

Switching Costs and the Timing of Merger-Induced Price Changes

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Abstract

This paper formalizes a non-cooperative explanation for pre-merger price increases. When consumers face switching costs, firms have strong incentives to offer bargain prices to lock in consumers whom they can exploit in the future. A future merger reduces a firm's incentive to gain current market share, however, because the firm anticipates sharing future profits. Focusing on near-term profit, it chooses pre-merger prices higher than prices absent a merger. This obtains for both horizontally related and unrelated merging partners. Mergers are profitable in both cases. Price dynamics depend on the horizontal relationship. These results have implications for empirical work on mergers.

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1. Introduction

Mergers raise antitrust concerns, in large part, because economic theory predicts that reduced competition may result in higher prices once the merger is consummated. To execute a merger, United States firms must submit paperwork to the Federal Trade Commission (FTC) and the Department of Justice (DOJ) convincing these authorities that the merger does not violate any antitrust laws.¹ The FTC/DOJ review also requires merging firms to delay collaborating on prices for at least 30 days, and this “waiting period” often spans several months.² Among the small number of empirical studies of merger-induced price changes, it is notable that three (Borenstein 1990; Kim and Singal 1993; Prager and Hannan 1998) estimate price increases during the pre-merger interval.³

The goal of this paper is to help explain and understand the economics of pre-merger price increases. One possible explanation, advanced by Kim and Singal (1993), is that merging firms find it easier to collude due to more frequent communication during negotiations over a proposed merger. While intuitive, this explanation is unsatisfying for two reasons. First, it relies on potentially illegal behavior. Firms caught “gun jumping,” as overt waiting-period coordination has come to be known, face potential penalties under the Hart-Scott-Rodino Act⁴ and, if they are competitors, Section 1 of the Sherman Act.⁵ Second, tacit collusion during the waiting period (which would be less likely to trigger enforcement action for “gun jumping”) relies on dynamic oligopoly theories of collusion. Since such theories are nearly always plagued by multiple equilibria, tacit collusion may not be a statistically falsifiable

¹The Hart-Scott-Rodino Act of 1976, also known as Section 7A of the Clayton Act, gives the US Department of Justice and Federal Trade Commission this authority. Firms of limited size are exempt. See Title 15, Chapter 1, Section 8 of the U.S. Code.

²If the FTC/DOJ request additional information, then there is an additional 30 day waiting period that begins once the merging firms provide FTC/DOJ with the necessary information. The recent Delta-Northwest merger was proposed April 14, 2008 and completed October 30, 2008. In the 14 airline mergers studied by Kim and Singal (1993), the average pre-merger window is about 5 months.

³See Weinberg (2008) for a survey of this literature. Prager and Hannan (1998) study interest rates on bank deposits and find merger-induced *decreases* in interest rates offered to consumers.

⁴For example, in *United States v. Gemstar-TV Guide International Inc.* [Civil Action No. 1:03CV00198 (February 6, 2003)], the US government alleged that Gemstar and TV Guide coordinated their actions on contracts and prices in the pre-merger period. Gemstar and TV Guide paid a penalty of \$5.68 million. See Gotts (2006, p. 91) and www.usdoj.gov/atr/cases/gemstar0.htm for further discussion.

⁵Sherman Act claims may be brought privately and violations carry the potential of treble damages. In *United States v. Computer Associates International, Inc. and Platinum Technology International* [Case No. 1:01CV02062 (September 28, 2001)], the Department of Justice alleged Section 1 violations. While the case was settled without treble damages, Computer Associates and Platinum agreed to several restrictions on conduct in future mergers and acquisitions. Hence, the gun-jumping action had the side effect of exposing the merging parties to greater future scrutiny.

explanation. Specifically, if such collusion explains pre-merger price increases, questions remain as to which of many collusive equilibria we should expect to see (Whinston 2006), and with what timing?⁶

As an alternative, I formalize an explanation for pre-merger price increases that relies on neither illegal nor cooperative behavior. First proposed informally by Weinberg (2008), this explanation rests on consumer switching costs. When consumers face costs in switching from one firm’s product to another firm’s product, as is the case in both the airline (Borenstein 1990; Kim and Singal 1993) and banking (Prager and Hannan 1998) industries, firms face dynamic incentives in choosing prices. By charging a low price today, a firm may attract new customers who are partially locked in to that same firm in the future (via, e.g., frequent-flier programs or costs of opening and closing accounts). In a standard multi-period oligopoly model of switching costs with initially new customers only, equilibrium price dynamics follow a “bargain-then-ripoff” pattern (Farrell and Klemperer 2007).

When a firm anticipates a future merger, however, its incentive to price low to gain market share is diminished by its lower share of post-merger profit. The merger induces a *myopia effect*, where merging firms capitalize in early periods by charging higher prices than they would absent a merger. I formalize this idea in a two-period, three-firm oligopoly model in which two firms exogenously merge between periods one and two. The model pairs a Salop (1979) circle of horizontally differentiated consumers with switching costs styled on Von Weiszäcker (1984) and Klemperer (1987a).⁷ My analysis identifies subgame-perfect Nash equilibria in prices.

The myopia effect generates higher period-one prices both when the merging firms compete horizontally and when the firms reside in non-overlapping but otherwise identical markets—i.e., on two different circles. Interestingly, both types of mergers are profitable for merging firms. The intuition for the latter case, which I term a *conglomerate merger*,⁸ is that the merger is a commitment device. Firms compete less fiercely in early periods

⁶Experimental evidence on the importance of communication for coordination is also decidedly mixed (Crawford 1998).

⁷Several other papers (Klemperer 1987b, 1995; Padilla 1992) study switching costs in two-period models. Farrell and Shapiro (1988) and Padilla (1995) consider infinite-horizon models.

⁸One could also think of this as a “market extension” merger in the sense used by Steiner (1975), e.g. a merger of airlines that serve entirely different city-pair markets. I favor the term “conglomerate” because none of my theoretical results for this case rely on economies due to product similarity among the merging firms. Indeed, the merging firms are neither horizontally nor vertically related prior to the merger.

when locked in to a future merger. The gains from the increase in current prices (in equilibrium) more than offset the decrease in future profits due to lower period-one market share. The non-merging firm, which chooses a lower period-one price in both the horizontal and conglomerate cases, always earns the highest profit.⁹

The myopia effect also generates higher period-one prices when consumers are either “naïve” or “rational,” in the sense used by Klemperer (1987a). In making their period-one purchase decisions, naïve consumers do not factor in the anticipated effect of those decisions on their expected period-two surpluses. Rational consumers, on the other hand, recognize that a period-one bargain will lead to partial lock-in and are therefore less price sensitive. In both cases, merging firms charge higher period-one prices than in the “no merger” case. As in Klemperer (1987a), equilibrium period-one prices are higher with rational (vs. naïve) consumers due to the relatively inelastic demand in the rational case. Interestingly, merging firms surrender less market share with rational consumers, as equilibrium period-one prices are closer together. As a result, they earn strictly higher profits.

Relative to a market without a merger, all post-merger prices are higher under a horizontal merger. However, merging firms’ post-merger prices are lower under a conglomerate merger. While a horizontal merger increases market power post-merger, a conglomerate merger does not. Indeed, the merged conglomerate prices lower to “catch up” to its non-merged competitors, who exploit their higher share of partially locked-in customers in period two. With rational consumers, however, the merged conglomerate does not fall as far behind, so it prices less aggressively in period two.

My results have implications for interpreting comparisons of prices pre-merger with prices post-merger. I confirm the importance of considering multiple event windows, as Borenstein (1990), Kim and Singal (1993) and Prager and Hannan (1998) did. If switching costs are present, mere comparisons of pre-merger to post-merger prices will be biased toward indicating no merger-induced price change. More importantly, I show that pre-merger price increases do not necessarily provide evidence of gun jumping.

My results also inform merger simulation, a tool used by the US Department of Justice and Federal Trade Commission in evaluating the anti-competitive effects of mergers (Peters 2006; Ashenfelter, Hosken and Weinberg 2009). The standard merger simulation uses

⁹The intuition for this routine result dates to at least Stigler (1950).

a static-oligopoly, price-competition framework to estimate demand parameters with pre-merger data, then simulates the effects of consolidation on prices post-merger. If switching costs are present but are not included in the demand side of the model, then simulation will predict price adjustment paths that do not account for the dynamic nature of competition. As shown in my analysis, price dynamics differ substantially between the horizontal and conglomerate cases, between these two cases and the “no merger” case and between all these cases and the “no switching costs” case.

Finally, these results also offer a profit motivation for conglomerate mergers that is, to my knowledge, entirely novel. It therefore complements existing theories of financial economies such as diversification of risk (Lintner 1971) or managerial synergies (Matsusaka 1993), and explanations based on temporal fluctuations in stock-market valuations of merging firms (Schleifer and Vishny 1998).¹⁰ One straightforward prediction is that, all else equal, conglomerate mergers should be more profitable when consumer switching costs are present.

2. The Model

I adapt the Salop (1979) circle model of horizontal differentiation to a setting of switching costs and mergers. A mass of risk-neutral consumers, each of whom buys either 0 or 1 units of a single consumption good per period, are uniformly distributed along a circle of unit circumference. Each consumer receives gross benefit V from consuming the good. If she travels d units of distance to purchase the good at price P , she suffers cost $P + td^2$, for *transportation cost* $t > 0$.

Three firms, indexed by $j \in \{A, B, C\}$, are located equidistant from each other on the circle, with firm A located at $x = 0$ (which is also $x = 1$), firm B located at $x = \frac{1}{3}$ and firm C located at $x = \frac{2}{3}$ (see Figure 1). Fixed and marginal costs are normalized to zero. The firms compete in prices over two periods. Denote firm j 's price in period $i \in \{1, 2\}$ as P_i^j . Adopting the convention that **bold** letters represent vectors, let $\mathbf{P}_i \equiv \{P_i^A, P_i^B, P_i^C\}$ denote prices for period i .

