

POST-MERGER PRODUCT REPOSITIONING*

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This paper analyzes the effects of mergers between firms competing by simultaneously choosing price and location. Products combined by a merger are repositioned away from each other to reduce cannibalization, and non-merging substitutes are, in response, repositioned between the merged products. This repositioning greatly reduces the merged firm's incentive to raise prices and thus substantially mitigates the anticompetitive effects of the merger. Computation of, and selection among, equilibria is done with a novel technique known as the *stochastic response dynamic*, which does not require the computation of first-order conditions.

I. INTRODUCTION

HORIZONTAL MERGER POLICY FOR DIFFERENTIATED CONSUMER PRODUCTS INDUSTRIES derives from a single-dimensional model of price competition in which mergers involving competing products give rise to 'unilateral effects' (Werden and Froeb [1994, 2008]). The merger internalizes the competition between products combined by the merger, causing the merged firm to prefer higher prices for any given prices of rivals. Non-merging rivals benefit from increases in their demands resulting from the merged firm's price increases, and they increase their prices in accord with their unchanged best-response functions. Roughly speaking, the greater the substitutability between the products combined by the merger, the more competition is internalized, and the greater the price effect of the merger.

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The model of price-only competition suggests a clear approach to merger analysis, which has been widely employed by enforcement agencies (see Federal Trade Commission [2006] pp. 27–31) and also by the courts (e.g., *Oracle* [2004]). Prediction of the likely unilateral effects of a proposed differentiated products merger can be based largely on an empirical assessment of the degree of substitutability between products combined by the merger, a problem that has received much attention in the recent empirical industrial organization literature. A potentially significant limitation of this approach, however, is that competition may occur in dimensions other than than price, such as ‘product positioning.’

The Horizontal Merger Guidelines [1997, §2.212] issued by the two federal antitrust enforcement agencies in the United States suggest that non-merging rivals could ‘replace any localized competition lost through the merger by repositioning their product lines’ and thereby prevent price increases. Similarly, the only court decision extensively discussing unilateral effects (*Oracle* [2004] p. 1118) asserts that before a differentiated products merger may be enjoined on the basis of such a theory, ‘the plaintiff must demonstrate that the non-merging firms are unlikely to introduce products sufficiently similar to the products controlled by the merging firms to eliminate any significant market power created by the merger.’ The court’s language suggests that it believed the non-merging rivals have the incentive to reposition their products in a manner that recreates the pre-merger intensity of price competition, but it is not at all clear why that would be true.¹

We formally analyze the effects of mergers with multiple dimensions of competition by positing a model in which firms compete in both price and location. To highlight the impact of competition in location, we unrealistically assume that firms instantaneously and costlessly reposition their products after a merger. We follow Anderson, de Palma, and Hong [1992] by modelling location using the Hotelling [1929] line segment. Physical location can be viewed as a metaphor for brand positioning in any single dimension, and in form, our model shares the basic ingredients of the discrete choice models of competition widely employed in the theoretical and empirical literature on product differentiation.

We compare the effects of mergers in our price-location model to those in a model in which each product has a fixed location and firms compete only in price. We find that merger effects in the former model may differ substantially from those in the latter model but not in the manner suggested by the Horizontal Merger Guidelines. In the most policy relevant scenario—in which the merging products are initially quite close to each

¹ The court found it unnecessary to address whether the plaintiff had made the required showing because of shortcomings it found in other evidence presented (*Oracle* [2004], p. 1172). Thus, repositioning has not yet played a significant role in any litigated merger case.

other so the merger would be flagged as anticompetitive by the price-only model—the merger is less anticompetitive in the price-location model than in the price-only model. In the price-only model, combining close substitute products creates a strong incentive for the merged firm to increase their prices. In the price-location model, combining close substitute products creates a strong incentive for the merged firm to separate those products, and that separation greatly reduces the incentive to raise prices.

The pattern of post-merger product repositioning arising in our model also reduces the benefits a merger confers on non-merging rivals. The merged firm in the price-location model repositions its products so as to make them the least substitutable pair of products in the market. This repositioning substantially mitigates the merged firm's price increases and thereby also reduces the extent to which the merged firm's price increases cause the demands for non-merging rivals' products to increase. In addition, product repositioning by the merged firm causes its non-merging rivals to retreat towards the middle of the line segment, which intensifies price competition among the non-merging rivals and reduces their incentive to raise prices. The combination of these effects substantially reduces—and can eliminate altogether—the benefits conferred by the merger on non-merging rivals. The merged firm thus captures a much larger share of gains from reducing competition, and non-merging rivals may even be made worse off.

Our results suggest several significant insights: First, the mechanism through which product repositioning occurs involves the incentives of the merged firm, rather than the incentives of its non-merging rivals, as postulated by the Horizontal Merger Guidelines. Second, competitor opposition to a merger may not be proof positive that the merger is efficient, as is usually assumed.²

Our novel method of solving the price-location model also is of interest. Standard root-finding algorithms are unsatisfactory with the price-location model because they require that profit functions be smooth enough so that their first derivatives both exist and can be computed precisely. In models like ours, however, small changes in rivals' prices or locations can cause a firm to prefer a substantially different location, causing a discontinuity in the profit functions. Root-finding algorithms also can be problematic because of multiple equilibria in the price-location model. Consequently, we employ a new method for computing the pure strategy Nash equilibrium.

