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**Abstract**

We analyze theoretically the efficiency of structural remedies in merger control in retail markets and show that this crucially depends on the retail chains' pricing policy. Whereas a retail merger can be perfectly remedied by divestiture of stores under local pricing, such remedies are not only less effective, but might even be counterproductive, if the chains set national prices. Paradoxically, such remedies might be even more counterproductive if the chains also compete locally along non-price dimensions such as quality. Our analysis suggests that antitrust authorities should be very cautious when reviewing structural remedies in retail markets with national pricing.

*Keywords*: Retail mergers; structural remedies; national pricing.

*JEL Classification*: L11; L22; L41.

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# 1 Introduction

Merger control lies at the heart of competition policy worldwide. In resolving merger cases, the acceptance of structural remedies has become an increasingly important policy tool. Structural remedies are measures proposed by (and involving a structural change on the part of) the merging parties, that may be accepted by a competition authority. Such remedies will typically involve divestment of assets.[1]

An important area where structural remedies are particularly relevant is in retail merger cases. According to the UK Competition & Markets Authority (CMA), retail mergers account for a significant number of cases that are presented before the authority (CMA, 2017). By its nature, retail markets facilitate the use of structural remedies, and such remedies will involve divestitures of local retail outlets. The 2008 merger between Co-op and Somerfield in the grocery market (Co-op/Somerfield, 2008) may serve as an illustrative example.[2] Co-operative Group Limited (Co-op), the UK's largest co-operative owning 2 228 food retail outlets, proposed to the Office of Fair Trading (OFT) to acquire the entire share capital of Somerfield Limited (Somerfield). Somerfield was a food retailer which at the time had 877 retail outlets. In this case the OFT raised competition concerns in a number of local markets throughout the UK. In 2008, the OFT announced a decision to seek divestment remedies, and later the same year the OFT cleared the merger by accepting an offer from Co-op to sell more that 120 supermarket stores in markets where the OFT had raised competitive concerns.

Another feature of many retail markets is that retail chains often use national pricing.[3] National pricing means that prices are uniform across local markets. The alternative to national (or regional) pricing is local pricing where prices are set according to competition and demand conditions in each local market. A recent study by DellaVigna and Gentzkow (2019)

[1]Structural remedies are distinguished from behavioral remedies, the latter typically intended to regulate the future behavior of a party involved in a merger. The remedy can take various forms, for instance price regulations.

[2]Towards the end of this paper, in Section 6, we offer a more detailed dicussion of this and other retail merger cases resolved by local divestitures of retail outlets.

[3]There exists a literature seeking to rationalize the use of national pricing in retail markets; see, e.g., Dobson and Waterson (2005) and Gabrielsen et. al. (forthcoming).

finds that most US food, drugstore, and mass-merchandise chains charge national or regional prices, even though there is large variation in demographics and competition across the different regional and local markets. Dobson and Waterson (2005) report that UK electrical goods retailers predominately use national prices, US office supply superstores adopt local prices, and in the UK supermarket sector some groups price uniformly and others price locally.[4]

Under national pricing, merger policy appears to be guided by a simple an admittedly intuitive logic. National prices are determined by local characteristics of all markets in which a retail chain is active. If a merger reduces competition in a local market, this will tend to increase the national price, and the appropriate measure is to remedy the merger in this market. The intuitive idea is that such a measure will bring down the national price to the pre-merger level. As we show in the present paper, this logic is fundamentally wrong. As opposed to when prices are set locally in each market, changes in ownership structure create externalities across markets with national pricing. With local pricing, structural remedies only affect pricing in the specific market where the remedy is adopted. However, with national pricing, the change in store ownership structure, brought about by structural remedies applied to a particular local market, induces price changes in not only that market, but also in other markets. This key mechanism is central to the analysis presented here.

The aim of our analysis is to investigate the effects on consumer welfare of a structurally remedied merger in a retail market. We will perform our analysis under both local and national pricing, and also when the local competition entails non-price dimensions, e.g., local quality or service. We present a model with spatial differentiation in which four retail chains compete in two local markets and where two of the retail chains propose a merger. The two markets vary in terms of market size, competition intensity and diversion ratios (competitive overlap) between the merger candidates. In this setting we investigate how structural remedies, i.e., divestitures of local retail outlets, perform in terms of repairing the competitive harm to consumers created by the merger.

We show that when pricing is local, remedies perform perfectly in the

[4] For more evidence of national pricing, see also Hitsch et al. (2017).

sense that consumer welfare can be restored to the pre-merger level. However, when prices are set nationally, which in our model entails that each chain sets the same price for its product sold in both markets, structural remedies do not work that well, and they can even be detrimental compared to the unremedied merger. Moreover, and unlike remedied mergers under local pricing, under national pricing remedies will produce winners and losers. In each market, remedies will leave some consumers better off and others worse off compared to the pre-merger equilibrium, and we show that the latter effect will always dominate the former at the aggregate level. Under national pricing, it is generally not possible to find effective remedies.

Competition authorities appear inattentive to the externalities created by remedies under national pricing. Moreover, even if authorities sometimes recognize that national pricing might be an issue, they often argue that local remedies may still be useful. This was for instance the case in the Co-op/Somerfield case cited above. Here, Co-op argued that their local pricing was not based on local competition. The OFT countered this in two ways. First, they argued that even though the pricing policy was national, there was no conclusive evidence that local deviations from such a policy might not occur. Second, the OFT also argued that pricing is only one of a number of ways competitive harm could occur, including a deterioration of local non-price factors such as quality, range and service. On this basis, the OFT considered local divestitures to be the appropriate remedy even though Co-op claimed that prices were decided nationally.

In order to investigate this argument, we extend our model with national pricing by allowing stores also to compete locally on quality. We show that the logic presented above by the OFT is flawed; local non-price (quality) competition does not necessarily improve the effectiveness of structural remedies under national pricing. On the contrary, we show that such remedies may even perform worse with local quality competition than without.

Our analysis has important implications for merger policy. The main implication is that the pricing policy of the parties, i.e., whether they adopt national or local pricing policies, will have a crucial bearing on the effectiveness of structural remedies in retail markets. While it is true that pricing policy is often discussed in retail merger cases, it is also true that competition authorities tend to accept remedies "as if" the pricing policy is local. When pricing policy *de facto* is national, our analysis shows that this approach may lead to clearance of remedied mergers that will involve a loss in consumers' surplus, and sometimes even to the degree that allowing the unremedied merger would be better. Specifically, we show that consumers in the remedied market(s) may end up losing compared to allowing the unremedied merger.