If she has not previously purchased a good from firm j , then a consumer suffers *switching*

¹⁰See Steiner (1975) and Mueller (1977) for an overview of theories of conglomerate mergers and for discussion of the conglomerate merger wave of the late 1960s.

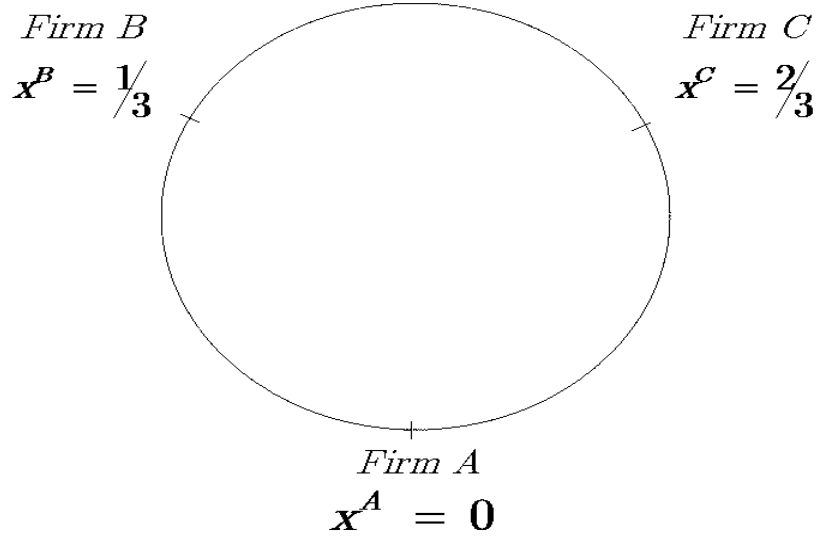


Figure 1: *The Basic Model*

cost $s > 0$ to purchase from that firm.¹¹ Thus, if in period i , she has not previously bought from firm j , her utility from purchasing there is

$$U_{i,s}^j = V - P_i^j - t(d^j)^2 - s,$$

where d^j is the distance traveled to firm j . Her utility from a repeat purchase from firm j is

$$U_i^j = V - P_i^j - t(d^j)^2.$$

Firms and consumers discount period-two surpluses at rate $\delta \in [0, 1]$. In period one, none of the consumers have previously bought. In period two, fraction ν of period-one consumers exit the market and are replaced by an identically-sized group of new consumers, whose tastes are uniformly distributed on the circle. Fraction $1 - \nu$ of period-one consumers have tastes for product characteristics (apart from switching costs) independent of their period-one tastes. This group is randomly reassigned, uniformly, along the circle in period two.

¹¹I use “she” when referring to a consumer and “he” when referring to the owner of a firm.

None of the period-one consumers knows which category (of future preference changes) she is in prior to her period-one purchase, and her location on the circle is independent of which category she is in.

Each firm seeks to maximize expected discounted profits. I identify subgame-perfect Nash equilibria for firms' prices. In period two, firms prices form a Nash equilibrium, conditional on period-one market shares $\sigma(\mathbf{P}_1) \equiv \{\sigma^A(\mathbf{P}_1), \sigma^B(\mathbf{P}_1), \sigma^C(\mathbf{P}_1)\}$. In period one, firms rationally anticipate the effects of their period-one prices on period-two profits. Period-one prices form a Nash equilibrium.

Mergers aside, the basic model shares many features of the models of Von Weizsäcker (1984) and Klemperer (1987a). Most notably, I adopt their specification for the switching cost and include a group of consumers who remain in the market but whose tastes change randomly across periods. This group of consumers establishes a dynamic link between periods. Without them ($\nu = 1$), the model collapses to a sequence of two one-shot games.¹² Like Klemperer (1987a) but unlike Von Weizsäcker (1984), I permit firms to change prices across periods. This helps to illustrate price dynamics pre- and post-merger and to highlight differences across the three cases considered below. Unlike either of the other models, my setup includes three firms instead of two. This permits the comparison of prices of merging firms with those of a non-merging firm. Finally, for technical reasons I also depart from the other papers in modeling transportation costs as quadratic in distance traveled.¹³

2.1. No Merger

The “no merger” case serves as a benchmark. Firm j 's profit is written

$$\Pi_{NoMerger}^j = \pi_1^j + \delta\pi_2^j, \tag{1}$$

where

$$\pi_i^j = P_i^j D_i^j(\mathbf{P}_i) \tag{2}$$

¹²Klemperer (1987a) also includes a group of consumers whose preferences do not change across periods (and who never switch in equilibrium). As I am not primarily concerned with comparing equilibrium prices to what would obtain in a world without switching costs, adding these consumers in would not qualitatively change my results so long as parameters are such that interior solutions obtain—essentially, one would merely redefine the parameter ϕ from section 3.2. I abstract from this class of consumers to keep the assumptions for guaranteeing non-pathological equilibria as simple as possible.

¹³Under linear transportation costs, equilibrium is not guaranteed in the post-merger period under a horizontal merger.

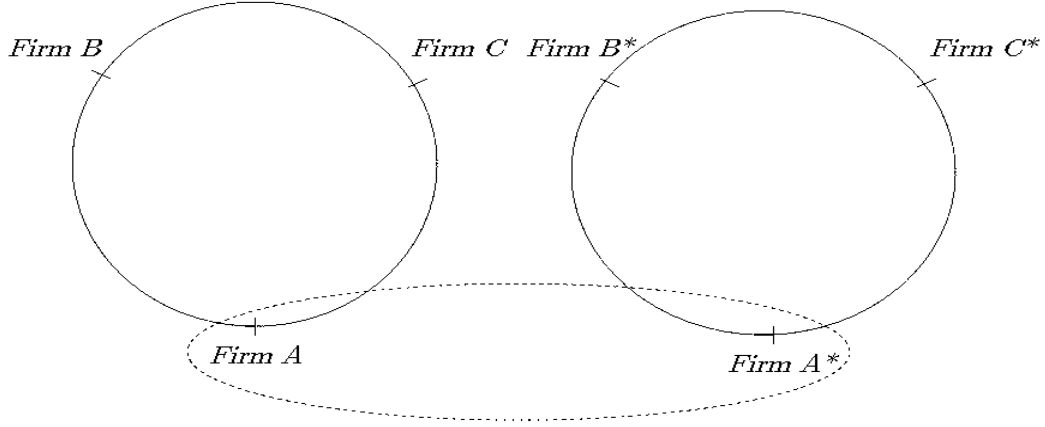


Figure 2: *Period Two Under a Conglomerate Merger*

and D_i^j represents firm j 's demand in period i . Firms choose prices non-cooperatively in each period.

2.2. A Conglomerate Merger

In a conglomerate merger, two firms in unrelated but otherwise identical markets—i.e. on two different circles—merge between periods one and two. The owners then share profits evenly in period two. Denote the three firms on the second circle as A^* , B^* and C^* , and let firm A merge with firm A^* . Figure 2 illustrates period two of this case. To fix ideas on the interaction of switching costs and the *anticipation* of a merger, I assume no cost synergies for the merging firms.

The profits of firms B and C follow (1). Firm A 's owner earns profit

$$\Pi_{Cong}^A = \pi_1^A + \delta \left(\frac{\pi_2^A}{2} + \frac{\pi_2^{A^*}}{2} \right), \quad (3)$$

where π_i^A follows (2). Since A and A^* are identical, the owner of firm A earns $\pi_1^A + \delta\pi_2^A$

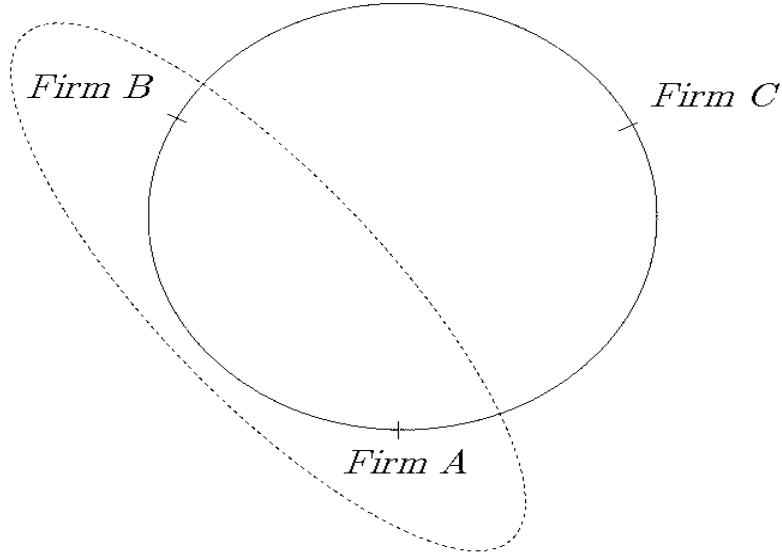


Figure 3: *Period Two Under a Horizontal Merger*

in equilibrium. However, the owner will compete differently than in the “no merger” case because his period-one price affects only the $\frac{\pi_2^A}{2}$ part of his period-two payoff.