Gandhi [2006] calls this method the *stochastic response dynamic*: Players in the game take turns responding stochastically to the actions of rivals. Unlike

² Brito [2003] also shows that mergers in a spatial model may harm rivals if the motive for merger is the prevention of efficient mergers by rivals. Non-merging rivals have challenged mergers on the dubious theory that the merger would precipitate predation (see Werden [1986]).

similar deterministic learning dynamics that converge only under special conditions (Fudenberg and Levine [1998] ch. 2), under very general conditions, the stochastic response dynamic produces a Markov chain that converges probabilistically to the pure strategy equilibria of the underlying game. Only the profit functions are necessary to compute equilibria; the method does not employ first derivatives or depend on starting values. The stochastic response dynamic also provides a refinement to the equilibrium concept that eliminates the problem of multiple equilibria in the price-location model. Computations using the stochastic response dynamic yield a unique solution, which is the equilibrium most profitable for the competitors.

II. SIMULTANEOUS PRICE AND LOCATION GAME

II(i). *Specification of Demand and Firms*

We employ a simple version of a demand model commonly applied to differentiated products. Consumers with heterogeneous tastes choose among alternatives viewed as ‘bundles of characteristics.’ A consumer with given tastes chooses the alternative with a combination of price and characteristics making it preferable over alternatives. Each consumer in set I chooses a single alternative from set J . These alternatives are supplied by set N of firms, with each firm $m \in N$ producing subset $J_m \subseteq J$ of the alternatives, such that the J_m are mutually exclusive and exhaustive for J . Y denotes the space of product characteristics, and product $j \in J$ has characteristics $y_j \in Y$. X denotes the space of consumer characteristics, and consumer $i \in I$ has characteristics $x_i \in X$.

A widely employed specification for the utility of consumer i choosing alternative j is

$$u_{ij} = \delta_j - \alpha_i p_j + V(x_i, y_j) + \varepsilon_{ij}.$$

In this utility function, δ_j is a quality level for alternative j ; α_i indicates consumer i 's price sensitivity; $V(x_i, y_j)$ is the utility a consumer with tastes x_i derives from a choice with characteristics y_j ; and ε_{ij} is an idiosyncratic taste of consumer i for alternative j . This model is employed in many recent econometric analyses of product differentiated industries (e.g., Berry, Levinshon, and Pakes [1995], Nevo [2000] and Petrin [2002]). The idiosyncratic taste shock both adds flexibility and realism to the model.

In our simple version of this model, all consumers have the same price sensitivity, α , and $X = Y = [0, I] \subset \mathbb{R}$, i.e., the space of both tastes and characteristics is the same segment of the real line. Thus, X and Y represent the Hotelling [1929] line segment, along which are located both consumers and the alternatives among which they choose, which we refer to as stores. Other things being equal, a consumer's preference for a store is greater the

closer the consumer lives to the store. We follow Hotelling by specifying V as the negative of the cost of travelling between two locations. Thus,

$$V(x_i, x_j) = -\tau|x_i - x_j|,$$

where τ is the travel cost per unit of distance, and x_i and x_j are the locations of consumer i and store j . We also include an ‘outside alternative’ $j = 0$, which can be thought of as the ‘no purchase’ alternative. Its utility is normalized so that

$$u_{i0} = \varepsilon_{i0}.$$

The utility maximization hypothesis implies that consumer i chooses store j if $u_{ij} > u_{ik}, \forall k \neq j$. This choice depends upon the vector of consumer i 's attributes $z_i = (x_i, \varepsilon_i), \varepsilon_i = (\varepsilon_{ij})_{j \in J}$. Assuming a density $f(z)$ for this vector over the population, aggregate demand of store j is the share of the population selecting it:

$$s_j = \int_{A_j} f(z) dz,$$

for $A_j = \{(x, \varepsilon) \in X \times \mathbb{R}^{|J|} : \delta_j - \alpha p_j + V(x, x_j) + \varepsilon_j > \delta_k - \alpha p_k + V(x, x_k) + \varepsilon_k, \forall j \neq k\}$. For convenience, we express $-\alpha p_j + V(x, x_j)$ as $v(x, x_j, p_j)$.

We assume $f(z)$ is the product of independent components, $f(z) = g(x)h(\varepsilon)$, with $g(x)$ being uniform over X and $h(\varepsilon)$ being independent Gumbel variates across $\mathbb{R}^{|J|}$. These simplifications give rise to the familiar logit functional form for the demand of store j from consumers at location $x \in X$,

$$s_j(x) = \frac{\exp^{\delta_j + v(x, x_j, p_j)}}{\sum_{k \in J} \exp^{\delta_k + v(x, x_k, p_k)}}.$$

The aggregate demand for store j is found by adding the demands from each location:

$$s_j = \int_0^l s_j(x) dx = \int_0^l \frac{\exp^{\delta_j + v(x, x_j, p_j)}}{\sum_{k \in J} \exp^{\delta_k + v(x, x_k, p_k)}} dx.$$

This is a ‘mixed logit’ demand specification (McFadden and Train [1999]), which has become a prominent part of econometric work on differentiated products industries. The specification allows for a range of substitution patterns among stores to be controlled by a single parameter—the travel cost, τ . Increasing travel cost makes competition on the line more localized. Anderson, de Palma, and Hong [1992] use this model to study competition among two firms simultaneously choosing price and location. We extend their analysis to the case of an arbitrary number of firms, then consider the effect of mergers.