The theoretical literature on merger remedies is scarce, and most of this theory analyze Cournot markets where all parts of the industry are equal. The focus in this literature is on whether the availability of merger remedies is welfare enhancing. One of the first papers to address this question is Vergé (2010), who shows that a merger without synergies is highly unlikely to benefit consumers, even if it is subjected to appropriate structural remedies. The issues studied in the literature also include whether competition authorities will request too much remedies, denoted as overfixing (Vasconcelos, 2010; Farrell, 2003), information problems related to the competitive harm (Cosnita-Langlais and Sørgard, 2018), the implication of having the parties propose remedies (Dertwickel-Kalt and Wey, 2016a), and when the parties have private information on the competitive harm and can signal (Dertwickel-Kalt and Wey, 2016b). These approaches are very different from ours as we study retail mergers and remedies in highly diversified local markets with a focus on the pricing policy of the parties. Cabral (2003) studies the effects of a merger in a spatially differentiated oligopoly. His focus is on how cost efficiencies and remedies will be affected by free entry after the merger and how this affects consumers' welfare compared to when entry is exogenous. While our model also is a spatially differentiated oligopoly, our setup and focus are very different. We have two local markets with four active retail chains, and our main ingredient is the potential pricing externalities between markets caused by structural remedies in one market.

The rest of the paper is organized as follows. In Section 2 we present our model. Section 3 contains the analysis of our benchmark case in which all four retail chains set local prices in both markets. In Section 4 we assume that the retail chains use national prices, and we compare the outcome from this case with our benchmark case. The next section, Section 5, extends our analysis by introducing store-specific quality provision. In Section 6 we interpret and discuss our results in relation to a range of retail merger cases relevant for our analysis, handled by competition authorities in different jurisdictions. Section 7 concludes, and the Appendix contains the proofs of all results.

# 2 Model

Consider four national retail chains, indexed by $i = 1, 2, 3, 4$, that compete in two local markets, indexed by $j = A, B$. Each chain has one store in each market, where the stores are equidistantly located on a circle with circumference equal to 1. Our main aim is to analyze the effect of a merger between two chains in this setting, and we take Chain 1 and Chain 2 as the merger candidates.

In each market, consumers are uniformly distributed on the circle and each consumer demands one unit of the good from the most preferred retailer. The total mass of consumers in Market $j$ is given by $m^j$. The utility of a consumer in Market $j$ who is located at $x^j$ and buys the good from the store of Chain $i$, located at $z_i^j$, is given by

$$U^j(x, z_i) = v - p_i^j - t^j \left| x^j - z_i^j \right|, \tag{1}$$

where $p_i^j > 0$ is the price charged by Chain $i$ in Market $j$ and $t^j > 0$ is a transport cost parameter that captures the degree of horizontal product differentiation, and therefore inversely measures the intensity of competition, in Market $j$. The utility parameter $v > 0$ is assumed to be sufficiently large such that both markets are always fully covered in equilibrium.

We assume that the two markets differ along three dimensions: (i) the intensity of competition, inversely measured by $t^A \neq t^B$; (ii) the size of the markets, measured by $m^A \neq m^B$; and (iii) the diversion ratio between the merger candidates. The latter asymmetry is introduced by assuming that the order of store locations differs across the two markets. In Market $A$, the order of locations is $\{1, 2, 3, 4\}$, whereas in Market $B$, the order of locations is $\{1, 3, 2, 4\}$. Since competition is localized, this implies that the diversion ratio between the stores of the merger candidates (Chain 1 and

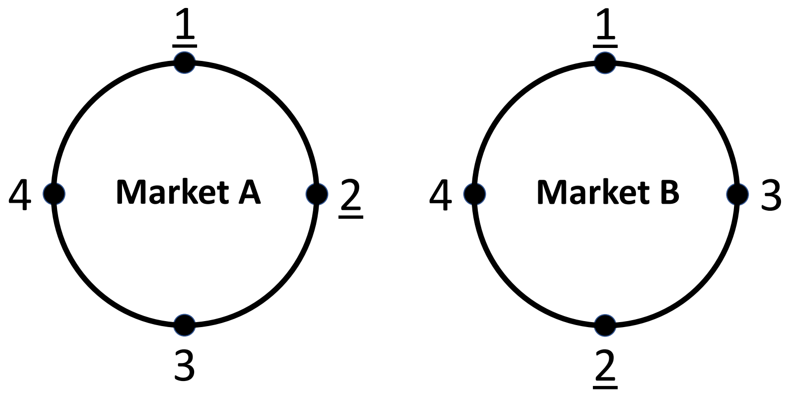


Figure 1: All four retail chains are active in two local markets, Market $A$ and Market $B$. The stores of the merging retail chains (underlined), Chain 1 and 2, are direct competitiors in Market $A$ but not in Market $B$.

2) is one half in Market $A$ and zero in Market $B$. In other words, the merger candidates compete directly with each other in Market $A$ but not in Market $B$. The two markets are illustrated in Figure 1, where the stores of the merger candidates are underlined.

Under the assumption that all consumers make utility-maximising decisions, the demand facing Store $i$ in Market $j$ is given by

$$q_i^j = m^j \left( \frac{1}{4} - \frac{2p_i^j - p_{i+1}^j - p_{i-1}^j}{2t^j} \right), \tag{2}$$

where subscripts $i-1$ and $i+1$ refer to the stores located immediately to the left and right, respectively, of Store $i$. In order to understand the intuition behind some of the subsequently derived results, the following property of (2) is useful:

**Lemma 1** *Defining the price elasticity of demand for Store $i$ in Market $j$ as*

$$\varepsilon_i^j := -\left(\partial q_i^j / p_i^j\right)\left(p_i^j / q_i^j\right), \tag{3}$$

*it follows that*

$$\frac{\partial^2 \varepsilon_i^j}{\partial \left(t^j\right)^2} = \frac{p_i^j}{8} \left( \frac{t^j q_i^j}{m^j} \right)^{-3} > 0. \tag{4}$$

We focus only on the anti-competitive effects of a merger; in other words, the effects of price coordination between the merging chains. For simplicity, we therefore assume that there are no variable costs of production, implying that the profits of Store $i$ in Market $j$ are given by[5]

$$\pi_i^j = p_i^j q_i^j. \tag{5}$$

Finally, for space-saving purposes, in the subsequent analysis we will use the following notational shorthands: $\alpha := m^A t^B$, $\beta := m^B t^A$ and $\tau := t^A t^B$.