2.3. A Horizontal Merger

In a horizontal merger, firm *A* merges with firm *B* between periods one and two. Figure 3 illustrates period two of the horizontal merger case. As in the conglomerate case, there are no cost synergies from merging. Firm *C*’s profit follows (1). Letting Π_{Horiz}^A denote firm *A*’s owner’s payoff under a horizontal merger, we have the following:

$$\begin{aligned}
 \text{Firm A: } \quad \Pi_{Horiz}^A &= \pi_1^A + \delta \left(\frac{\pi_2^M}{2} \right) \\
 \text{Firm B: } \quad \Pi_{Horiz}^B &= \pi_1^B + \delta \left(\frac{\pi_2^M}{2} \right),
 \end{aligned} \tag{4}$$

where $\pi_2^M = \pi_2^A + \pi_2^B$, with π_2^j defined as in (2), denotes the period-two payoff of the merged firm *M*. The owners of firms *A* and *B* choose P_1^A and P_1^B non-cooperatively, then choose P_2^A and P_2^B cooperatively.

3. Equilibrium under No Merger

This case is similar to the two-firm analysis of Klemperer (1987a). I approach the problem recursively.

3.1. Period Two

Consider the different groups of consumers. Fraction ν are new consumers, who buy from firm A if $P_2^A + t(x - x^A)^2 < P_2^j + t(x - x^j)^2$ for $j \in \{B, C\}$. This condition holds for any

$$x \in [0, x_2^{AB}(\emptyset)],$$

where the *pivotal* buyer

$$x_2^{AB}(\emptyset) = \frac{1}{6} + \frac{3(P_2^B - P_2^A)}{2t}$$

is indifferent between buying from A and B .¹⁴ I use the argument \emptyset here to represent the fact that this cutoff applies to consumers whose set of previous purchases is empty. Consumers with locations

$$x \in [x_2^{AC}(\emptyset), 1],$$

where the pivotal buyer

$$x_2^{AC}(\emptyset) = \frac{5}{6} + \frac{3(P_1^A - P_1^C)}{2t}$$

is indifferent between buying from A and C , also buy from A in period two. Firm A thus sells to mass $\nu \left[\frac{1}{3} + \frac{3}{2t}(P_2^B + P_2^C - 2P_2^A) \right]$ of these customers.

The fraction $(1 - \nu)\sigma^A$ purchased from firm A in period one, but have uniformly distributed tastes in period two. Conditional on buying from A in period one and on being in this group of consumers, the consumer will again buy from A if

$$x \in [0, x_2^{AB}(A)],$$

where

$$x_2^{AB}(A) = \frac{1}{6} + \frac{3(P_2^B - P_2^A)}{2t} + \frac{3s}{2t}, \quad (5)$$

¹⁴Without loss, I assume indifferent consumers purchase from the firm with the highest x^j .

or if

$$x \in [x_2^{AC}(A), 1],$$

where

$$x_2^{AC}(A) = \frac{5}{6} + \frac{3(P_1^A - P_1^C)}{2t} - \frac{3s}{2t}. \quad (6)$$

The consumer buys from B if

$$x \in [x_2^{AB}(A), x_2^{BC}(A)],$$

where

$$x_2^{BC}(A) = \frac{1}{2} + \frac{3(P_2^C - P_2^B)}{2t} \quad (7)$$

does not depend on s because the consumer pays s when buying either B or C . The consumer buys from C if

$$x \in [x_2^{BC}(A), x_2^{AC}(A)].$$

Hence, A 's product is most attractive to mass $(1 - \nu)\sigma^A \left[\frac{1}{3} + \frac{3}{2t}(P_2^B + P_2^C - 2P_2^A + 2s) \right]$. Constructing cutoffs analogous to (5)-(7) for consumers who bought from B and C in period one, we find that A also sells to mass $(1 - \nu)\sigma^B \left[\frac{1}{3} + \frac{3}{2t}(P_2^B + P_2^C - 2P_2^A - s) \right]$ and to mass $(1 - \nu)\sigma^C \left[\frac{1}{3} + \frac{3}{2t}(P_2^B + P_2^C - 2P_2^A - s) \right]$.

Writing period-two demand for firm j , D_2^j , as a function of period-one market shares and period-two prices, we have

$$\begin{aligned} D_2^j(\sigma(\mathbf{P}_1), \mathbf{P}_2) = & \nu \left[\frac{1}{3} + \frac{3}{2t}(P_2^k + P_2^l - 2P_2^j) \right] \\ & + (1 - \nu)\sigma^j \left[\frac{1}{3} + \frac{3}{2t}(P_2^k + P_2^l - 2P_2^j + 2s) \right] \\ & + (1 - \nu)(\sigma^k + \sigma^l) \left[\frac{1}{3} + \frac{3}{2t}(P_2^k + P_2^l - 2P_2^j - s) \right], \end{aligned} \quad (8)$$

for $j, k, l \in \{A, B, C\}$ and $j \neq k \neq l$. This expression constitutes demand if the following two conditions are satisfied.

Condition 1. $s \leq \frac{t}{9} - |P_2^j - P_2^k|$ for all $j, k \in \{A, B, C\}$.

Condition 2. $r \geq s + P_2^j + t(x^j - x_2^{jk}(l))^2$ for all $j, k \in \{A, B, C\}$ with $j \neq k$, and all $l \in \{A, B, C, \emptyset\}$.

If Condition 1 holds, then each seller has a positive market share for each category of consumers in period two. Condition 1 is guaranteed by assuming a “sufficiently low” switching cost, $s \leq \frac{2t}{27}$.¹⁵ If Condition 2 holds, then all pivotal buyers derive non-negative utility from buying. It is guaranteed by assuming a “sufficiently high” reservation value, $r \geq s + \frac{8t}{27}$.¹⁶ Jointly, the sufficient assumptions $s \leq \frac{2t}{27}$ and $r \geq s + \frac{8t}{27}$ guarantee concave profit functions and unique, interior solutions for periods one and two.

Substituting the expression for demand from (8) into the profit function (2), taking the first-order condition with respect to P_2^j and rearranging terms, I identify firm j 's period-two best-response function:

$$P_2^j = \frac{t}{6} \left\{ \left[\frac{1}{3} + \frac{3}{2t}(P_2^k + P_2^l) \right] + \frac{3(1-\nu)s}{2t}(3\sigma^j - 1) \right\}$$

for $j, k, l \in \{A, B, C\}$ and $j \neq k \neq l$. The first-order conditions yield a 3×3 linear system of equations. Its solutions are

$$P_2^j = \frac{t}{9} + \frac{(1-\nu)s}{5}(3\sigma^j - 1) \quad (9)$$

for all $j \in \{A, B, C\}$.

If $\nu < 1$ and $s > 0$, then each firm's period-two price is increasing in its period-one market share, $\frac{dP_2^j}{d\sigma^j} = \frac{3(1-\nu)s}{5} > 0$. Switching costs allow firm j to take advantage of its period-one customers by charging a higher price. If all customers are new ($\nu = 1$), then firm j has no switching cost advantage over any customers, so market share does it no good. Market share also does it no good if there are no switching costs ($s = 0$).

Each firm's price is increasing in the size of the switching cost if and only if its market share exceeds $\frac{1}{3}$, as $\frac{dP_2^A}{ds} = \frac{(1-\nu)}{5}(3\sigma^j - 1)$. The level of the switching cost only matters at the margin for the $(1-\nu)$ customers whose tastes are randomly reassigned in period two. Firm j benefits from a larger s with the $(1-\nu)\sigma^j$ fraction of customers whose tastes are

¹⁵Effectively, this guarantees that a “randomly reallocated” consumer located at x^j purchases from firm j in period two in the case where the consumer bought from a different firm in period one. The highest possible $|P_2^j - P_2^k|$ is $\frac{t}{27}$; this obtains under a horizontal merger with $\delta = 0$. Inserting this difference into Condition 1, we get sufficiency for the entire analysis.

¹⁶The highest possible P_i^j is $\frac{5t}{27}$, the period-two price for the merged firm under a horizontal merger for the case $\delta = 0$. Given condition 1, the greatest distance traveled by any purchasing consumer does not exceed $\frac{1}{3}$, so $t(x_i^j - x_i^{jk}(l))^2 \leq \frac{t}{9}$. Inserting the maximum price and maximum distance traveled into condition 2, we get sufficiency for the entire analysis.

random, as a larger s gives it more market power with these customers. This benefit favors j versus both k and l . On the other hand, a larger s hurts j in selling to the $(1 - \nu)(\sigma^k + \sigma^l)$ customers who bought from a different firm in period one and whose tastes are random in period two. Since the firms are identical, the *distribution* of market share among firms k and l is irrelevant to j . Indeed, the negative effect for these customers is identical in size to the positive effect for the $(1 - \nu)\sigma^j$ customers.¹⁷ Hence, j increases its price in response to an increase in the switching cost if its market share is larger than the average $\frac{1}{3}$, and lowers its price if its market share is smaller than average. If $\sigma^j = \frac{1}{3}$, then its price does not depend on s .

Next, consider equilibrium demands. With the prices given in (9), demands among the fraction ν of new customers are

$$D_2^{j,\nu} = \frac{1}{3} + \frac{9(1 - \nu)s}{10t}(1 - 3\sigma^j).$$

Similarly, among the fraction $(1 - \nu)$ of the randomly reassigned customers, we have

$$D_2^{j,1-\nu} = D_2^{j,\nu} + \frac{3s}{2t}(3\sigma^j - 1).$$

Collecting terms and doing a bit of algebra, I can show the useful result that demands are proportional to prices

$$D_2^j = \frac{1}{3} + \frac{3(1 - \nu)s}{5t}(3\sigma^j - 1) = \frac{3P_2^j}{t}. \quad (10)$$

Clearly, if $\sigma^j = \frac{1}{3}$ for all j , then the equilibrium in a one-shot game ($D_2^j = \frac{1}{3}$ and $P_2^j = \frac{t}{9}$ for all j) obtains.

3.2. Period One

Following Klemperer (1987a), I consider two assumptions about consumer beliefs. The simplest case is *naïve* consumers, who do not factor in the impact of their period-one purchases on their expected period-two surpluses. I also consider *rational* consumers, who do

¹⁷This stems from the uniform distribution of consumers whose tastes are randomly reassigned between periods. With a non-uniform reallocation of consumers, firms would be more sensitive to attracting consumers located in population-dense locations.

factor in such surpluses.