Firms strategically choose prices and locations for their stores, with store $j \in J_k$, owned by firm k , having constant marginal cost c_j for serving each consumer. The vector of prices for stores owned by firm k is $\mathbf{p}_k = (p_j)_{j \in J_k}$, and the vector of locations for stores owned by firm k is $\mathbf{x}_k = (x_j)_{j \in J_k}$. The vector of prices of all the stores is $\mathbf{p} = (\mathbf{p}_k)_{k \in N}$, and the vector of locations of all the stores is $\mathbf{x} = (\mathbf{x}_k)_{k \in N}$.

The share of each store j is a function of the prices and locations of all the stores: $s_j(\mathbf{p}, \mathbf{x})$. Because the no purchase alternative is assigned a share, $\sum_{j \in N} s_j < 1$. If the total population of consumers is M , firm k has profit function

$$\pi_k(\mathbf{p}, \mathbf{x}) = M \sum_{j \in J_k} (p_j - c_j) s_j(\mathbf{p}, \mathbf{x}).$$

The N profit functions define a one-shot game G in which each firm k chooses a vector of strategic variables $(\mathbf{p}_k, \mathbf{x}_k)$. The outcome of this game is the Nash equilibrium consisting of prices $\mathbf{p}^* = (\mathbf{p}_k^*)_{k \in N}$ and locations $\mathbf{x}^* = (\mathbf{x}_k^*)_{k \in N}$.

We leave open at this point whether G actually has an equilibrium and, if so, whether it is unique. Given the integral that defines $s_j(\mathbf{p}, \mathbf{x})$, these questions are difficult to address analytically. Instead, we take a numerical approach.

II(ii). *Computation of Nash Equilibria*

To avoid the inherent intractability of an analytic solution to the model, we employ numeric methods. The usual approach to finding the Nash equilibrium vector of prices and locations would be to find the (\mathbf{p}, \mathbf{x}) vector that solves, for $k \in N$, the system of equations

$$\begin{aligned} \frac{d}{d\mathbf{x}_k} \pi_k(\mathbf{p}, \mathbf{x}) &= 0 \\ \frac{d}{d\mathbf{p}_k} \pi_k(\mathbf{p}, \mathbf{x}) &= 0. \end{aligned}$$

But standard iterative methods for solving this system of equations fail to converge for our model unless derivatives are computed precisely and suitable starting values are chosen. In addition, the system contains multiple solutions. Of course these problems are compounded dramatically by the fact that the equations must be solved repeatedly over a range of parameter values. These problems are avoided by the econometric literature on models of product differentiation (e.g., Berry [1994]) through the use of estimation techniques that do not require computation of the equilibrium, but we do not have that option. To assess the competitive effects of mergers, it is necessary to compute both pre- and post-merger equilibria. Thus, we follow

a new approach developed by Gandhi [2006] for addressing the computational problem of finding and selecting pure strategy Nash equilibria (PSNE) in structural game theoretic models with a continuum of possible actions.

Early game theory literature (e.g., Robinson [1951]; see Vega-Redondo [2003] pp. 421–26) focused on the *best response dynamic*, a process in which players take turns best responding to the actions of each other, as a natural learning model for discovering PSNE in games with a continuum of actions. (Much the same idea was employed in literature on the stability Cournot equilibria (e.g., Friedman [1983] pp. 43–46).) Learning models (Fudenberg and Levine [1998] ch. 2) also provide a basis for refining the equilibrium concept, effectively selecting among multiple equilibria by identifying those that can be arrived at through an iterative process of players responding to each others' actions. It is difficult, however, to specify naturally satisfied game theoretic conditions under which the best response dynamic is guaranteed to converge. In fact, it fails to converge even for even very standard specifications, such as Cournot competition with isoelastic demand and constant marginal cost (see Puu [1997] ch. 7).

Gandhi [2006] develops a new method for finding PSNE in games with a continuum of actions and continuous payoff functions. He addresses the potential failure of convergence by adding noise to the best response dynamic. Instead of making the best response to others' actions, Gandhi posits that a player makes a 'stochastic response.' A player randomly identifies a possible action and takes that action if it improves his utility, holding actions of the other players fixed, as compared with repeating the action taken at the immediately prior iteration. The utility comparison is based on a utility function containing a stochastic component.

The process of iterative stochastic responses is a learning process termed the *stochastic response dynamic*. Unlike the classical best response dynamic, the stochastic response dynamic is a Markov chain, which under very general conditions converges to a stationary distribution. Gandhi shows that, under conditions likely met in practice, as the variances of the stochastic components in the players' utility functions approach zero, the stationary distribution of actions taken by the players collapses to a degenerate set of point masses over a subset of the Nash equilibria of the game.

Said another way, as the noise in players' responses gets smaller, the stochastic response dynamic finds itself in an ever smaller neighborhood of a Nash equilibrium with increasingly higher probability. Eventually, a state is reached in which there is only a very slim chance of a player taking an action different from that taken in the last iteration; thus, each player is making nearly the best response, which is an approximate Nash equilibrium.

By simulating the stochastic response dynamic, and letting the variances of the stochastic components in the players' utilities approach zero, the stochastic response dynamic grows ever attracted to an equilibrium point of

the game. Due to this globally convergent nature of the process, the stochastic response dynamic can act as a refinement of the equilibrium concept that selects among multiple equilibria. Critically, for the price-location game we consider, computation using the stochastic response dynamic yields a unique solution. When the price-location game has multiple Nash equilibria, the same equilibrium is preferred by all the players, and the stochastic response dynamic accordingly identifies that equilibrium. Simulating the stochastic response dynamic requires only knowing the values of the utility or profit functions. There is no need to identify best responses or compute first derivatives, which greatly simplifies computation.