# 3 Local pricing

As a benchmark for comparison, consider the case in which each chain sets local prices in a non-cooperative game. It is straightforward to derive the Nash equilibrium prices, which are given by

$$p_i^j = \frac{t^j}{4}. \tag{6}$$

Since the chains are symmetrically located within each market, each chain sets the same price in each market, but prices are lower in the market with the higher intensity of competition. Consumers' surplus in Market $j$ is then given by

$$CS^j = m^j \left( v - \frac{5}{16} t^j \right). \tag{7}$$

## 3.1 Merger

Suppose now that Chain 1 and Chain 2 merge, allowing them to coordinate the prices set for Stores 1 and 2 in each of the two markets. Such a price coordination only has an effect on prices in Market $A$, in which the merger participants directly compete. In the post-merger equilibrium, the prices set by the insiders (Chain 1 and 2) and the outsiders (Chain 3 and 4) in

[5] Although we do not explicitly model production costs, we assume that a merger entails (unmodelled) fixed-cost synergies that always make a merger profitable, with and without remedies. Since such synergies do not affect the chains' pricing incentives, consumer welfare is also unaffected.

this market are given by, respectively,

$$p_1^A = p_2^A = \frac{5}{12} t^A \tag{8}$$

and

$$p_3^A = p_4^A = \frac{1}{3} t^A. \tag{9}$$

The merger participants use their increased market power to set higher prices, which in turn induces a price increase (though by a smaller amount) also for the outsiders, because of strategic complementarity. Thus, a merger leads to a price increase for all stores in Market $A$. The merger therefore creates two different types of distortions that contribute to a reduction in consumers' surplus. In addition to the price increase, which obviously affects consumers negatively, the post-merger equilibrium is asymmetric, which implies an increase in aggregate transportation costs. Post-merger consumers' surplus in Market $A$ is given by

$$CS^A = m^A \left( v - \frac{205}{288} t^A \right), \tag{10}$$

which is lower than the pre-merger surplus. In Market $B$, on the other hand, the merger has no effects on prices.

## 3.2 Merger remedies

The negative effect of the merger on consumer welfare in Market $A$ can in principle be countervailed by a structural remedy that eliminates the price coordination effect of the merger. Such a remedy must necessarily imply a change of ownership for one of the two neighboring stores of the merging chains in Market $A$. In our setting, there are two different types of ownership transfer that can eliminate the price coordination effect, which we define as follows:

***Remedy I*** The merged chain sells one of its stores in Market $A$ to a competing chain, such that the diversion ratio between the two stores of the acquiring chain in Market $A$ is zero. This can be achieved either by Chain 3 buying Store 1 or by Chain 4 buying Store 2.

***Remedy II*** The merged chain sells one of its stores in Market $A$ to a new entrant, if such a potential buyer exists.

Under local pricing, it is straightforward to see that either remedy would completely restore the pre-merger equilibrium in terms of prices. This establishes our first main result of the paper.[6]

**Proposition 1** *Under local pricing, the anticompetitive effect of a merger can be fully rectified by a structural remedy.*

# 4 National pricing

Suppose instead that the retail chains practice national pricing, such that the same price applies to all stores within a chain. For each chain, the optimally chosen price, $p_i$, must satisfy the following condition:[7]

$$\left(\frac{q_i^A}{q_i^A + q_i^B}\right) \varepsilon_i^A \left(p_i, t^A\right) + \left(\frac{q_i^B}{q_i^A + q_i^B}\right) \varepsilon_i^B \left(p_i, t^B\right) = 1, \tag{11}$$

where $\varepsilon_i^j \left(p_i, t^j\right)$ is the price elasticity of demand for Chain $i$ in Market $j$. Whereas optimal local prices are set such that the price elasticity of demand is equal to one in each market, the optimal national price is set such that the *weighted average price elasticity* of demand across the two markets is equal to one. Using (2), the symmetric Nash equilibrium under national pricing is given by

$$p_i = \frac{\left(m^A + m^B\right) \tau}{4 \left(\alpha + \beta\right)}. \tag{12}$$

Comparing (6) and (12), it is easy to verify that the equilibrium national price is higher (lower) than the lowest (highest) price under local pricing. More specifically, if $t^A < t^B$, then $p_i^A < p_i < p_i^B$. Notice also that, in contrast to the case of local pricing, the national prices are affected by relative market sizes as long as the intensity of competition is different in

[6] The proof is trivial and thus omitted.

[7] We implicitly assume that the differences between the two markets are sufficiently small, so that we can rule out the possibility of setting the locally optimal price in the most profitable market and stop serving the other market.

the two markets. If $t^A < t^B$, the equilibrium national price is decreasing (increasing) in $m^A$ ($m^B$), because of a higher weight given to the market with more (less) price-elastic demand. The opposite holds of course for $t^A > t^B$. If $t^A = t^B$, equilibrium prices are equal under local and national price setting.

Consumers' surplus in Market $j$ is given by

$$CS^j = m^j \frac{16v\left(m^j t^{-j} + m^{-j} t^j\right) - t\left(5m^j t^{-j} + 4m^{-j} t^{-j} + m^{-j} t^j\right)}{16\left(m^j t^{-j} + m^{-j} t^j\right)}, \quad (13)$$

where superscript $-j$ indicates the other market than $j$.

## 4.1 Merger

With national pricing, a merger between Chain 1 and Chain 2 affects prices in both markets, even if the merging chains are competitors in only one of the markets. In the post-merger equilibrium, the prices set by insiders and outsiders, respectively, are given by[8]

$$p_1 = p_2 = \frac{(2\alpha + 3\beta)\left(m^A + m^B\right)\tau}{(5\alpha + 6\beta)(\alpha + 2\beta)} \quad (14)$$

and

$$p_3 = p_4 = \frac{3\left(m^A + m^B\right)\tau}{2(5\alpha + 6\beta)}. \quad (15)$$

A comparison of (8)-(9) and (14)-(15) shows that the price effects of a merger are qualitatively similar under local and national pricing. In both cases, all prices increase and the price increase is larger for the merged chain. The main difference is that, under national pricing, these price effects occur in both markets. In other words, national price setting creates an externality whereby the anticompetitive effect of price coordination in one local market spills over to markets in which the merger participants do not compete. On the other hand, although the merger has anticompetitive effects in both markets, the relative price increase is smaller under national

[8]Notice that the stores of Chain 3 and 4 are symmetrically located vis-à-vis the stores of the merged chain in both markets (see Figure 1), which implies that these chains will set the same price in the post-merger equilibrium.

price setting.[9] This is entirely intuitive, since the price coordination externality caused by national pricing represents a profit loss to the coordinating chains. Similarly to the case of local pricing, consumers are also negatively affected by a merger due to higher aggregate transportation costs caused by the post-merger asymmetry in prices.

## 4.2 Merger remedies

As before, the price coordination effect of the merger is eliminated if one of the merged chains' stores in Market $A$ is sold out, either to a competing chain (*Remedy I*) or to an independent buyer (*Remedy II*). If selling to a competing chain, the equilibrium outcome is identical whether Chain 1's store is sold to Chain 3 or Chain 2's store is sold to Chain 4. We will therefore consider the latter ownership transfer. The post-merger store ownership structure with each of the two remedies is illustrated in Figure 2.

