Operational collaborations among competitors

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1 Introduction

Firms in nearly every industry are now considering alliances, joint ventures, mergers, and other collaborative arrangements with their competitors (Piraino 2001). Take the case of Canadian National (CN) Rail and Canadian Pacific (CP) Rail. The firms compete for freight traffic, yet they also share infrastructure such as rail tracks and yard facilities. In a successful example of what they call "co-production," CN Rail and CP Rail agreed to a "directional running zone" through the Fraser Canyon in British Columbia, Canada (Cairns 2007). This arrangement has allowed the firms to "accommodate an increased number of trains at faster speed" without the need for either firm to build costly double-track infrastructure. Other examples of operational collaborations include sharing of networks by communication firms[1] and cooperation in maintenance, repair, and overhaul (MRO) services by competing airlines (Carpenter and Henderson 2008).

The argument in favor of such "competitor collaborations" is straightforward. Competitors often have complementary assets that, through collaboration, can be exploited to the benefit of both the competing firms and their customers. This idea has been highlighted by Brandenburger and Nalebuff (1996) and by others (e.g., Hamel, Doz and Prahalad 1989). Complementarities may exist in production, distribution, purchasing, or in developing new products or technologies.

Despite the benefits, collaborations between competitors also carry risks for the firms. Because the firms' cost structures change, so do the competitive dynamics in the industry. The benefit of reducing costs through collaboration may be outweighed

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[1]See http://www.vodafone.com/start/responsibility/our_network/network_sharing.html.

by the downside of facing a more efficient competitor. The net impact on profitability is unclear. Consider the example of the print-media industry in the United States. The Newspaper Preservation Act of 1970 authorized the formation of joint operating agreements (JOAs) among competing newspaper within the same market area. The collaborating newspapers maintained separate editorial controls and separate identities, but essentially merged their printing and distribution operations. The Act was touted as a relief measure to allow multiple newspapers competing in the same market to cut costs, thus ensuring that no one paper could have supremacy in the market by driving the other(s) out of business. However, mounting evidence suggests that over the years many of such two-party collaborations are beginning to fold.

In this paper we focus on the following research questions. First, under what conditions should a firm enter into an operational collaborations with its competitor? Second, how should such collaborations be structured? We focus on the agreements that ensure that all firms benefit from the collaboration. Finally, because any agreements between competitive firms are bound to raise antitrust scrutiny, we also consider the welfare implications of agreements that sustain collaboration. Our focus, in this paper, is on explicit rather than implicit collaborations, i.e. we consider the case where the firms collaborate directly and not through an existing market intermediary or a new entity set up as a joint venture. Also, we restrict our analysis to "operational collaborations" which we define as any collaboration between competitors that reduces the *marginal* cost of procuring, producing, or distributing a product. We do not consider collaborations that affect the demand for products, as would occur when firms collaborate to develop new products or technologies.

Collaboration between firms reduces marginal costs if the firms have complementary skills or assets. This can be understood in the context of economies of scope. In our basic model, we analyze the case where the presence of scope economies helps firms reduce marginal costs through collaboration. We extend our analysis to study the impact of cost uncertainty and information asymmetry on operational collaborations. To illustrate points from our analysis we discuss the case of the newspaper industry (discussed earlier) within our modeling framework. Finally, we also study the case with fixed costs. We discuss collaboration under scale economies (and under private information), where we argue that collaboration driven by scale economies is more likely to be implicit due to the "hold-up problem".

2 Model and Analysis

Two firms, 1 and 2, compete on prices in a differentiated duopoly. Firm i faces a demand curve $D_i = \gamma_i - p_i + \theta p_j$ $(j \neq i)$. The different demand intercepts $\gamma_i \geq 1$ capture the fact the firms can be of different sizes, and $0 \leq \theta < 1$ represents the degree of product differentiation ($\theta = 0$ implies that the products are completely independent).

Before collaboration, each firm incurs a marginal production cost c_i. Without loss of generality, we assume that firm 1 is the higher cost firm; $c_2 \leq c_1$. If the firms collaborate in their operations, they both incur a cost c. Due to economies of scope, $0 < c \leq c_2 \leq c_1$.