III. PARAMETERS AND EQUILIBRIUM

We consider a simple spatial model with four stores located along a line segment of unit length. Initially, each store is separately owned, then two owners merge. Before and after the merger, the owners play a simultaneous-move, price-location game. We compare the effects of a merger in this game to those when stores are constrained to their pre-merger locations. The four-store model allows for a sufficiently rich industry structure to exhibit interesting effects of post-merger product repositioning.

For purposes of illustrating these effects, we assume the following parameter values: Each store $j \in J$ has marginal cost $c_j = 2$ and a quality level of $\delta_j = 4$. We consider a single value of the price sensitivity parameter, $\alpha = .2$, but a broad range of values for the travel cost parameter, τ , which allows for a wide range of substitution patterns. When τ is sufficiently small, competition among stores is essentially global, and as τ increases, competition becomes more localized. We examined higher and lower values for both c_j and δ_j , and found that they yielded qualitatively similar results.

We now take up the questions avoided thus far on the existence and uniqueness of equilibrium in the price-location game. As explained by Anderson, de Palma and Hong ([1992] pp. 78–79) and Anderson, de Palma and Thisse ([1992] ch. 9), equilibrium in this model does not exist if travel costs are sufficiently close to 0 and the idiosyncratic component of consumers' utility functions is therefore insignificant. Similarly, d'Aspremont, Jaskold and Thisse [1979] and Economides [1993] show that the same non-existence problem arises in two-period spatial models, in which location is chosen in the first period and price in the second. In terms of our computational approach, such non-existence implies a lack of convergence of the stochastic response dynamic.

If travel costs are not sufficiently close to 0, our model necessarily has a *bunching equilibrium*, both pre- and post-merger, in which all stores are located at the midpoint of the line segment. As travel costs increase, a *partial-separating equilibrium* emerges, in which stores locate at more than one point but at least two stores are at the same point. With yet higher travel costs, there is a *full-separating*

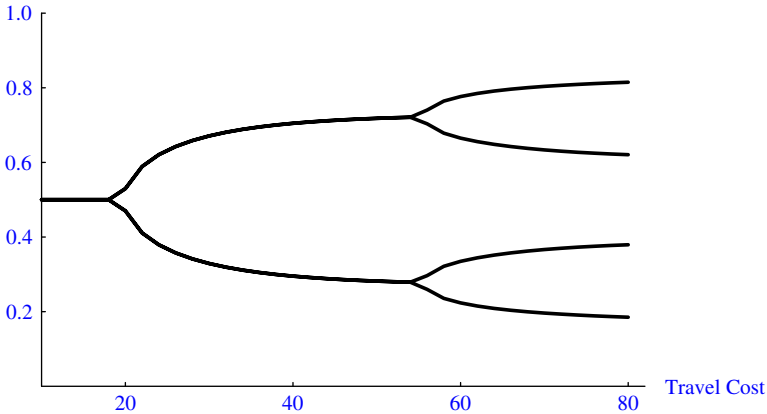


Figure 1
Pre-Merger Store Locations as a Function of Travel Cost.

equilibrium, in which all four stores are located at different points. Whenever equilibrium exists, there is a bunching equilibrium, and whenever there is a full-separating equilibrium, there is also a partial-separating equilibrium.

With our model, the stochastic response dynamic always selects a single, unique equilibrium. If the model has multiple equilibria, the equilibrium selected is the one with the greatest separation. If travel costs are such that only partial-separating and bunching equilibria exist, the stochastic response dynamic selects the partial-separating equilibrium. If full-separating, partial-separating, and bunching equilibria all exist, the stochastic response dynamic selects the full-separating equilibrium. The equilibrium with maximal separation is naturally selected because all of the stores are most profitable in the most separating equilibrium, so maximal separation is Pareto optimal.

Before the merger, each firm j has one store for which it strategically chooses price p_j , as well as location x_j in the interval $[0, 1]$. This game is denoted G^{pre} , and its Nash equilibrium is $\mathbf{p}^{pre} = (p_j^{pre})_{j \in J}$ and $\mathbf{x}^{pre} = (x_j^{pre})_{j \in J}$. In the pre-merger game, equilibrium locations are unique, but the assignment of firms to locations is not. Figure 1 plots the four equilibrium locations along the vertical axis against values of the travel cost parameter on the horizontal axis in the interval $[10, 100]$. To place these values in perspective, we offer a simple calculation. If consumer purchases were uniformly distributed over the line segment and store locations minimized total transportation cost, delivered prices would have an average transportation component $\tau/16$. With prices at the competitive level (i.e., set equal to $c_j = 2$), transportation would account for 24–73% of the average delivered price for $\tau \in [10, 100]$.

Figure 1 may be most easily understood by working from right to left. With sufficiently high travel cost, the four stores are fully separated in equilibrium. As travel costs decline, the pair of stores above the midpoint move toward each other, as do the pair of stores below the midpoint, until the two stores in each pair share a single location (the partial separating equilibrium). As travel costs decline further, the two pairs of stores sharing a single location move toward each other until all four stores share the same location when travel costs are sufficiently low (the bunching equilibrium).