### 4.2.1 *Remedy I*

If the store of Chain 2 in Market $A$ is transferred to Chain 4, each store (in both markets) has stores from competing chains as neighbors, which effectively removes the price coordination effect of the merger. However, the ownership structure has changed compared to the pre-merger situation, as illustrated in Figure 2. One of the non-merging chains (Chain 4) has now two stores in Market $A$, whereas one of the merger participants (Chain 2) has a store only in Market $B$. Under local pricing, such a reallocation of store ownership would have no effect on equilibrium price setting, as evidenced by Proposition 1, implying that the anti-competitive effect of the merger would be completely eliminated by the remedy. Under national pricing, however, this reallocation of store ownership has non-trivial effects on equilibrium price setting for all the chains in the market, as we will show below.

[9] The interested reader can easily verify this by comparing equilibrium prices before and after the merger in each of the two price setting regimes.

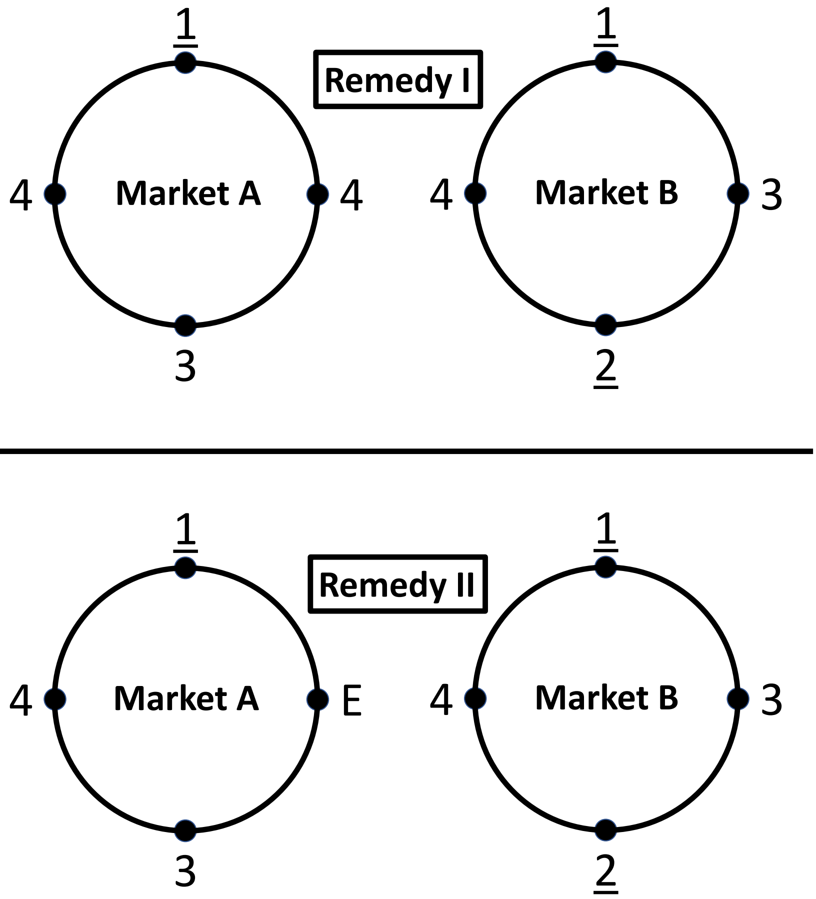


Figure 2: The two structural merger remedies that are considerd. Under *Remedy I* (top panel) the store of Chain 2 in Market $A$ is transferred to Chain 4. Under *Remedy II* (bottom panel) the store of Chain 2 in Market $A$ is transferred to a new entrant, $E$.

If we allow all chains to reoptimize their prices after the merger and the implementation of *Remedy I*, the Nash equilibrium prices are given by

$$p_1 = \frac{\left[\begin{array}{c} \alpha\left(2\alpha\left(48m^A + 43m^B\right) + \beta\left(163m^A + 148m^B\right)\right) \\ +4\beta^2\left(13m^A + 12m^B\right) \end{array}\right]\tau}{4\left(\alpha\beta\left(249\alpha + 200\beta\right) + 48\left(2\alpha^3 + \beta^3\right)\right)}, \tag{16}$$

$$p_2 = \frac{\left[\begin{array}{c} 48\left(m^A\alpha^2\left(t^A + t^B\right) + \beta^3\right) \\ +m^A\beta\left(3\alpha\left(27t^A + 56t^B\right) + 4\beta\left(7t^A + 43t^B\right)\right) \end{array}\right]t^B}{4\left(\alpha\beta\left(249\alpha + 200\beta\right) + 48\left(2\alpha^3 + \beta^3\right)\right)}, \tag{17}$$

$$p_3 = \frac{\begin{bmatrix} \alpha \left(2\alpha \left(48m^A + 49m^B\right) + \beta \left(151m^A + 156m^B\right)\right) \\ +4\beta^2 \left(11m^A + 12m^B\right) \end{bmatrix} \tau}{4 \left(\alpha\beta \left(249\alpha + 200\beta\right) + 48 \left(2\alpha^3 + \beta^3\right)\right)}, \qquad (18)$$

$$p_4 = \frac{\begin{bmatrix} \alpha \left(4\alpha \left(24m^A + 19m^B\right) + \beta \left(173m^A + 132m^B\right)\right) \\ +4\beta^2 \left(17m^A + 12m^B\right) \end{bmatrix} \tau}{4 \left(\alpha\beta \left(249\alpha + 200\beta\right) + 48 \left(2\alpha^3 + \beta^3\right)\right)}. \qquad (19)$$

If we compare these prices with the price in the symmetric pre-merger equilibrium, we can characterize the price responses as follows:[10]

**Proposition 2** *(Remedy I under national pricing) Suppose that a merger between Chain 1 and Chain 2 is remedied by a transfer of store ownership in Market A from Chain 2 to Chain 4. If* $t^A < (>)\, t^B$*, this remedied merger leads to a price increase (decrease) for the stores of Chain 2 and Chain 4, whereas prices go down (up) for the stores of Chain 1 and Chain 3.*

Notice first that a remedied merger leads to price increases for some stores and price reductions for others. Thus, and in contrast to the case of local pricing, there are both winners and losers among consumers. These price changes are caused by the remedy, which produces two different first-order price responses. First, Chain 2 is left with only one store (in Market $B$) after the remedy is implemented, implying that it effectively practices local pricing after the merger. This leads to a price increase (decrease) if the intensity of competition is lower (higher) in Market $B$ than in Market $A$. Second, the remedy also causes Chain 4 to have more stores in Market $A$ than in Market $B$, implying that Chain 4 will place a larger weight on demand conditions in Market $A$ when setting its national price. This leads to a higher (lower) price if the intensity of competition is lower (higher) in Market $A$ than in Market $B$. Thus, the price responses of Chain 2 and Chain 4 always go in opposite directions.