Our goal is to analyze the impact of collaboration on the firms as well as on consumers. To analyze the impact of collaboration on firm profits we define $\Delta\pi_i$ $(i = 1, 2)$ as the increase in firm i's profits due to collaboration (over it's non-collaborative profit). Similarly, define $\Delta\pi$ as the net impact of collaboration on total profits of both the firms. Further, define

1. $\tilde{\theta}$ as the value of θ at which $\Delta\pi = 0$, and
2. $\hat{\theta}$ as the value of θ at which $\Delta\pi_2 = 0$.

We now summarize the results of our analysis:

1. Operational collaboration among competitors reduces prices and therefore increases consumer surplus.
2. $\Delta\pi_i$ and $\Delta\pi$ are concave over $\theta \in [0, 1]$.
3. (i) There exists a unique $\tilde{\theta} \in (0, 1)$ if and only if $c_1 - c_2 \geq \gamma_1 - \gamma_2$, and (ii) $\Delta\pi \geq 0$ if $\theta \in [0, \tilde{\theta}]$ and $\Delta\pi \leq 0$ if $\theta \in [\tilde{\theta}, 1]$.
4. The high cost firm, firm 1, benefits from collaboration for all $\theta \in [0, 1]$.
5. Collaboration benefits firm 2 when
$$\frac{(c_2 - c)}{(c_1 - c)} > \frac{\theta}{(2 - \theta^2)}. \tag{1}$$
6. There exists a unique $\hat{\theta} \in (0, \tilde{\theta})$ such that $\Delta\pi_2$ is positive if $\theta < \hat{\theta}$, negative if $\theta > \hat{\theta}$ and equal to zero if $\theta = \hat{\theta}$. This unique value of $\hat{\theta}$ is given by
$$\hat{\theta} = \frac{\sqrt{(9c^2 + c_1^2 + 8c_2^2 - 2c\,(c_1 + 8c_2))} - (c_1 - c)}{2\,(c_2 - c)}. \tag{2}$$
Consequently, operational collaboration benefits the low cost firm, firm 2, only for values of $\theta \in [0, \hat{\theta}]$

7. It is worth noting that $\frac{c_2-c}{c_1-c} \leq \hat{\theta} \leq \tilde{\theta}$.

8. If $\theta \in \left(\hat{\theta}, \tilde{\theta}\right)$, joint expected profits are positive.

9. If $\theta \in \left(\hat{\theta}, \tilde{\theta}\right)$, operational collaboration can be made pareto-efficient with a fixed fee transfer.

10. It is possible to develop appropriate contractual agreements (either fixed transfer payment or two-part tariffs) to enable collaboration over the entire range of θ.

Next, we analyze the case of "collusive collaboration" when both collaborating firms collude on prices and hold the prices at the non-collaborative level. We make the following observations under such collusive collaborations:

1. For both firms, collusive collaboration may be worse than "competitive collaboration" when θ is low value. In this case, the firms actually prefer to lower prices and expand their markets, and customers also get lower prices.

2. But for high values of θ, competitive collaboration may be worse than collusive collaboration.

3. For both firms, collusive collaboration is always better than no collaboration.

An important question then arises regarding the anti-trust issues of such collusive operational collaborations. To this end, we note that

1. While firms are essentially colluding on prices, as long as prices are held at or below the non-collaborative level, collusive collaboration can never hurt customers.

2. Such "ancillary restraints," where firms agree to limit competition in order to facilitate collaboration, are sometimes accepted by antitrust regulators (ABA 2006).

3. But such agreements do raise concerns that the competitors will not simply restrict prices to the non-collaborative level; but may agree to collude in other ways that is detrimental to consumers.

3 Sensitivity analysis

First, we study the impact of uncertainty about cost parameters on $\hat{\theta}$ and $\tilde{\theta}$. To this end, we show that

1. $\hat{\theta}$ is convex and decreasing in c_1, concave and increasing in c_2, and concave and decreasing in c, and

2. If $c_1 - c_2 \geq \gamma_1 - \gamma_2$ then $\tilde{\theta}$ increases as c_2 increases and decreases as c increases.

We now illustrate our main result regarding uncertainty in cost parameters. Our analysis suggests that $\hat{\theta}$ is more sensitive to cost uncertainty than $\tilde{\theta}$. Cost uncertainty in c_1 benefits the collaboration by inducing firm 2 to collaborate for higher values of θ. The benefit is larger with larger variance in c_1. Finally, $\tilde{\theta}$ is not sensitive to cost uncertainty.

Next, we study the role of private information about costs. Under reasonably mild assumptions we show that private information about costs does not matter, i.e., firms cannot seek additional profit from the collaboration due to private cost information.

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