Naïve Consumers

Intuitively, naïve consumers are exposed to period-one choices made by others and are then themselves purchasers in period two. For example, a parent might acquire miles in an airline frequent-flyer plan in purchasing plane tickets for a child, who later makes her own purchases (possibly in a different city served by different major air carriers).

Since no consumer has yet purchased, pivotal buyers follow $x^{AB}(\emptyset)$, $x^{BC}(\emptyset)$ and $x^{AC}(\emptyset)$ from section 3.1. Period-one demand satisfies

$$D_1^j = \sigma^j = \frac{1}{3} + \frac{3}{2t} [P_1^k + P_1^l - 2P_1^j],$$

for $j, k, l \in \{A, B, C\}$ and $j \neq k \neq l$. Firm j 's period-one pricing problem is

$$\text{Max}_{\{P_1^j\}} P_1^j \sigma^j(\mathbf{P}_1) + \delta \pi_2^j(\sigma(\mathbf{P}_1)) \quad (11)$$

Given symmetry, the Nash equilibrium price must satisfy

$$\left\{ P_1^j \frac{d\sigma^j(\mathbf{P}_1)}{dP_1^j} + \sigma^j(\mathbf{P}_1) + \delta \left[P_2^j(\sigma(\mathbf{P}_1)) \frac{dD_2^j(\sigma(\mathbf{P}_1))}{dP_1^j} + \frac{dP_2^j(\sigma(\mathbf{P}_1))}{dP_1^j} D_2^j(\sigma(\mathbf{P}_1)) \right] \right\}_{P_1^j=P_1^k=P_1^l} = 0 \quad (12)$$

Symmetry implies that $\sigma^j = \frac{1}{3}$, $P_2^j = \frac{t}{9}$ and $D_2^j = \frac{1}{3}$ and it is easy to show that

$$\frac{dP_2^A}{dP_1^A} = -\frac{3}{t} \quad \frac{dP_2^A}{dP_1^A} = \frac{3s(1-\nu)}{5} \left(-\frac{3}{t}\right) \quad \frac{dD_2^A}{dP_1^A} = \frac{9s(1-\nu)}{5t} \left(-\frac{3}{t}\right), \quad (13)$$

where I use (10) to get demand.

Plugging into (12) and simplifying, we have equilibrium prices

$$P_1^A = P_1^B = P_1^C = \frac{t}{9} \left(1 - \frac{2\delta\phi}{5}\right), \quad (14)$$

where I define $\phi \equiv \frac{9s(1-\nu)}{t}$ to streamline notation.¹⁸ Along with the discount factor δ , this term summarizes the importance of switching costs in pricing. I say that switching costs

¹⁸Note that this definition yields $0 \leq \phi < 1$, where the second inequality follows from the assumption $s \leq \frac{2t}{27}$, which is sufficient for Condition 1. This proves convenient in characterizing our results and in proving propositions.

matter if and only if $\delta\phi > 0$. As in Klemperer (1987a), the prices in (14) are lower than in a one-shot model without switching costs as long as switching costs matter.

Rational Consumers

If consumers have rational expectations, then they factor the difference in the expected period-two surplus into their decision of whether to buy in period one. For example, a rational consumer deciding which cellular phone to buy recognizes that a low price for an initial contract may not be duplicated in subsequent contracts. She also anticipates that it is possible she will no longer live in an area in which the phone company provides reliable service. Both of these things tend to make her less sensitive to price.

Consider period-one demand. A consumer located at x gets period-one surpluses of $V - P_1^A - t(x - x^A)^2 - s$ and $V - P_1^B - t(x - x^B)^2 - s$ from buying from A and B, respectively. With probability ν , the consumer is out of the market (so that period two does not matter). With probability $(1 - \nu)$, the consumer's tastes are uniformly distributed on the circle. Suppose a consumer buys from A in period one. If the consumer buys from A a second time, which she will do if she is located at $x \in [0, x^{AB}(A))$ [recall (5)] or at $x \in [x^{AC}(A), 1]$ [recall (6)], then she realizes a surplus of $V - P_2^A - t(x - x^A)^2$. If she buys from firm B, which she will do if she is located at $x \in [x^{AB}(A), x^{BC}(A))$ [recall (7)], then she realizes a period-two surplus of $V - P_2^B - t(x - x^B)^2 - s$. The consumer buys from C if she is located at $x \in [x^{BC}(A), x_2^{AC}(A))$ realizing a period-two surplus of $V - P_2^C - t(x - x^C)^2 - s$.

Hence, her expected period-two surplus, conditional on buying from A in period one and being in the group of consumers with randomly reassigned tastes, is δ times

$$\int_0^{x_2^{AB}(A)} [V - P_2^A - t(x - x^A)^2] dx + \int_{x_2^{AB}(A)}^{x_2^{BC}(A)} [V - P_2^B - t(x - x^B)^2 - s] dx \\ + \int_{x_2^{BC}(A)}^{x_2^{AC}(A)} [V - P_2^C - t(x - x^C)^2 - s] dx + \int_{x_2^{AC}(A)}^1 [V - P_2^A - t(x - x^A)^2] dx.$$

Writing analogous expressions for period-two surplus conditional on buying from firm B in period one, integrating the expressions, factoring in period-one surpluses and simplifying notation, we see the gain in surplus to a consumer located at x from buying from A rather than B in period one is

$$\left[P_1^B - P_1^A - \frac{2tx}{3} + \frac{t}{9} \right] + \delta \left[\frac{\phi}{2} (P_2^B - P_2^A) \right].$$

Similar expressions can be derived for the gain in surplus from buying from A instead of C and from buying from B instead of C . By (9), we have $P_2^B - P_2^A = \frac{3(1-\nu)s}{5}(\sigma^B - \sigma^A)$. Substituting, I find the condition for the period-one cutoff buyers

$$0 = \left[P_1^B - P_1^A - \frac{2t}{3}x_1^{AB} + \frac{t}{9} \right] + \delta \left[\left(\frac{t(\sigma^B - \sigma^A)}{30} \right) \phi^2 \right]. \quad (15)$$

We also have

$$\begin{aligned} \sigma^B - \sigma^A &= (x_1^{BC} - x_1^{AB}) - (x_1^{AB} + (1 - x_1^{AC})) \\ &= x_1^{BC} + x_1^{AC} - 2x_1^{AB} - 1, \end{aligned}$$

where the cutoff is the same for all consumers (who are all new in period one). Substituting this into (15) yields one equation in the three unknown cutoff buyers $\{x_1^{AB}, x_1^{BC}, x_1^{AC}\}$. Performing similar calculations for B versus C and A versus C yields 2 more equations written as functions of the same three cutoff buyers. Solving these 3 equations yields

$$\begin{aligned} x_1^{AB} &= \frac{1}{6} + \frac{\frac{3}{y}(P_1^B - P_1^A)}{2t} & \sigma^A &= \frac{1}{3} + \frac{3}{2ty} (P_1^B + P_1^C - 2P_1^A) \\ x_1^{BC} &= \frac{1}{2} + \frac{\frac{3}{y}(P_1^C - P_1^B)}{2t} & \sigma^B &= \frac{1}{3} + \frac{3}{2ty} (P_1^A + P_1^C - 2P_1^B) \\ x_1^{AC} &= \frac{5}{6} + \frac{\frac{3}{y}(P_1^A - P_1^C)}{2t} & \sigma^C &= \frac{1}{3} + \frac{3}{2ty} (P_1^A + P_1^B - 2P_1^C), \end{aligned} \quad (16)$$

where

$$y = 1 + \delta \left(\frac{3\phi^2}{20} \right) > 1$$

implies that period-one demand is more inelastic when consumers are rational about period two.

Now, consider the firms' period-one pricing problems, which are similar to the analogous case of naïve consumers [recall (11)]. The first-order condition for P_1^j follows (12), while $\frac{d\sigma^j}{dP_1^j}$, $\frac{dP_2^j}{dP_1^j}$ and $\frac{dD_2^j}{dP_1^j}$ follow (13) except that they are proportional to $-\frac{3}{ty}$ instead of $-\frac{3}{t}$. Plugging $\sigma^j = \frac{1}{3}$ and $P_2^j = \frac{t}{9}$ for all j into (12) and solving, we have

$$P_1^A = P_1^B = P_1^C = \frac{t}{9} \left[y - \frac{2\delta\phi}{5} \right].$$

As in Klemperer (1987a), when consumers have rational expectations, period-one competition is softened and prices are higher (relative to the naïve case).¹⁹ Non-zero price differences

¹⁹Klemperer (1987a) also shows that if there are enough consumers whose preferences are unchanged, period-one prices can be higher than in a model without switching costs.

in period one would lead to non-zero price differences in period two, with the period-one-low-price firms charging higher prices in period two. Hence, these price differences increase the likelihood that a consumer purchasing the lower-priced product in period one will wind up paying switching costs in period two. Consumers are hesitant to do this, making them less price sensitive.

4. Equilibrium under a Conglomerate Merger

Consider the case of two three-firm industries, each playing the two-period Salop circle game as described in section 3. The prices chosen by firms on one circle have no effect on the payoffs on the other circle. As in figure 2, let the firms competing on the second circle be A^* , B^* and C^* . Suppose firms A and A^* exogenously merge between periods one and two and that they anticipate the merger from the beginning of the game.