In addition, there are (second-order) price responses from Chain 1 and Chain 3 due to strategic interaction. Three of the four stores that are neighbors to Chain 1's stores are owned by Chain 4. Because of strategic complementarity, the price response of Chain 1 will therefore follow that of Chain 4. Chain 3, on the other hand, has the stores of both Chain 4

[10] The proofs of this and all subsequent propositions are given in the Appendix.

and Chain 2 as neighbors. Notice, however, that the magnitude of the price response is always larger for Store 2 than for Store 4. The reason is simply that the remedy implies that Chain 2 prices *only* according to market conditions in Market $B$, whereas the pricing incentives for Chain 4 are more modestly affected. For this reason, the price response of Chain 3 will always follow that of Store 2.

#### 4.2.2 *Remedy II*

Suppose instead that the store of Chain 2 in Market $A$ is sold to a new entrant, denoted by $E$ (see Figure 2). As for the case of *Remedy I*, the price coordination effect of the merger is eliminated. However, such a remedied merger implies, once more, that the store ownership structure is affected in a way that turns out to have significant effects on prices and consumer welfare under national pricing. Similarly to *Remedy I*, Chain 2 operates now only in Market $B$, but in addition, *Remedy II* also implies that the number of store owners increases from four to five, with the new entrant operating only in Market $A$.

If we allow all chains to reoptimize their prices after the merger and the implementation of *Remedy II*, the Nash equilibrium prices are given by

$$p_1 = \frac{\begin{bmatrix} \left(48m^A + 43m^B\right)\alpha^2 + \left(53m^A + 48m^B\right)\beta^2 \\ + \left(94m^B + 104m^A\right)\alpha\beta \end{bmatrix}\tau}{12(\alpha+\beta)\left(16\left(\alpha^2+\beta^2\right)+33\alpha\beta\right)}, \tag{20}$$

$$p_2 = \frac{\begin{bmatrix} \left(24\alpha^2 + 23\beta^2 + 48\alpha\beta\right)m^A t^A \\ +24\alpha^3 + 48\beta^3 + 124\alpha\beta^2 + 99\alpha^2\beta \end{bmatrix} t^B}{12(\alpha+\beta)\left(16\left(\alpha^2+\beta^2\right)+33\alpha\beta\right)}, \tag{21}$$

$$p_3 = \frac{\begin{bmatrix} \left(48m^A + 49m^B\right)\alpha^2 + \left(49m^A + 48m^B\right)\beta^2 \\ +98\left(m^A + m^B\right)\alpha\beta \end{bmatrix}\tau}{12(\alpha+\beta)\left(16\left(\alpha^2+\beta^2\right)+33\alpha\beta\right)}, \tag{22}$$

$$p_4 = \frac{\begin{bmatrix} \left(48m^A + 53m^B\right)\alpha^2 + \left(43m^A + 48m^B\right)\beta^2 \\ + \left(104m^B + 94m^A\right)\alpha\beta \end{bmatrix}\tau}{12\left(16\left(\alpha^2+\beta^2\right)+33\alpha\beta\right)}, \tag{23}$$

$$p_E = \frac{\begin{bmatrix} 48\alpha^3 + 24\beta^3 + 99\alpha\beta^2 + 124\alpha^2\beta \\ + \left(24\alpha^2 + 24\beta^2 + 48\alpha\beta\right) m^B t^B \end{bmatrix} t^A}{12\left(\alpha+\beta\right)\left(16\left(\alpha^2+\beta^2\right) + 33\alpha\beta\right)}. \tag{24}$$

The price responses of this remedied merger can then be characterised as follows:

**Proposition 3** *(Remedy II under national pricing) Suppose that a merger between Chain 1 and Chain 2 is remedied by a transfer of store ownership in Market A from Chain 2 to a new entrant. If* $t^A < (>)\, t^B$*, this remedied merger leads to a price increase (decrease) for the store of Chain 2 and the stores of Chain 4, whereas prices go down (up) for the stores of Chain 1 and for the store acquired by the new entrant. The price effect for the stores of Chain 3 is a priori indeterminate.*

Once more, prices go up in some stores and down in others, implying that a merger with *Remedy II* has both winners and losers among consumers. The first-order price effects of such a remedied merger now occur for the remaining store of Chain 2 and for the store of the new entrant. These two stores are located in different markets and prices are set only according to local market conditions. The response for the remaining store of Chain 2 is similar under both types of remedies and leads to a price increase (decrease) if this store is located in the market with lower (higher) competition intensity. Since the store of the new entrant is located in the other market, the price response always goes in the opposite direction for this store.

The price responses for the remaining stores are second-order effects resulting from strategic complementarity. The directions of the price responses for Chain 1 and Chain 4 are unambiguous. Since Chain 1 is a neighbor to the new entrant in Market $A$ but not to Chain 2 in Market $B$, its price response follows that of the new entrant. Conversely, since Chain 4 is a neighbor to Chain 2 in Market $B$ but not to the new entrant in Market $A$, its price response follows that of Chain 2. Finally, since Chain 3 is a neighbor to the new entrant in Market $A$ and also to Chain 2 in Market $B$, the price response depends on the relative size *and* competition intensity across the two markets. More specifically, the remedied merger leads to a higher price for the stores of Chain 3 if $t^A > t^B$ and $m^A/m^B < t^A/t^B$, or if

$t^A < t^B$ and $m^A/m^B > t^A/t^B$. Otherwise, the national price set by Chain 3 goes down.

#### 4.2.3 Effects of a remedied merger on consumer welfare

Since a remedied merger under national pricing always leads to price increases for some stores and price reductions for others, regardless of which remedy is applied, the effect on aggregate consumer welfare is not immediately obvious. Could the gains of some consumers possibly outweigh the losses of the remaining consumers? The next Proposition gives a negative answer to this question.

**Proposition 4** *Under national pricing, a remedied merger leads to a higher average price and lower consumers' surplus, for all* $t^A \neq t^B$*, regardless of whether Remedy I or Remedy II is applied.*

Despite the mixed price responses of the different stores, and despite the fact that the direction of these price responses vary according to the relative degree of competition in the two markets, the average price always goes up as a result of the remedied merger. This means that, regardless of which chains increase their prices after the merger, the price increases always outweigh the price reductions. Furthermore, a remedied merger leads to an asymmetric equilibrium outcome with unequal market shares across the stores in each market. This leads in turn to an increase in aggregate transportation costs. Combined with a higher average price, the overall effect is an unambiguous reduction in consumers' surplus. This result holds for both types of merger remedy.