This pattern reflects the fact that as travel costs decline, there is less opportunity to gain market power by separating from other stores and thus a greater incentive to locate in the manner that best serves the greatest number of customers. For a given travel cost, consider what prevents store 1 from locating further towards the end of the interval at 0. The logit choice probabilities imply that every store, regardless of location, draws at least a small share of the customers from every point on the interval, but its share of the customers at any point depends on its proximity, and that of each of the other stores, to those customers. The advantage in competing for local customers gained by separating from the other stores is outweighed by the disadvantage in competing for customers over the rest of the interval. Thus, the profit-maximizing calculus for each store limits differentiation. Of course, a merger alters this calculus by allowing the merged firm to move one of its two stores closer to 0 while serving customers far from 0 with the other store.

Let G^{PL} (PL signifying ‘price-location’) denote the post-merger game in which firms strategically choose both price and location. This game has an equilibrium $\mathbf{p}^{PL} = (p_j^{PL})_{j \in J}$ and $\mathbf{x}^{PL} = (x_j^{PL})_{j \in J}$. For the time being, we leave open the pre-merger locations of the merging stores and focus on the pattern of post-merger locations. We take up the issue of the identity of the merging stores when we address the merger’s effects.

If the travel cost parameter is sufficiently high that a partial- or full-separating equilibrium exists post merger, the merged firm relocates its stores to outside locations, while the non-merging firms take the inside locations. In the post-merger partial-separating equilibrium, the merged firm’s stores take the outside positions while the non-merging stores are bunched in the middle. In the post-merger full-separating equilibrium, the non-merging stores separate from each other, but nevertheless take the inside positions. Critically, *whatever their pre-merger positions*, the merged stores (interchangeably) take the outside locations in the post-merger equilibrium, and the non-merging stores (interchangeably) take the inside locations.³

³ Norman and Pepall [2000] find a similar repositioning with spatial Cournot competition. In that model, the pre-merger equilibrium has all competitors at a single point, and the merged firm moves its two operations to both sides of that point.

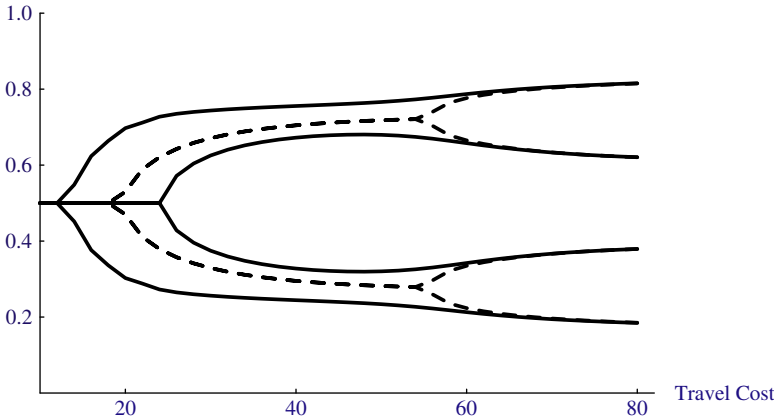


Figure 2
Pre- and Post-Merger Store Locations

We depict the pattern of both pre- and post-merger locations in Figure 2. The solid lines are the post-merger locations, and the dashed lines are the pre-merger locations from Figure 1. Reading the figure from left to right, for low travel costs, only a bunching equilibrium exists in both the pre-merger and post-merger states. As travel costs increase further, a partial-separating equilibrium emerges in the post-merger state, whereas only a bunching equilibrium exists in the pre-merger state. For higher travel costs, a partial-separating equilibrium exists in both the pre-merger and post-merger states. For yet higher travel costs, a full-separating equilibrium exists in the post-merger state, while only the partial-separating equilibrium exists in the pre-merger state. And finally, for the highest travel costs, a full-separating equilibrium exists in both the pre-merger and post-merger states. As can be seen, for given travel costs, the outside locations are located (weakly) further outside, and the inside locations are located (weakly) further inside, in the post-merger state as compared to the pre-merger state.

It is critical to appreciate that Figure 2 does not indicate the identity of the store at any particular location and thus may tend to mask the impact a merger has on the locations of the merging stores. For example, at $\tau = 80$, Figure 2 indicates that the points on the line segment at which stores choose to locate are the same pre- and post-merger, but this does not mean that the merged firm does not reposition its stores. The merger does not induce repositioning only if the merging stores hold the outside positions before the merger. In the case of greatest policy relevance, however, the merging stores hold any two adjoining positions before the merger, and in any such case, the merging stores are repositioned to the outside locations by the merged firm.

In standard Bertrand competition, with price as the only strategic variable, the internalization of competition between the products combined

by the merger occurs solely through raising prices. When there is a second dimension of competition, the merged firm has two instruments for internalizing the competition—raising prices and differentiating products. Our computational results show the merged firm always makes its two products the least substitutable pair in the post-merger market. Thus, the merged firm makes most use of the differentiation instrument when there is the greatest competition to internalize.

As compared with mergers in the game that holds locations constant, mergers in the price-location game affect consumers differently in several ways. Mergers may increase product variety, which would benefit consumers directly. Increased variety driven by the separation of the merging products, however, softens price competition; it confers localized market power which creates an incentive to raise prices to the detriment of consumers. On the other hand, increased differentiation of the merging products lessens the merged firm's incentive to raise prices. When the merging products are close substitutes, our computational results show that the repositioning of those products causes the merger to produce much smaller price increases than in the price-only model. In the next section, we provide a more formal analysis of both effects.