Since the circles are ex ante identical, it suffices to study one circle. We write

$$\text{Firm A: } \text{Max}_{\{P_1^A\}} P_1^A \sigma^A(\mathbf{P}_1) + \delta \left[\frac{1}{2} \pi_2^A(\sigma(\mathbf{P}_1)) + \frac{1}{2} \pi_2^{A^*} \right]$$

$$\text{Firm B: } \text{Max}_{\{P_1^B\}} P_1^B \sigma^B(\mathbf{P}_1) + \delta \pi_2^B(\sigma(\mathbf{P}_1))$$

$$\text{Firm C: } \text{Max}_{\{P_1^C\}} P_1^C \sigma^C(\mathbf{P}_1) + \delta \pi_2^C(\sigma(\mathbf{P}_1)).$$

Since the merging firms are located on different circles, period two competition on each circle follows that from the “no merger” case in section 3.1. Period-two prices and demands, as functions of period-one market shares, follow (9) and (10).

Consider period one. The first-order conditions are quite similar to those in (12):

$$\begin{aligned} P_1^A \frac{d\sigma^A(\mathbf{P}_1)}{dP_1^A} + \sigma^A(\mathbf{P}_1) + \frac{\delta}{2} \left\{ P_2^A(\sigma(\mathbf{P}_1)) \frac{dD_2^A(\sigma(\mathbf{P}_1))}{dP_1^A} + \frac{dP_2^A(\sigma(\mathbf{P}_1))}{dP_1^A} D_2^A(\sigma(\mathbf{P}_1)) \right\} &= 0 \\ P_1^B \frac{d\sigma^B(\mathbf{P}_1)}{dP_1^B} + \sigma^B(\mathbf{P}_1) + \delta \left\{ P_2^B(\sigma(\mathbf{P}_1)) \frac{dD_2^B(\sigma(\mathbf{P}_1))}{dP_1^B} + \frac{dP_2^B(\sigma(\mathbf{P}_1))}{dP_1^B} D_2^B(\sigma(\mathbf{P}_1)) \right\} &= 0 \\ P_1^C \frac{d\sigma^C(\mathbf{P}_1)}{dP_1^C} + \sigma^C(\mathbf{P}_1) + \delta \left\{ P_2^C(\sigma(\mathbf{P}_1)) \frac{dD_2^C(\sigma(\mathbf{P}_1))}{dP_1^C} + \frac{dP_2^C(\sigma(\mathbf{P}_1))}{dP_1^C} D_2^C(\sigma(\mathbf{P}_1)) \right\} &= 0. \end{aligned} \quad (17)$$

Using the symmetry of firms B and C , I impose $P_1^B = P_1^C$ and reduce the number of conditions to two.

Naïve Consumers

For the case of naïve consumers, I substitute for $\frac{d\sigma^j}{dP_1^j}$, $\frac{dP_2^j}{dP_1^j}$ and $\frac{dD_2^j}{dP_1^j}$ using (13), substitute $\phi = \frac{9(1-\nu)s}{t}$ and perform some algebra to find the following two equations in two unknowns, which characterize best responses:

$$\begin{aligned} P_1^A \left(\frac{-3}{t} \right) + \left(\frac{1}{3} + \frac{3(P_1^B - P_1^A)}{t} \right) + \frac{\delta}{2} \left\{ \left(\frac{-3}{t} \right) \left(\frac{2\phi}{5} \right) \left[\frac{t}{9} + \frac{\phi(P_1^B - P_1^A)}{5} \right] \right\} &= 0 \\ P_1^B \left(\frac{-3}{t} \right) + \left(\frac{1}{3} + \frac{3(P_1^A - P_1^B)}{2t} \right) + \delta \left\{ \left(\frac{-3}{t} \right) \left(\frac{2\phi}{5} \right) \left[\frac{t}{9} + \frac{\phi(P_1^A - P_1^B)}{10} \right] \right\} &= 0. \end{aligned}$$

Note that the terms in square brackets equal P_2^A and P_2^B , respectively. Solving these equations yields

$$\begin{aligned} P_1^A &= \frac{t}{9} \left[1 - \delta\phi \left(\frac{175 - 6\delta\phi^2}{625 - 20\delta\phi^2} \right) \right] & \sigma^A &= \frac{1}{3} \left[1 - \frac{50\delta\phi}{625 - 20\delta\phi^2} \right] \\ P_1^B = P_1^C &= \frac{t}{9} \left[1 - \delta\phi \left(\frac{225 - 6\delta\phi^2}{625 - 20\delta\phi^2} \right) \right] & \sigma^B = \sigma^C &= \frac{1}{3} \left[1 + \frac{25\delta\phi}{625 - 20\delta\phi^2} \right], \end{aligned} \quad (18)$$

and I can state the following.

Proposition 1. *Suppose that switching costs matter. In the conglomerate merger case, all firms charge period-one prices higher than in the “no merger” case, and $P_1^A > P_1^B = P_1^C$.*

Having less of a stake in its own period-two profits, firm A focuses more on earning profit in period 1 and sets a higher price. Note from A 's first-order condition in (17) that it behaves exactly as would a firm not anticipating a merger but with a discount factor half as high. That is, it behaves *myopically* relative to its behavior in the “no merger” case. I therefore refer to the effect of the merger on A 's period-one price as a myopia effect. Obviously, firm A^* behaves the same as A .

In period two, the merged firm inherits a relatively low σ^A , but otherwise competes in the two markets on equal footing with the non-merged firms. As a result it prices more aggressively to recover market share, while the non-merged firms exploit their partially locked-in customers bases by charging higher prices. Solving for period-two prices using (9) and demands using (10), we find

$$\begin{aligned} P_2^A &= \frac{t}{9} \left[1 - \frac{10\delta\phi^2}{625 - 20\delta\phi^2} \right] & D_2^A &= \frac{1}{3} \left[1 - \frac{10\delta\phi^2}{625 - 20\delta\phi^2} \right] \\ P_2^B = P_2^C &= \frac{t}{9} \left[1 + \frac{5\delta\phi^2}{625 - 20\delta\phi^2} \right] & D_2^B = D_2^C &= \frac{1}{3} \left[1 + \frac{5\delta\phi^2}{625 - 20\delta\phi^2} \right]. \end{aligned}$$

Since A and A^* are identical, the merged firm earns two times π_2^A . Thus, in determining whether the merger is profitable, it suffices to compare $\pi_1^A + \delta\pi_2^A$ in the “no merger” and “merger” cases. It is immediately clear that π_2^A is less than in the case with no merger, as $P_2^A \leq \frac{t}{9}$ and $D_2^A \leq \frac{1}{3}$. However, the extra profit it earns in period one more than makes up for this.

Proposition 2. *A conglomerate merger is profitable for merging firms. Non-merging firms’ profits increase by more.*

Intuitively, the prospect of a conglomerate merger between firms A and A^* serves as a commitment device for both firms’ owners to behave myopically for one period. By slackening the incentive to compete for market share, this partially mitigates the negative external effect generated by switching costs. Overall, the myopia effect generated by the merger increases profit because firms A and A^* behave as if they value period-two profit half as much, which increases period-one profit a lot, but sacrifice only a fractional amount of period-two profit in equilibrium.

To see this in sharp relief, note that if firms A , B and C simultaneously merged with A^* , B^* and C^* respectively, all firms’ profits would rise. Period-one prices would follow the “no merger” equilibrium (14), except that each firm would price as if it had a discount factor half as high. Hence, this set of mergers induces higher period-one prices, while market shares and period-two prices would be the same.

Rational Consumers

Under rational expectations, the results are different in straightforward, but qualitatively important, ways. Once again, $\frac{d\sigma^j}{dP_1^j}$, $\frac{dP_2^j}{dP_1^j}$ and $\frac{dD_2^j}{dP_1^j}$ are each proportional to $-\frac{3}{ty}$ instead of $-\frac{3}{t}$ in the first-order conditions, so that best responses are characterized by the following:

$$P_1^A \left(\frac{-3}{ty} \right) + \left(\frac{1}{3} + \frac{3(P_1^B - P_1^A)}{ty} \right) + \frac{\delta}{2} \left\{ \left(\frac{-3}{ty} \right) \left(\frac{2\phi}{5} \right) \left[\frac{t}{9} + \frac{\phi(P_1^B - P_1^A)}{5y} \right] \right\} = 0$$

$$P_1^B \left(\frac{-3}{ty} \right) + \left(\frac{1}{3} + \frac{3(P_1^A - P_1^B)}{2ty} \right) + \delta \left\{ \left(\frac{-3}{ty} \right) \left(\frac{2\phi}{5} \right) \left[\frac{t}{9} + \frac{\phi(P_1^A - P_1^B)}{10y} \right] \right\} = 0.$$

Note that the terms in square brackets, P_2^A and P_2^B , depend on y because market shares

[equation (16)] depend on y .²⁰ Solving these equations yields

$$\begin{aligned} P_1^A &= \frac{t}{9} \left[\frac{625y^2 - 20\delta\phi^2y - 175\delta\phi y + 6\delta^2\phi^3}{625y - 20\delta\phi^2} \right] & \sigma^A &= \frac{1}{3} \left[1 - \frac{50\delta\phi}{625y - 20\delta\phi^2} \right] \\ P_1^B = P_1^C &= \frac{t}{9} \left[\frac{625y^2 - 20\delta\phi^2y - 225\delta\phi y + 6\delta^2\phi^3}{625y - 20\delta\phi^2} \right] & \sigma^B = \sigma^C &= \frac{1}{3} \left[1 + \frac{25\delta\phi}{625y - 20\delta\phi^2} \right] \end{aligned} \quad (19)$$

for period one. Under rational expectations, both the level of period-one prices is higher but the difference is lower.²¹ With more inelastic demand, competition for market share is slackened. Equilibrium market shares also differ by less than in the naïve case (recall $y > 1$). Hence, firm A 's period-one price, market share and profit are higher than in the naïve case.