A key factor behind this result is that the *magnitude* of the price responses to a remedied merger is generally smaller when the price response is negative than when it is positive. This follows from Lemma 1, which says that the price elasticity of demand is convex in the intensity of competition (inversely measured by $t^j$). The implication of this demand property is that the market with more intense competition is relatively more important for the optimal choice of a national price, all else being equal. This implies in turn that if a chain goes from owning one store in each market to owning only one store in one of the markets, the chain's price response to such an ownership change is smaller in absolute value if the remaining store is located in the market with more intense competition. Thus, although merger remedies (of both types) imply a change of ownership structure that leads to price responses in both directions, the demand property highlighted in Lemma 1 means that positive price responses tend to dominate, leading to an increase in the average price paid by consumers.

These results are obviously based on a model with a *particular* market structure, and the nature of our research question is such that it cannot be addressed in a theoretical framework that encompasses all possible market structures. Nevertheless, there are some general insights that can be gleaned from the above analysis. Under national pricing, if a remedied merger leads to an increased degree of store ownership *asymmetry* across local markets that differs in competition intensity, and if the price elasticity of demand is *convex* in the degree of local competition intensity, the outcome is likely to be a higher average retail price and a lower consumers' surplus.[11] This effect is caused by cross-market spillovers of national pricing strategies that are not present if the chains practice local pricing.

#### 4.2.4 *Remedy I* versus *Remedy II*

Under local pricing, the two alternative remedies are completely equivalent in the sense that they produce exactly the same market outcome. In both cases, the price coordination effect in Market $A$ is eliminated and the competitive harm of the merger is therefore fully remedied. This is not the case under national pricing. Not only are both remedies imperfect, as shown by Proposition 4, but they also produce different market outcomes. It turns out that one of the two remedies is consistently superior:

**Proposition 5** *Under national pricing, a merger with Remedy I yields a lower average price and a higher consumers' surplus than a merger with Remedy II.*

In other words, under national pricing a merger is better remedied by letting the merged chains sell a store in Market $A$ to a competing chain than

[11] The convexity highlighted by Lemma 1 is not particular to the Salop (or Hotelling) model. It is easily shown that an equivalent property holds for a Bowley-type demand system, where competition intensity is given by the degree of product substitutability.

to a new entrant. This is arguably a surprising result, since it implies that consumers are better off with a lower number of independent competitors, given that the merger takes place.

To see the intuition behind this result, notice that the key difference between *Remedy I* and *Remedy II* is that the number of chains operating in both markets is lower with the latter remedy, and this has implications for price setting under national pricing. Suppose first that the degree of competition is higher in Market $A$, so that prices are generally lower in this market than in Market $B$. Under *Remedy I*, where Store 2 in Market $A$ is sold to Chain 4, the higher competitive pressure in Market $A$ spills over to Market $B$ because Chain 4 places a larger weight on Market $A$ (where it owns two out of three stores after *Remedy I* is applied) in its national price setting. A similar spillover effect does not occur with *Remedy II*, because the new entrant does not operate in Market $B$, implying that the average price is lower under *Remedy I* than under *Remedy II*. Suppose instead that the degree of competition is *lower* in Market $A$. Under *Remedy II*, a new entrant would thus set a relatively high price because it prices only to this market. In contrast, under *Remedy I*, the fact that Chain 4 also owns a store in Market $B$ (where competition is tougher) contributes to *dampening* the price increase in Market $A$ under this particular remedy. The result is once more that the average price is lower under *Remedy I* than under *Remedy II*.

Since our analysis is conducted within the context of a particular market structure, the result in Proposition 5 can obviously not be extended to a general policy recommendation that the optimal merger remedy in markets with national pricing always implies a transfer of store ownership to existing chains rather than to new entrants. Nevertheless, this result illustrates that the pattern of cross-market ownership is crucially important in determining the optimal merger remedy, and that policies that only consider local market conditions can result in suboptimal outcomes when different markets are connected through national pricing.

#### 4.2.5 Counterproductive merger remedies

We have already established that structural remedies to eliminate the effect of price coordination are less effective when the chains set national rather than local prices. Could it also be the case that such remedies can be counterproductive, in the sense that the remedy might actually do more harm than the merger? Perhaps surprisingly, the answer is yes:

**Proposition 6** *For a sufficiently high degree of asymmetry between the markets in terms of competition intensity, and if the market in which the merger participants do not directly compete is sufficiently large, there exists a parameter set for which Remedy II is counterproductive under national pricing, leading to a higher average price and a lower consumers' surplus.*

It is possible to identify a counterproductive effect of *Remedy II*, where one of the stores of the merged chain is sold to a new entrant. As we show in the proof of Proposition 6 (see Appendix), this might occur in a scenario where Market $B$ is sufficiently large, and the degree of competition in this market is sufficiently strong, relative to Market $A$. Without any remedy, a merger will lead to higher prices because of a price coordination effect between the merger participants in Market $A$; a price coordination effect that spills over to Market $B$ because of national pricing. However, this effect is relatively modest if Market $B$ is both large and with a high degree of competition. In this case, the merged chain will place a large weight on Market $B$ (because of its size) when setting the national price, and the higher degree of competition in this market will therefore constrain the price increase as a result of the merger. In such a situation, if *Remedy II* is implemented, the price coordination effect is removed by the introduction of a new player in Market $A$. However, the new entrant is *not* constrained in its price setting by store ownership in another market with stronger competition. The entrant will therefore set a relatively high price and, as proven by Proposition 6, there exists a parameter set for which the entrant's incentive for setting a high price outweighs the price coordination effect of an unremedied merger, implying that the remedy in itself leads to a higher average price and a lower consumers' surplus. In other words, the cure is worse than the disease. Once more, this result illustrates that basic intuition about optimal merger control that applies under local pricing might fail, and sometimes spectacularly so, in markets that are characterised by national pricing.

# 5 Local quality competition

In this section we extend our main analysis by introducing a second dimension of competition, namely store-specific quality (or service) provision. Our main aim is to investigate whether the presence of local quality competition creates a rationale for using local divestiture as a merger remedy under national pricing. The short answer: It does not. While quality competition at the local level may improve the efficiency of structural remedies in certain situations, it also makes it worse in others. Thus, it is still impossible to offer a strong recommendation for the use of such remedies, as long as the firms are pricing nationally.

Suppose that consumers care not only about the price and transportation cost when choosing which store to buy from, but also value the quality offered by the stores. We incorporate quality by extending the utility function along the lines of Gabrielsen et al. (forthcoming), so that the utility of a consumer in Market $j$ who is located at $x^j$ and buys the good from the store of Chain $i$, located at $z_i^j$, is given by

$$U^j(x, z_i) = v + bs_i^j - p_i - t^j \left| x^j - z_i^j \right|, \tag{25}$$

where $s_i^j$ is the quality offered by Chain $i$ in Market $j$. The parameter $b > 0$ measures the marginal willingness-to-pay for quality and therefore also measures how strongly the chains compete on quality relative to prices, all else being equal.