IV. PRICE EFFECTS AND CONSUMER WELFARE

Like the standard approach to merger analysis with differentiated products, post-merger game G^{PO} (PO signifying 'Price-Only') constrains all firms to keep their stores at their pre-merger locations \mathbf{x}^{pre} . At these locations, the firms play a price game in which the merged firm maximizes the joint profits of the two stores merged together, while non-merging firms continue to maximize profit for their individual stores. The shift to the new equilibrium prices, $\mathbf{p}^{PO} = (p_j^{PO})_{j \in J}$, is driven by the internalization of price competition between the merging stores, causing the merged firm to raise prices at its two stores. To focus on just the prices of the merged firm, we use the scalars p^{pre} and p^{PO} to represent a share weighted price index of the merging stores.

A merger causing prices to change from p^{pre} to p^{PO} in post-merger game G^{PO} generates the incremental markup

$$m^{PO} = \frac{\Delta^{PO}}{p^{pre}}, \Delta^{PO} = p^{PO} - p^{pre}.$$

A merger causing prices to change from p^{pre} to p^{PL} in post-merger game G^{PL} (PL signifying 'Price-Location') generates the incremental markup

$$m^{PL} = \frac{\Delta^{PL}}{p^{pre}}, \Delta^{PL} = p^{PL} - p^{pre}.$$

In comparing the effects of mergers in the two models, we are interested in the difference

$$\Delta m = m^{PL} - m^{PO} = \frac{p^{PL} - p^{PO}}{p^{pre}}.$$

If $\Delta m > 0$, the price-increasing effects of a merger are greater with price-location competition than with price-only competition. And if $\Delta m < 0$, the reverse is true.

To compare the effects of merger in price-location game, G^{PL} , with those in the price-only game, G^{PO} , we introduce a hypothetical intermediate game, G^{RE} (*RE* signifying Repositioning Effect). It is a price-only game in which firms price as they do pre merger; thus, the merged firm does not internalize the price competition between the stores merged together. Stores, however, are located as they are in the post-merger equilibrium of the price-location game. In this game, the share-weighted price index for the merging stores' equilibrium prices is p^{RE} . The price change $\Delta^{RE} = p^{RE} - p^{pre}$ reflects the change in prices solely due to the merging stores post-merger separation, as seen in Figure 2.

The post-merger locations \mathbf{x}^{PL} reflect the merged stores' more isolated positions relative to the pre-merger locations \mathbf{x}^{pre} . Each merged store has more local market power in the \mathbf{x}^{PL} locations, so even if the firms continue to price as single-store firms, there is an upward pressure on price in moving from G^{pre} to G^{RE} , which implies that $\Delta^{RE} > 0$.

The merged firm also internalizes price competition, causing its share-weighted price index to change from that of the G^{RE} equilibrium, p^{RE} , to that of the post-merger price-location game equilibrium, p^{PL} . The resulting price change, $\Delta^{PL} = p^{PL} - p^{RE}$, reflects the change in prices due only to internalization of price competition between the merging stores, after they already were separated by the merged firm. Thus, Δ^{PL} is analogous to the effect of a merger on prices in the price-only game, Δ^{PO} , because both are differences in equilibrium prices between a pre-merger ownership structure and a post-merger ownership structure with locations held fixed. The difference is that the locations for Δ^{PL} are \mathbf{x}^{PL} , while the locations for Δ^{PO} are \mathbf{x}^{pre} .

The magnitudes of Δ^{PL} and Δ^{PO} are determined by the degree of substitutability between the merging stores, i.e., how close they are on the line segment. As seen in Figure 2, the merging stores are further apart at their \mathbf{x}^{PL} locations than at their \mathbf{x}^{pre} locations, provided that travel costs are sufficiently high that a separating equilibrium exists post merger. Consequently, $\Delta^{PL} < \Delta^{PO}$.

We are now ready to decompose Δm . Since $\Delta^{PL} = \Delta^{pre} + \Delta^{RE} + \Delta^{PL}$ and $p^{PO} = p^{pre} + \Delta^{PO}$,

$$\Delta m = m^{PL} - m^{PO} = \frac{\Delta^{RE}}{p^{pre}} + \frac{\Delta^{PL} - \Delta^{PO}}{p^{pre}}.$$