Period-two prices and demands, which follow (9) and (10), differ by less than in the naïve case:

$$\begin{aligned} P_2^A &= \frac{t}{9} \left[1 - \frac{10\delta\phi^2}{625y - 20\delta\phi^2} \right] & D_2^A &= \frac{1}{3} \left[1 - \frac{10\delta\phi^2}{625y - 20\delta\phi^2} \right] \\ P_2^B = P_2^C &= \frac{t}{9} \left[1 + \frac{5\delta\phi^2}{625y - 20\delta\phi^2} \right] & D_2^B = D_2^C &= \frac{1}{3} \left[1 + \frac{5\delta\phi^2}{625y - 20\delta\phi^2} \right]. \end{aligned}$$

The qualitative results in Propositions 1 and 2 continue to hold under rational expectations. However, since its period-two price and market share are both higher than in the naïve case, firm A 's profit is higher in both periods.

5. Equilibrium under a Horizontal Merger

Consider the case, illustrated in figure 3, where firms A and B merge between periods 1 and 2 and anticipate the merger at the beginning of the game. We can write the firms' problems as

$$\begin{aligned} \text{Firm A: } & \text{Max}_{\{P_1^A\}} P_1^A \sigma^A(\mathbf{P}_1) + \frac{\delta}{2} \pi_2^M(\sigma(\mathbf{P}_1)) \\ \text{Firm B: } & \text{Max}_{\{P_1^B\}} P_1^B \sigma^B(\mathbf{P}_1) + \frac{\delta}{2} \pi_2^M(\sigma(\mathbf{P}_1)) \\ \text{Firm C: } & \text{Max}_{\{P_1^C\}} P_1^C \sigma^C(\mathbf{P}_1) + \delta \pi_2^C(\sigma(\mathbf{P}_1)), \end{aligned} \quad (20)$$

where $\pi^M = \pi_2^A + \pi_2^B$.

²⁰In the "no merger" case, $P_2^A = P_2^B$ in equilibrium, so y affects neither period-one market shares nor period-two prices.

²¹ $\frac{dP_1^A}{dy} = \frac{t}{9} \left[\frac{(625y)^2 - 25,000\delta\phi^2y + \delta^2\phi^3(400\phi - 250)}{(625y - 20\delta\phi^2)^2} \right]$, which is positive given $0 \leq \phi < 1$.

5.1. Period Two

In period two, firms A and B have merged. Apart from switching costs, this period is a special (i.e., 3-firm) case of the one-period, n -firm model studied previously by Levy and Reitzes (1992) and Brito (2003). To avoid confusion I refer to the two merged-firm locations as “store A ” and “store B ,” where store A inherits share σ^A and charges P_2^A and store B inherits share σ^B and charges P_2^B . The term “store C ” has the same interpretation as “firm C .”

The merged firm’s problem is to maximize the sum of profits of stores A and B :

$$\text{Max}_{\{P_2^A, P_2^B\}} P_2^A D_2^A(\sigma(\mathbf{P}_1), \mathbf{P}_2) + P_2^B D_2^B(\sigma(\mathbf{P}_1), \mathbf{P}_2),$$

while firm C ’s problem is

$$\text{Max}_{\{P_2^C\}} P_2^C D_2^C(\sigma(\mathbf{P}_1), \mathbf{P}_2)$$

and period-two demands D_2^j for $j \in \{A, B, C\}$ follow (8). Taking first-order conditions and performing some algebra, we find the following set of best-response functions:

$$\begin{aligned} P_2^A &= \frac{t}{6} \left\{ \left[\frac{1}{3} + \frac{3}{2t}(2P_2^B + P_2^C) \right] + \frac{3(1-\nu)s}{2t}(3\sigma^A - 1) \right\} \\ P_2^B &= \frac{t}{6} \left\{ \left[\frac{1}{3} + \frac{3}{2t}(2P_2^A + P_2^C) \right] + \frac{3(1-\nu)s}{2t}(3\sigma^B - 1) \right\} \\ P_2^C &= \frac{t}{6} \left\{ \left[\frac{1}{3} + \frac{3}{2t}(P_2^A + P_2^B) \right] + \frac{3(1-\nu)s}{2t}(3\sigma^C - 1) \right\}. \end{aligned} \tag{21}$$

These functions highlight the asymmetries between stores A, B and C introduced by the merger. While each best response $P_2^j[P_2^k, P_2^l, \sigma(\mathbf{P}_1)]$ is strictly increasing in own-market share σ^j and in the other stores’ prices, the effects of the prices are asymmetric. Store A raises its own price more in response to an increase in store B ’s price than to an increase in store C ’s price—that is, P_2^A is more *sensitive* to P_2^B than to P_2^C . Intuitively, an increase in store B ’s price increases directly the profit accruing to store A by yielding more customers. This enhances the strategic complementarity of prices. On the other hand, store C is equally sensitive to P_2^A and P_2^B , and this sensitivity is lower than store A ’s sensitivity to P_2^B .

This is a 3×3 system, whose solution yields

$$\begin{aligned}
P_2^A(\sigma(\mathbf{P}_1)) &= \frac{5t}{27} + \frac{(1-\nu)s}{12} (5\sigma^A - \sigma^B - 4\sigma^C) \\
P_2^B(\sigma(\mathbf{P}_1)) &= \frac{5t}{27} + \frac{(1-\nu)s}{12} (-\sigma^A + 5\sigma^B - 4\sigma^C) \\
P_2^C(\sigma(\mathbf{P}_1)) &= \frac{4t}{27} + \frac{(1-\nu)s}{6} (3\sigma^C - 1)
\end{aligned} \tag{22}$$

The asymmetry of best-responses in (21) yields asymmetric effects of market shares and switching costs on equilibrium prices. Just as in the “no merger” case, each store’s equilibrium price is increasing in its own market share. After a horizontal merger, however, equilibrium P_2^A and P_2^B are both explicitly decreasing in the market share of the other stores.²² Moreover, the parties to the merger are less sensitive to the market share of the other party than to firm C ’s market share. Intuitively, the merger causes A and B to respond to the other merger-party’s price less aggressively. As a result, A responds to an increase in σ^B less aggressively than to an increase in σ^C .

A similar asymmetry emerges when one considers the response of equilibrium prices to a change in the switching cost. As in the “no merger” case, equilibrium P_2^C increases with s if and only if $\sigma^C > \frac{1}{3}$ and does not depend on s if $\sigma^C = \frac{1}{3}$. Store A ’s price, by contrast, increases if and only if $\sigma^A > \frac{\sigma^B + 4\sigma^C}{5}$. If $\sigma^A = \frac{1}{3}$, then equilibrium P_2^A depends on s as long as $\sigma^B \neq \sigma^C$, in contrast to the “no merger” case.

If $P_1^A = P_1^B$, then $\sigma^A = \sigma^B$, so that $P_2^A = P_2^B = \frac{5t}{27} + \frac{(1-\nu)s}{3}(\sigma^A - \sigma^C)$. Stores A and B charge the no-switching-cost equilibrium prices $P_2^A = P_2^B = \frac{5t}{27}$ under equal market shares. If $\sigma^A = \sigma^B < \sigma^C$, which is what obtains in the subgame-perfect equilibrium of the two-period game, then stores A and B charge less than $\frac{5t}{27}$. The size of s enhances the price cut.

We now use equilibrium prices and (8) to calculate period-two demands. Demands among the ν fraction are

$$\begin{aligned}
D_2^{A,\nu} &= \frac{5}{18} + \frac{(1-\nu)s}{8t} (-13\sigma^A + 5\sigma^B + 8\sigma^C) \\
D_2^{B,\nu} &= \frac{5}{18} + \frac{(1-\nu)s}{8t} (5\sigma^A - 13\sigma^B + 8\sigma^C) \\
D_2^{C,\nu} &= \frac{4}{9} + \frac{(1-\nu)s}{t} (1 - 3\sigma^C).
\end{aligned}$$

²²Equilibrium P_2^C is *implicitly* decreasing in σ^A and σ^B . Any increase in σ^A or σ^B that results from a single change in a period-one price necessarily lowers σ^C .

Similarly, among the fraction $(1 - \nu)$ of the randomly reassigned customers, we have

$$\begin{aligned} D_2^{A,1-\nu} &= D_2^{A,\nu} + \frac{3s}{2t} (3\sigma^A - 1) \\ D_2^{B,1-\nu} &= D_2^{B,\nu} + \frac{3s}{2t} (3\sigma^B - 1) \\ D_2^{C,1-\nu} &= D_2^{C,\nu} + \frac{3s}{2t} (3\sigma^C - 1). \end{aligned}$$

Collecting terms, we have

$$\begin{aligned} D_2^A(\sigma(\mathbf{P}_1)) &= \frac{5}{18} + \frac{(1-\nu)s}{8t} (11\sigma^A - 7\sigma^B - 4\sigma^C) \\ D_2^B(\sigma(\mathbf{P}_1)) &= \frac{5}{18} + \frac{(1-\nu)s}{8t} (-7\sigma^A + 11\sigma^B - 4\sigma^C) \\ D_2^C(\sigma(\mathbf{P}_1)) &= \frac{4}{9} + \frac{(1-\nu)s}{2t} (3\sigma^C - 1). \end{aligned} \tag{23}$$

Clearly, $D_2^C = \frac{3P_2^C}{t}$ is proportional as in previous cases.