As in Gabrielsen et al. (forthcoming), we assume that quality is observable but non-verifiable, implying that it is impossible for the chains to commit to a national quality standard. By its nature, quality competition is local. Thus, we assume that the chains set national prices and local qualities.[12] With utility-maximising choices by each consumer, the demand for

[12] Hence the absence of superscript $j$ on the price variable in (25).

Chain $i$'s store in Market $j$ is given by

$$q_i^j = m^j \left( \frac{1}{4} + \frac{b\left(2s_i^j - s_{i+1}^j - s_{i-1}^j\right) - (2p_i - p_{i+1} - p_{i-1})}{2t^j} \right). \tag{26}$$

We assume that the cost of quality provision for Store $i$ in Market $j$, is equal to

$$C\left(s_i^j\right) = \frac{k}{2}\left(s_i^j\right)^2, \tag{27}$$

where $k > 0$. Thus, higher quality implies a higher fixed (i.e., output independent) cost.[13] The profits of Store $i$ in Market $j$ are then given by

$$\pi_i^j = p_i q_i^j - \frac{k}{2}\left(s_i^j\right)^2. \tag{28}$$

We consider a game in which prices and qualities are determined simultaneously. With competition on both price and quality, the strategic interaction between the chains is multi-dimensional. Here we will briefly summarise the nature of this strategic interaction, which is non-trivial. We refer the interested reader to Gabrielsen et al. (forthcoming) for a more detailed analysis.

Prices are strategic complements in the absence of quality competition, and this is obviously also true if we keep the quality levels fixed. This is dubbed *gross strategic complementarity*. The stores' qualities, on the other hand, are strategically independent under our assumption of output-independent quality costs. Moreover, price and quality are what we dub *complementary strategies* for each store/chain: A higher price makes it more profitable for the store to attract consumers by offering higher quality as well, and *vice versa*, higher quality increases demand and therefore makes it less price elastic, which in turn increases the chain's profit-maximising price, all else being equal.

However, the nature of the strategic interaction along the quality di-

[13] Gabrielsen et al. (forthcoming) also allow for the possibility that quality increases the marginal cost of supplying the good, specifically assuming

$$C\left(s_i^j\right) = cs_i^j q_i^j + \frac{k}{2}\left(s_i^j\right)^2,$$

where $c > 0$. Here we assume $c = 0$ to keep the analysis tractable.

mension changes once we take into account that a quality change by a rival chain leads to quality *and* price responses. A quality increase by one store will induce a price reduction by the rival store, which in turn gives the rival store an incentive to reduce the quality provision as well. This implies that a quality increase by Chain $i$ will be met by quality reductions by the rival Chain $j$, when we take into account the optimal price response by Chain $j$. Thus, qualities are *net strategic substitutes*, which is a key feature of the (two-dimensional) competition between the chains. The following Lemma will later prove useful when explaining the intuition for some of our results.

**Lemma 2** *For each of a chain's stores, the optimal local quality level is proportional to the chain's national price:*

$$s_i^j = s_r^j(p_i) := \frac{bm^j}{2t^j} p_i.$$

The implication of Lemma 2 is that each chain's price and quality levels change not only in the same direction, but also in the same proportion. Thus, a 10% increase in the national price translates into a 10% increase in the local quality level.

## 5.1 Pre-merger equilibrium

In the pre-merger equilibrium, the symmetry between the chains makes for simple equilibrium expressions, even while introducing quality competition. The national equilibrium price set by Chain $i$ is still given by (12), while the equilibrium quality chosen by Chain $i$ in Market $j$ is given by

$$s_i^j = m^j \frac{b\left(m^A + m^B\right) t^{-j}}{4k(\alpha + \beta)}. \tag{29}$$

Because the cost of quality provision is output independent, the chains' equilibrium prices are unaffected by the introduction of quality competition. In the pre-merger game, quality competition is therefore a pure benefit to the consumers.

## 5.2 Merger

The asymmetric post-merger Nash equilibria (with or without remedies) are given by a set of prices and qualities whose explicit expressions are highly involved and thus not presentable.[14] Our results are therefore best demonstrated by giving some numerical examples, which we will discuss in the following.

### 5.2.1 Competitive effects of a merger

Consider once more a merger between Chain 1 and Chain 2. In addition to the standard price effect of the merger, quality competition brings about three additional (direct) effects for the consumers; two beneficial and one harmful:

(i) The merging parties will coordinate and thus *reduce* their quality levels to save costs in Market $A$, where they are adjacent rivals. This effect is clearly negative for the consumers in this market.

(ii) However, because own quality and price are complementary strategies, the quality reduction in Market $A$ will *dampen* the standard price increase following the merger. In the extreme, this effect may even be strong enough to cause a price reduction for the merging parties.[15] With national pricing, this effect is clearly positive for the consumers in *both* markets.

(iii) Finally, because of the national price increase, and again because price and quality are complementary strategies, the merging chains will also increase their quality levels in Market $B$, where they are *not* adjacent rivals. This effect is clearly positive for the consumers in this market.

Interestingly, it turns out that effects (ii) and (iii) may sometimes dominate and thus cause the merger to be less harmful overall with quality competition. In turn, this may also influence how effective the remedies are at preventing harm to the consumers, which we will discuss below.

[14] The equilibrium solutions were computed in Mathematica and further details are available upon request.

[15] Brekke et al. (2017) show how this may happen in a model without national pricing.

#### 5.2.2 Remedies

As before, the competitive harm of the merger may potentially be remedied by store ownership transfer in Market $A$ (either *Remedy I* or *II*), which eliminates the price coordination effect of the merger. In the absence of quality competition, we know from Proposition 4 that such remedies are not able to eliminate the adverse effect of the merger on consumers when the chains practice national pricing, and *Remedy II* might even be counterproductive and reinforce the adverse effects of the merger. We want to explore whether this problem is reduced or aggravated in the presence of quality competition.

To get a sense of how quality competition may affect the outcome, we let Market $A$ be the smaller market by setting $m^A = 0.3$ and $m^B = 1.7$. Furthermore, we let $t^A$ and $t^B$ be inversely related, such that $t^B = 4 - t^A$, and focus on the case where competition is stronger in Market $B$ (i.e., $t^A > 2$). Thus, in our example Market $A$ is a small market with relatively weak competition, and Market $B$ is a large market with relatively tough competition. Finally, we set $b = 1$ and $k = 2$.