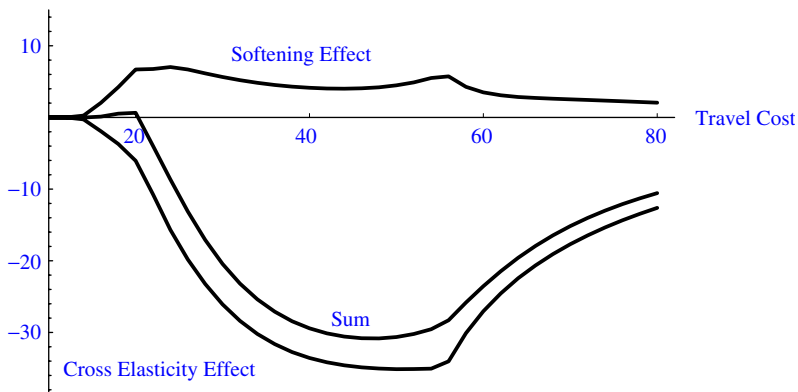


Figure 3
Decomposition of Merged Stores' Incremental Markup

The sign of Δm , thus, depends on whether the positive component, Δ^{RE}/p^{pre} , or the negative component, $(\Delta^{PL} - \Delta^{PO})/p^{pre}$, dominates. The first component is the 'softening of price competition effect,' and its positive sign results from the more-spread-out store locations in \mathbf{x}^{PL} as compared to \mathbf{x}^{pre} . The second component is 'cross-elasticity effect,' and its negative sign results from the fact that the cross price elasticity of demand between the merging stores is lower at \mathbf{x}^{RE} locations than at the \mathbf{x}^{pre} locations. Which effect dominates hinges on how close merging stores are per merger. The closer they are pre merger, the larger in magnitude is the cross elasticity effect, and hence the more likely it is that the merger is more anticompetitive in the price-only game than in the price-location game.

We focus on the policy relevant case in which the merging stores are close together in the pre-merger state, and the merger would thus be strongly flagged as anticompetitive in the price-only model. Referring to Figure 2, we choose the merging stores to be the two closest to 0. As a function of travel cost, Figure 3 plots for the merged firm the two terms appearing in the above equation—labelled the 'Softening Effect' and the 'Cross Elasticity Effect'—as well as their 'Sum.' As is apparent, the positive effect from softening price competition is far outweighed by the negative cross elasticity effect.

Figure 3 plots differences between the pre- and post-merger equilibria, and the local maxima and inflection points correspond to the points in Figure 2 at which increasing travel cost slightly generates additional separation of the stores in either the pre- or post-merger equilibrium. For example, before the merger, a full-separating equilibrium exists only for travel costs exceeding 56, and at $\tau = 56$, the Softening Effect has a local

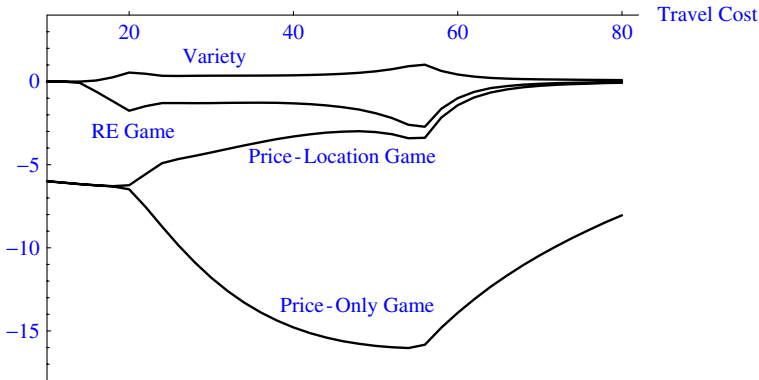


Figure 4
Post-Merger Consumer Welfare Changes

maximum. For $50 < \tau < 56$, increasing τ has almost no effect on the distance between the pre- and post-merger graphs in Figure 2, so increasing τ in this range decreases the intensity of price competition and thereby increases the Softening Effect. On the other hand, for $\tau > 56$, a full-separating equilibrium exists pre merger and increasing τ causes the pre- and post-merger graphs in Figure 2 to converge. In this range, the effect of increasing τ is to diminish the impact of the merger on store locations and thus to decrease the Softening Effect. Much the same logic explains all the peaks and inflection points in Figures 3, 4, and 5.

Post-merger product repositioning also confers consumer benefits not observed in the standard price-only model. Variety may increase, which would have a direct welfare-enhancing effect, and the post-merger price increases with post-merger product repositioning are apt to be significantly less. Figure 4 plots the percentage change in consumer welfare from the pre-merger game, G^{pre} , to four different post-merger states. The 'Variety' state refers to the post-merger state in which stores are at their post-merger locations in the price-location game, G^{PL} , but the prices are still at the pre-merger levels. The plot corresponding to this state is above the zero point on the consumer welfare axis, indicating that product repositioning enhances consumer welfare. The next post-merger state, labelled 'RE Game,' is the equilibrium of the intermediate game, G^{RE} . In this state, the prices in the Variety state are adjusted to an equilibrium level reflecting the post-merger locations of the stores. This change is driven by the softening of price competition effect and causes a slight post-merger decline in consumer welfare.

The next post-merger state, labelled 'Price-Location Game,' is the equilibrium of G^{PL} in which the merged stores price jointly at the

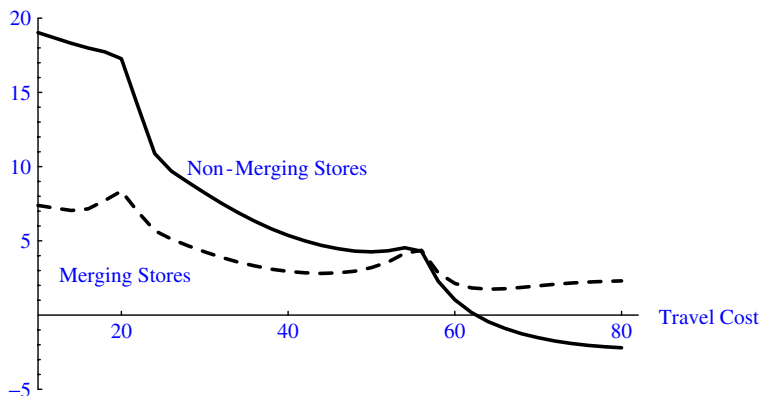


Figure 5
Post-Merger Profit Changes for Merging and Non-Merging Stores

repositioned locations. Consumer welfare falls below the G^{RE} level because the merger causes an increase in price. The final post-merger state is that of the 'Price-Only Game,' in which firms are constrained to remain at their pre-merger locations. Unless travel cost is quite low, this game displays a far greater consumer welfare loss following a merger than the price-location game. If travel cost is quite high, on the other hand, the welfare changes are the same for the Variety state, the RE Game, and the Price-Location Game because, as seen in Figure 2, consumers find stores at the same locations pre and post merger. The Price-Only Game exhibits by far the greatest reduction in consumer welfare from the merger because the merged stores are not separated by repositioning as they are in the other three post-merger states.