5.2. Period One

Recalling the profit maximization problems in (20), the first-order conditions for the three firms satisfy

$$\begin{aligned} P_1^A \frac{d\sigma^A}{dP_1^A} + \sigma^A(\mathbf{P}_1) + \frac{\delta}{2} \left[P_2^A(\sigma(\mathbf{P}_1)) \frac{dD_2^A(\sigma(\mathbf{P}_1))}{dP_1^A} + \frac{dP_2^A(\sigma(\mathbf{P}_1))}{dP_1^A} D_2^A(\sigma(\mathbf{P}_1)) \right. \\ \left. + P_2^B(\sigma(\mathbf{P}_1)) \frac{dD_2^B(\sigma(\mathbf{P}_1))}{dP_1^A} + \frac{dP_2^B(\sigma(\mathbf{P}_1))}{dP_1^A} D_2^B(\sigma(\mathbf{P}_1)) \right] &= 0 \\ P_1^B \frac{d\sigma^B}{dP_1^B} + \sigma^B(\mathbf{P}_1) + \frac{\delta}{2} \left[P_2^B(\sigma(\mathbf{P}_1)) \frac{dD_2^B(\sigma(\mathbf{P}_1))}{dP_1^B} + \frac{dP_2^B(\sigma(\mathbf{P}_1))}{dP_1^B} D_2^B(\sigma(\mathbf{P}_1)) \right. \\ \left. + P_2^A(\sigma(\mathbf{P}_1)) \frac{dD_2^A(\sigma(\mathbf{P}_1))}{dP_1^B} + \frac{dP_2^A(\sigma(\mathbf{P}_1))}{dP_1^B} D_2^A(\sigma(\mathbf{P}_1)) \right] &= 0 \\ P_1^C \frac{d\sigma^C}{dP_1^C} + \sigma^C(\mathbf{P}_1) + \delta \left[P_2^C(\sigma(\mathbf{P}_1)) \frac{dD_2^C(\sigma(\mathbf{P}_1))}{dP_1^C} + \frac{dP_2^C(\sigma(\mathbf{P}_1))}{dP_1^C} D_2^C(\sigma(\mathbf{P}_1)) \right] &= 0. \end{aligned} \tag{24}$$

Since firms A and B are symmetric, I impose $P_1^A = P_1^B$ and reduce the number of conditions to two. Although firm C 's first-order condition above looks the same as in the conglomerate case [recall (17)], it is slightly different because firm C 's period-two price depends on its market share differently.

Naïve Consumers

In the case of naïve consumers, cutoff buyers and σ are determined in the usual way, so

that $\sigma^j = \frac{1}{3} + \frac{3}{2t} [P_1^k + P_1^l - 2P_1^j]$ and

$$\frac{d\sigma^j}{dP_1^j} = -\frac{3}{t} \quad \frac{d\sigma^k}{dP_1^j} = \frac{3}{2t}. \quad (25)$$

Consider firm A 's first-order condition. Using prices in (22) and demands in (23), I identify the following derivatives:

$$\begin{aligned} \frac{dD_2^A(\sigma(\mathbf{P}_1))}{dP_1^A} &= -\frac{3}{2t} \left[\frac{33(1-\nu)s}{8t} \right] & \frac{dD_2^B(\sigma(\mathbf{P}_1))}{dP_1^A} &= \frac{3}{2t} \left[\frac{21(1-\nu)s}{8t} \right] \\ \frac{dP_2^A(\sigma(\mathbf{P}_1))}{dP_1^A} &= -\frac{3}{2t} \left[\frac{15(1-\nu)s}{12} \right] & \frac{dP_2^B(\sigma(\mathbf{P}_1))}{dP_1^A} &= \frac{3}{2t} \left[\frac{3(1-\nu)s}{12} \right]. \end{aligned} \quad (26)$$

When $P_1^A = P_1^B$ is imposed, we have $\sigma^A = \sigma^B$ and can use (22) and (23), respectively, to write

$$\begin{aligned} P_2^A(\sigma(\mathbf{P}_1)) &= P_2^B(\sigma(\mathbf{P}_1)) = \frac{5t}{27} + \frac{(1-\nu)s}{3} (\sigma^A - \sigma^C) \\ D_2^A(\sigma(\mathbf{P}_1)) &= D_2^B(\sigma(\mathbf{P}_1)) = \frac{5}{18} + \frac{(1-\nu)s}{2t} (\sigma^A - \sigma^C) \end{aligned}$$

Under period-one symmetry, the *sum* of period-two demands for A and B is proportional to merged-firm price: $D_2^A + D_2^B = \frac{5}{9} + \frac{(1-\nu)s}{t} (\sigma^A - \sigma^C) = \frac{3P_2^A}{t}$. Period-one symmetry also implies

$$\sigma^A - \sigma^C = \frac{9}{2t} [P_1^C - P_1^A]. \quad (27)$$

Collecting terms, plugging into the first line of (24) and substituting $\phi = \frac{9(1-\nu)s}{t}$, we have

$$P_1^A \left(\frac{-3}{t} \right) + \frac{1}{3} + \frac{3(P_1^C - P_1^A)}{2t} + \frac{\delta}{2} \left\{ \left(\frac{-3}{t} \right) \frac{\phi}{6} \left[\frac{5t}{27} + \frac{\phi(P_1^C - P_1^A)}{6} \right] \right\} = 0$$

Rearranging this expression yields firm A 's best response to firm C . The term in square brackets is P_2^A . Firm B 's best-response function is the same.

Next consider firm C 's (somewhat easier) problem. Here, I can set $P_1^A = P_1^B$ prior to taking derivatives with respect to P_1^C , because P_1^A and P_1^B affect firm C 's profits identically. Using (22) and (27) I can plug in, perform some algebra, and write

$$\begin{aligned} P_2^C(\sigma(\mathbf{P}_1)) &= \frac{4t}{27} + \frac{3(1-\nu)s}{2t} (P_1^A - P_1^C) \\ D_2^C &= \frac{3P_2^C}{t}. \end{aligned}$$

This yields the following derivatives:

$$\begin{aligned}\frac{dP_2^C(\sigma(\mathbf{P}_1))}{dP_1^C} &= -\frac{3(1-\nu)s}{2t} \\ \frac{dD_2^C(\sigma(\mathbf{P}_1))}{dP_1^C} &= -\left(\frac{9}{t}\right) \left[\frac{(1-\nu)s}{2t}\right].\end{aligned}$$

Collecting terms, plugging into the last line of (24) and substituting $\phi = \frac{9(1-\nu)s}{t}$, we have

$$P_1^C \left(\frac{-3}{t}\right) + \frac{1}{3} + \frac{3(P_1^A - P_1^C)}{t} + \delta \left\{ \left(\frac{-3}{t}\right) \frac{\phi}{3} \left[\frac{4t}{27} + \frac{\phi(P_1^A - P_1^C)}{6} \right] \right\} = 0.$$

Rearranging terms yields the best-response function for firm C . The term in square brackets equals P_2^C .

Solving the two equations in two unknowns, I find

$$\begin{aligned}P_1^A = P_1^B &= \frac{t}{9} \left[1 - \delta\phi \left(\frac{324-9\delta\phi^2}{1620-45\delta\phi^2} \right) \right] & \sigma^A = \sigma^B &= \frac{1}{3} \left(1 - \frac{99\delta\phi}{1620-45\delta\phi^2} \right) \\ P_1^C &= \frac{t}{9} \left[1 - \delta\phi \left(\frac{522-9\delta\phi^2}{1620-45\delta\phi^2} \right) \right] & \sigma^C &= \frac{1}{3} \left(1 + \frac{198\delta\phi}{1620-45\delta\phi^2} \right).\end{aligned}\tag{28}$$

We then have the following.

Proposition 3. *Suppose that switching costs matter. Then all firms charge period-one prices higher than in the “no merger” case, with $P_1^A = P_1^B > P_1^C$.*

As in the conglomerate case, the myopia effect causes firms A and B to favor period-one profit and charge equilibrium prices higher than in the “no merger” case. With both A and B pricing less aggressively, firm C charges the lowest equilibrium price.

In period two, firms A and B have merged. In contrast to the conglomerate case, the increases in concentration and market power cause the merged firm to charge prices higher than in the “no merger” case. However, because $P_1^A = P_1^B > P_1^C$, the merged firm inherits low market share at the beginning of period 2. This market-share disadvantage causes stores A and B to price more aggressively than in a model without switching costs. Solving for period-two prices and demands using (22) and (23), we have

$$\begin{aligned}P_2^A = P_2^B &= \frac{t}{9} \left(\frac{5}{3} - \frac{33\delta\phi^2}{1620-45\delta\phi^2} \right) & D_2^A = D_2^B &= \frac{5}{18} - \frac{11\delta\phi^2}{2(1620-45\delta\phi^2)} \\ P_2^C &= \frac{t}{9} \left(\frac{4}{3} + \frac{33\delta\phi^2}{1620-45\delta\phi^2} \right) & D_2^C &= \frac{4}{9} + \frac{11\delta\phi^2}{1620-45\delta\phi^2}\end{aligned}$$

Just as in the conglomerate case, there is an incentive to merge, but the merger benefits the non-merging firm more.

Proposition 4. *A horizontal merger is profitable for merging firms. Non-merging firms' profits increase by more.*

Although firms A and B set higher prices and earn less market share in period one than in the “no merger” case, their ability to collude in period two results in strictly higher profit. Firm C benefits the most, as it faces less competition in both periods.

Rational Consumers

Rational consumers factor in the impact of period-one purchases on period-two surpluses. To keep things simple, I assume that they do not anticipate the merger.²³ Hence, cutoff buyers are determined the same as the “no merger” case.

