shares in ITV. The UK Competition Commission (2007) concluded that the transaction would give BSkyB a significant degree of corporate control in ITV. The Commission's view was that BSkyB would have an incentive and ability to weaken the competitive constraint ITV has on BSkyB. The

Commission felt that BSkyB's shareholding in ITV should be reduced below 7.5%, since this would then restrict the BSkyB's ability to have corporate control in ITV.

## 5 Conclusion

The competitive effects of mergers are well understood. Two firms that previously were independent, by merging, are now able to coordinate their output and pricing decisions. In the case where the firms produce substitute products, this leads them—in the absence of any cost savings—to charge higher prices and/or to cut back on their outputs. It is well known, however, that this effect can be trumped if rival firms in the market are thereby induced to become more aggressive (see Salant et al, 1983). Hence, much of the literature on the profitability of mergers turns on whether the merger would induce rival firms to become more or less aggressive.

Our starting point is a situation in which the merger would induce rival firms to become less aggressive. This presumably is a best-case scenario for a merger to be profitable, as the dampening-of-competition effect seemingly works in the merger's favor. Nevertheless, we have shown in this paper that a merger (in the usual sense of acquiring 100% financial interest in a rival) may not be the optimal strategy for the would-be merging firms. Instead, we have shown that the joint profit of the acquiring firm and the acquired firm can be higher if the acquiring firm purchases less than 100% of the shares in the acquired firm. Although this results in pricing and output distortions that disadvantage it relative to the profit a merged firm would earn all else being equal, the distortions can in some cases lead to a further dampening of competition—which may more than offset the original loss due to the distortions.

This has implications for competition policy. Consider a case in which two out of three firms in a market are owned by one stakeholder. Should competition authorities intervene if the owner wants to sell say 30% of the shares of one of these firms to a passive investor? Our analysis suggests that this could worsen competition. By the same token, assume that competition authorities would allow a merger between two out of three firms in a market (due to efficiency gains). If the acquiring firm wants to buy say 70% of the shares in the acquired firm instead of

all the shares, should the competition authorities require it to buy all the shares?

To our knowledge, this paper is the first to look at the profitability of partial ownership arrangements when the acquiring firm obtains corporate control. Nevertheless, there is much scope for future work. Given that general results are difficult to obtain with differentiated products, one avenue for future research is to assess whether and to what extent the results may hold in other demand contexts (e.g., in models with vertical as well as horizontal product differentiation). It may also be fruitful to look at the effects of agency relationships, in which the acquiring firm hires an agent to carry out its instructions. In these settings, one could then allow for corporate control that is not an all or nothing proposition. One might expect the optimal contract in this case (assuming it were publicly observed) to incentivize the agent to give fractional weights to the interests of both the acquiring firm and the acquired firm when setting prices, which can potentially lead to a richer analysis.

## 6 Appendix

**Proof of Proposition 1:** Given  $p_3$ , the profit-maximizing  $p_1$  and  $p_2$  are given by the simultaneous solution to the first-order conditions

$$\frac{\partial \Pi_1}{\partial p_1} + \beta \frac{\partial \Pi_2}{\partial p_1} = 0,$$

$$\frac{\partial \Pi_1}{\partial p_2} + \beta \frac{\partial \Pi_2}{\partial p_2} = 0.$$

Totally differentiating this yields

$$\begin{pmatrix} Z_{11} & Z_{12} \\ Z_{21} & Z_{22} \end{pmatrix} \begin{pmatrix} dp_1 \\ dp_2 \end{pmatrix} = \begin{pmatrix} -\frac{\partial \Pi_2}{\partial p_1} \\ -\frac{\partial \Pi_2}{\partial p_2} \end{pmatrix} d\beta,$$

where

$$\begin{aligned} Z_{11} &= \frac{\partial^2 \Pi_1}{\partial p_1^2} + \beta \frac{\partial^2 \Pi_2}{\partial p_1^2}, & Z_{12} &= \frac{\partial^2 \Pi_1}{\partial p_1 \partial p_2} + \beta \frac{\partial^2 \Pi_2}{\partial p_1 \partial p_2}, \\ Z_{21} &= \frac{\partial^2 \Pi_1}{\partial p_2 \partial p_1} + \beta \frac{\partial^2 \Pi_2}{\partial p_2 \partial p_1}, & Z_{22} &= \frac{\partial^2 \Pi_1}{\partial p_2^2} + \beta \frac{\partial^2 \Pi_2}{\partial p_2^2}. \end{aligned}$$

This yields

$$\frac{dp_1}{d\beta} = \frac{-\frac{\partial \Pi_2}{\partial p_1} Z_{22} + \frac{\partial \Pi_2}{\partial p_2} Z_{12}}{Z_{11} Z_{22} - Z_{12} Z_{21}}, \quad \frac{dp_2}{d\beta} = \frac{-\frac{\partial \Pi_2}{\partial p_2} Z_{11} + \frac{\partial \Pi_2}{\partial p_1} Z_{21}}{Z_{11} Z_{22} - Z_{12} Z_{21}}.$$

Our assumptions imply  $Z_{ii} < 0$ ,  $Z_{ij} > 0$ , and  $|Z_{ii}| > Z_{ij}$ , and since  $\frac{\partial \Pi_2}{\partial p_2} = -\frac{\partial \Pi_2}{\partial p_1}$  under symmetry when  $\beta = 1$ , it follows that  $\frac{dp_1}{d\beta} > 0$  and  $\frac{dp_2}{d\beta} < 0$  as in the Proposition.

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