V. PRODUCER WELFARE

We now examine the effects of post-merger product repositioning on producer welfare. Recall that in the price-only model, the merged firm internalizes competition by raising prices. This increases the demand for the products of non-merging rivals, which profit directly and also indirectly by raising prices. By internalizing competition through product differentiation and making its stores the least substitutable pair in the market, the merged firm in the price-location game reduces its incentive to raise prices, so the demand of non-merging rivals consequently increases less in the price-location model than in the price-only model. Moreover, by taking the outside positions, and causing the non-merging products to retreat to inside positions, the merged firm causes its non-merging rivals to take more price competitive locations, which reduces their power over prices. The

combination of these effects leads to a significant reduction in the benefits a merger confers on non-merging rivals. In the price-location model, non-merging rivals actually can be made worse off by the merger.

Figure 5 plots the percentage change in profit between the pre-merger state and the post-merger product-repositioning state for the pair of merging stores and for the pair of non-merging stores. With low travel costs, the non-merging stores gain more from the merger than the merging stores, but as travel costs increase, post-merger repositioning of the merged stores increasingly disadvantages the non-merging stores. While a bit difficult to see in Figure 2, for $\tau > 56$, the non-merging stores find it optimal to reposition nearer to the midpoint of the interval when the merged firm repositions its stores to outside locations. This incentive strengthens as travel cost continues to rise. In fact, sufficiently high travel costs cause the non-merging firms to experience more intense competition than they did pre merger, and the non-merging stores actually lower their prices for $\tau > 58$. As is apparent from Figure 5, the non-merging firms are made worse off by the merger when travel cost is higher still.

VI. EMPIRICAL EVIDENCE

Section 202 of the Telecommunications Act of 1996 substantially relaxed the restrictions on the ownership of radio stations which had been imposed by the FCC. A wave of mergers immediately followed, and empirical research on the aftermath of those mergers provides interesting evidence. Berry and Waldfogel [2001] found that increases in market concentration across 158 local markets between 1993 and 1997 were associated with increases in variety. In addition, they found that commonly owned stations competing in the same market were significantly less likely than all stations to have the same format (although they were significantly more likely than all stations to have a similar format). Sweeting [2006] examined playlists over time and found that similarly formatted stations in the same local market tended to differentiate their playlists more when they became commonly owned and that this differentiation gained listeners. He also found stations did not change the amount of time devoted to commercials when they became commonly owned. The newspaper industry also has experienced many mergers, and George [2001] found that reducing the number of owners of daily papers in a city, holding the number of papers constant, caused an increase in variety as reflected in the 'beats' covered by the papers.

This evidence tends to support to the basic prediction of the price-location model that the merged firm has the incentive to separate products that were close substitutes before the merger. Competition among radio stations and newspapers, however, is far more complex than competition in our model, in particular because radio stations and newspapers operate in two-sided markets. This gives firms instruments for internalizing competition

following mergers that are not reflected in our model and that are interrelated. For example, a likely anticompetitive effect from a merger is higher advertising rates, but that can enhance consumer welfare by reducing the amount of advertising.

Also interesting is the single observation of the aftermath of Carnival Corporation's acquisition of P&O Princess Cruises, PLC. Both companies operated multiple cruise lines, and following the acquisition, Carnival transferred ships between its lines so as to reposition the Cunard Line, which it already had owned, as a premium brand and reposition P&O Cruises, which it acquired, to appeal primarily to British consumers.

VII. CONCLUSION

In our simple model, post-merger product repositioning substantially alters the effects of a merger because the merged firm finds it optimal to separate closely competing products combined by the merger. The merged firm's product repositioning both mitigates the reduction in consumer welfare the merger otherwise would produce and allows the merged firm to capture a much larger portion of the profits the merger generates. Repositioning of the sort predicted by our model has been observed following mergers of radio stations, newspapers and cruise lines.

The Horizontal Merger Guidelines [1997, §2.212] and the case law (*Oracle* [2004, pp. 1118, 1172]) anticipate the possibility that anticompetitive price effects from mergers are mitigated by the repositioning of non-merging products. Neither the Guidelines nor the case law anticipates the possibility that the anticompetitive effects of a merger are mitigated by the repositioning of merging products. Our analysis finds that the latter possibility is more important.

Of course, product repositioning in the real world can be quite expensive and time consuming, and mergers therefore may have no effect on product positioning over the relatively near term. Werden and Froeb [1998] showed that relatively modest fixed costs of entry generally can be expected to prevent entry in response to differentiated products mergers, and the same likely is true for product repositioning. Certainly, the significance of post-merger product repositioning must be judged on the basis of the facts associated with any particular merger.

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