Once again, $\frac{d\sigma^j}{dP_1^k}$, $\frac{dP_2^j}{dP_1^j}$ and $\frac{dD_2^j}{dP_1^j}$ are each proportional to $-\frac{3}{ty}$ instead of $-\frac{3}{t}$ [recall (25) and (26)], and this is the only difference between the rational and naïve cases. Best-response functions satisfy:

$$\begin{aligned} P_1^A \left(\frac{-3}{ty} \right) + \left(\frac{1}{3} + \frac{3(P_1^C - P_1^A)}{2ty} \right) + \frac{\delta}{2} \left\{ \left(\frac{-3}{ty} \right) \left(\frac{\phi}{6} \right) \left[\frac{5t}{27} + \frac{\phi(P_1^C - P_1^A)}{6y} \right] \right\} &= 0 \\ P_1^C \left(\frac{-3}{ty} \right) + \left(\frac{1}{3} + \frac{3(P_1^A - P_1^C)}{ty} \right) + \delta \left\{ \left(\frac{-3}{ty} \right) \left(\frac{\phi}{3} \right) \left[\frac{4t}{27} + \frac{\phi(P_1^A - P_1^C)}{6y} \right] \right\} &= 0. \end{aligned}$$

Solving them yields

$$\begin{aligned} P_1^A = P_1^B &= \frac{t}{9} \left(\frac{1620y^2 - 45\delta\phi^2y - 324\delta\phi y + 9\delta^2\phi^3}{1620y - 45\delta\phi^2} \right) & \sigma^A = \sigma^B &= \frac{1}{3} \left(1 - \frac{99\delta\phi}{1620y - 45\delta\phi^2} \right) \\ P_1^C &= \frac{t}{9} \left(\frac{1620y^2 - 45\delta\phi^2y - 522\delta\phi y + 9\delta^2\phi^3}{1620y - 45\delta\phi^2} \right) & \sigma^C &= \frac{1}{3} \left(1 + \frac{198\delta\phi}{1620y - 45\delta\phi^2} \right). \end{aligned} \quad (29)$$

Just as in the conglomerate case, period-one prices are higher but closer together under rational expectations, as the inelastic demand dampens the effect of price asymmetries on market shares.

²³If consumers rationally anticipate the merger, this adds considerable technical complication to the model. Consumers would recognize that period-one market shares affect period-two prices asymmetrically, as in (22). As a result, period-one pivotal buyers would not be symmetric functions of period-one prices, as in (16). While adding this feature to the model would represent an interesting extension, it would distract from this paper's main point about the myopia effect. I discuss it further in the conclusion.

However, the merged firm sets a higher price in period two, so the rational expectations case is characterized by period-two prices [from (22)] and demands [from (23)] that are spread farther apart than in the naïve case.

$$\begin{aligned}
P_2^A = P_2^B &= \frac{t}{9} \left(\frac{5}{3} - \frac{33\delta\phi^2}{1620y-45\delta\phi^2} \right) & D_2^A = D_2^B &= \frac{5}{18} - \frac{11\delta\phi^2}{2(1620y-45\delta\phi^2)} \\
P_2^C &= \frac{t}{9} \left(\frac{4}{3} + \frac{33\delta\phi^2}{1620y-45\delta\phi^2} \right) & D_2^C &= \frac{4}{9} + \frac{11\delta\phi^2}{1620y-45\delta\phi^2}
\end{aligned}$$

The results in Propositions 3 and 4 continue to hold under rational expectations.

6. Conclusion

When consumers face switching costs, firms face dynamic pricing incentives. By setting a low price today, a firm attracts consumers who get partially locked in to that firm. The firm can then exploit that lock-in with high prices. In anticipation of a merger, however, a firm’s incentive to chase market share with low prices is diminished, because it will share future profits with its merging partner. Hence, the prospect of a merger induces a myopia effect where firms charge pre-merger prices higher than would obtain absent the merger. This obtains for both horizontally related and entirely unrelated firms.

Though my contribution is qualitative, my results nonetheless set up several potentially testable predictions. For example, though pre-merger prices are higher for both horizontal and conglomerate cases, both the price dynamics and the relationship between merging-firm prices and non-merging-firm prices are different. In the horizontal case, merging-firm prices are higher than non-merging firm prices in both the pre-merger and post-merger periods, prices are highest overall in the post-merger period and all prices are higher than in the “no merger” case. In the conglomerate case, by contrast, the merging firms’ pre-merger prices are higher than in the “no merger” case, while their post-merger prices are lower than in the “no merger” case. Non-merging firms’ prices are higher than in the “no merger” case in both periods. One possible way to test these predictions would be to separately estimate price changes for airfares in overlapping and non-overlapping routes. Kim and Singal (1993) break their data down in this way and get mixed results, but they do not disaggregate their data along other dimensions likely to affect price dynamics. Ideally, one would need to control for any cost asymmetries between firms and also control for inherited market shares.²⁴

²⁴One possible way to do this is to examine routes with roughly equal market shares before the merger’s announcement.

To fix ideas around my main point, I keep the model simple by abstracting from cost asymmetries, uncertain time horizons and entry. It would be interesting to add each of these features to sharpen the results. As discussed earlier in footnote 22, the case where consumers rationally anticipate the effects of the merger on post-merger prices is technically awkward yet promising. Comparing results on prices from this case to those from the case where consumers are naive about the merger could yield results about the value in publicizing pending mergers. Another natural extension would be to endogenize both the decision to merge and the terms of the merger—i.e., how profits are shared, the timing of the merger’s completion, etc. I look forward to further progress.

Appendix

Proof of Proposition 1. It is clearly true from (18) that $P_1^A > P_1^B = P_1^C$ as long as $\delta\phi > 0$. Thus, to prove the proposition, it suffices to show that P_1^B is higher under the conglomerate merger, which implies

$$\frac{t}{9} \left[1 - \frac{2\delta\phi t}{5} \right] < \frac{t}{9} \left[1 - \delta\phi \left(\frac{225 - 6\delta\phi^2}{625 - 20\delta\phi^2} \right) \right]$$

This reduces to

$$\frac{225 - 6\delta\phi^2}{625 - 20\delta\phi^2} < \frac{2}{5}.$$

Since $\phi \leq 1$, this clearly holds. **QED**

Proof of Proposition 2. Let $D \equiv 625 - 20\delta\phi^2$ and note that firm A’s total profit under the merger can be written as

$$\begin{aligned} \Pi^{A,M} = \frac{t}{27} \left\{ 1 - \frac{\delta\phi(175 - 6\delta\phi^2)}{D} - \frac{50\delta\phi}{D} + \frac{\delta\phi(175 - 6\delta\phi^2)(50\delta\phi)}{D^2} \right\} \\ + \frac{\delta t}{27} \left\{ 1 - \frac{20\delta\phi^2}{D} + \frac{(10\delta\phi^2)^2}{D^2} \right\} \end{aligned}$$

Ignoring the terms with D^2 in the denominator, a sufficient condition such that $\Pi^{A,M} > \Pi^{A,NM}$ is

$$\frac{t}{27} \left\{ 1 - \frac{\delta\phi(175 - 6\delta\phi^2)}{D} - \frac{50\delta\phi}{D} \right\} + \frac{\delta t}{27} \left\{ 1 - \frac{20\delta\phi^2}{D} \right\} > \frac{t}{27} \left\{ 1 + \delta - \frac{2\delta\phi}{5} \right\}$$

This is equivalent to

$$\frac{2\delta\phi}{5} > \frac{\delta\phi(175 - 6\delta\phi^2)}{D} + \frac{50\delta\phi}{D} + \frac{20\delta^2\phi^2}{5D}.$$

Plugging back in for D , the expression reduces to

$$125 > \delta\phi(100 + 10\phi). \quad (30)$$

Since $\phi \leq 1$ by Assumption 2, it follows that (30) clearly holds. **QED**

Proof of Proposition 3. It is clearly true from (28) that $P_1^A = P_1^B > P_1^C$ as long as $\delta\phi > 0$. Thus, to prove the proposition, it suffices to show that P_1^C is higher under the horizontal merger, which implies

$$\frac{t}{9} \left[1 - \frac{2\delta\phi}{5} \right] < \frac{t}{9} \left[1 - \delta\phi \left(\frac{522 - 9\delta\phi^2}{1620 - 45\delta\phi^2} \right) \right]$$

This reduces to

$$\frac{522 - 13\delta\phi^2}{1620 - 54\delta\phi^2} < \frac{2}{5}.$$

Since $\phi \leq 1$ by Assumption 2, this clearly holds. **QED**

Proof of Proposition 4. Let $D \equiv 1620 - 45\delta\phi^2$ and note that firm A's total profit under the merger can be written as

$$\begin{aligned} \Pi^{A,M} = \frac{t}{27} \left\{ 1 - \frac{\delta\phi(324 - 9\delta\phi^2)}{D} - \frac{99\delta\phi}{D} + \frac{\delta\phi(324 - 9\delta\phi^2)(99\delta\phi)}{D^2} \right\} \\ + \frac{\delta t}{27} \left\{ \frac{25}{18} - \frac{55\delta\phi^2}{D} + \frac{(33\delta\phi^2)^2}{2D^2} \right\} \end{aligned}$$

Ignoring the terms with D^2 in the denominator, a sufficient condition such that $\Pi^{A,M} > \Pi^{A,NM}$ is

$$\frac{t}{27} \left\{ 1 - \frac{\delta\phi(324 - 9\delta\phi^2)}{D} - \frac{99\delta\phi}{D} \right\} + \frac{\delta t}{27} \left\{ \frac{25}{18} - \frac{55\delta\phi^2}{D} \right\} > \frac{t}{27} \left\{ 1 + \delta - \frac{2\delta\phi}{5} \right\}$$

This is equivalent to

$$\frac{2}{5} > \frac{(324 - 9\delta\phi^2)}{D} + \frac{99}{D} + \frac{55\delta\phi}{D} - \frac{7\delta}{18}.$$

Plugging back in for D , the expression reduces to

$$1125 > \delta\phi(275 + 45\phi) - \frac{35\delta D}{18}. \quad (31)$$

Since $\phi \leq 1$ by Assumption 2, it follows that (31) clearly holds. **QED**

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