To measure the impact on consumers, we calculate their quality-adjusted total expenditures in each market, which account for both the price and travel costs (but adjusted for the consumers' willingness to pay for the quality). More specifically, the quality-adjusted total expenditure in Market $j$, denoted $P^j$, is defined as

$$P^j := \sum_{i=1}^{N=4} \left[ q_i^j \left( p_i - b s_i^j \right) + m^A t^j \left( \int_0^{x_{i+1}^*} x dx + \int_0^{x_{i-1}^*} x dx \right) \right], \qquad (30)$$

where $x_{i+1}^*$ and $x_{i-1}^*$ represent the *distances* from Store $i$ to the indifferent consumers on the right- and left-hand sides, respectively. The consumers' pre-merger equilibrium expenditure is denoted by $P_N^j$, whereas the post-merger expenditure is given by $P_M^j$ without remedies and by $P_I^j$ and $P_{II}^j$ with *Remedy I* and *II*, respectively. If $P_M^j - P_N^j > 0$, the unremedied merger increases consumers' expenditures and thus reduces their surplus in Market $j$, while the overall effect (in both markets) is given by $\sum_j \left( P_M^j - P_N^j \right) \lesseqgtr 0$.

In Figure 3 we plot the percentage increase in the consumers' quality-adjusted expenditures (relative to the pre-merger situation) in each market.

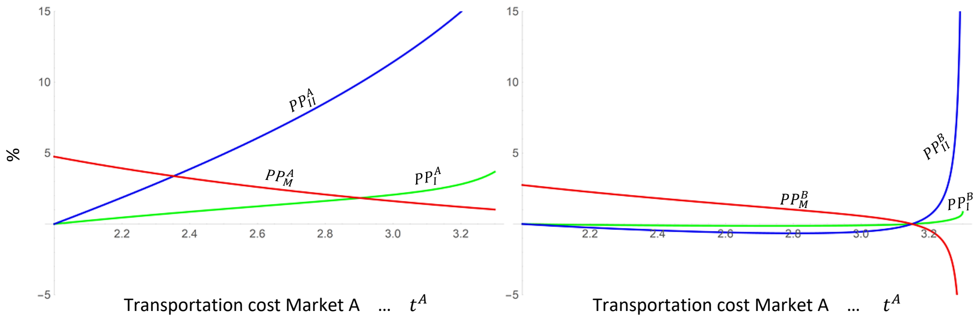


Figure 3: The percentage change in the consumers' (quality adjusted) expenditure relative to the situation before the merger, after the merger ($PP^A_M$ and $PP^B_M$), after *Remedy I* ($PP^A_I$ and $PP^B_I$), and after *Remedy II* ($PP^A_{II}$ and $PP^B_{II}$), for Market $A$ (left panel) and $B$ (right panel) respectively.

Denoting the cases of an unremedied merger and the two different remedied mergers (with *Remedy I* and *II*) by $M$, $I$ and $II$, respectively, the percentage expenditure increase in Market $j$ in case $S$ is

$$PP^j_S := 100\left(\frac{P^j_S}{P^j_N} - 1\right), \tag{31}$$

where $S \in \{M, I, II\}$.

For the chosen parameter set, we see that both $PP^A_I$ and $PP^A_{II}$ are strictly positive. In other words, the two remedies never manage to fully neutralize the competitive harm in Market $A$ (except for the special case of $t^A = t^B$). Moreover, if the degree of competition is sufficiently weak in Market $A$ relative to Market $B$, both remedies cause even more harm than the unremedied merger, in either one or both markets.

Figure 3 only illustrates the market-specific welfare effects. To measure the overall effect of case $S$, we calculate

$$PP^T_S := 100\left(\frac{\sum_j P^j_S}{\sum_j P^j_N} - 1\right). \tag{32}$$

The overall effects are plotted in Figure 4. Again, neither remedy manages to fully neutralize the harmful effect of the merger, and the remedies may also make the situation worse for the consumers overall. The fact that

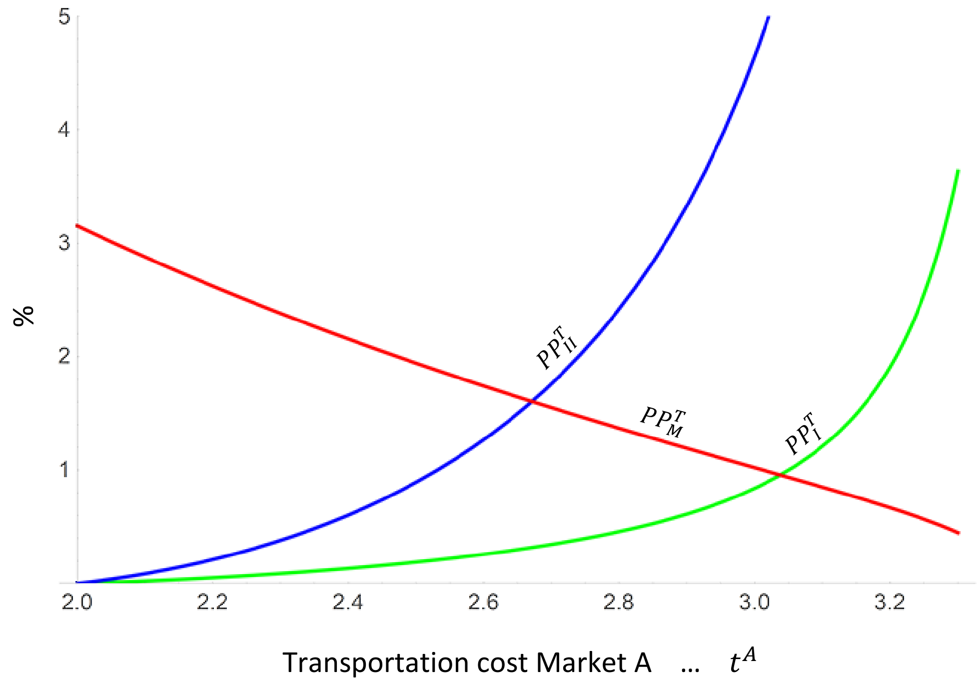


Figure 4: The percentage change in the consumers' (quality adjusted) expenditure relative to the situation before the merger, after the merger ($PP_M^T$), after *Remedy I* ($PP_I^T$), and after *Remedy II* ($PP_{II}^T$), in total for both markets.

both remedies may turn out to be counterproductive is different from the situation without quality competition, in which a counterproductive effect was only identified for *Remedy II*.

Finally, we may ask how the introduction of quality competition affects the efficiency of the remedies, which we measure by calculating the share of the consumers' loss that is remedied overall (in both markets). We define the efficiency $E_r$ of *Remedy* $r \in \{I, II\}$ as

$$E_r := 100 \left[ 1 - \frac{\sum_j \left( P_r^j - P_N^j \right)}{\sum_j \left( P_M^j - P_N^j \right)} \right]. \tag{33}$$

Figure 5a plots the efficiency of *Remedy I*, $E_I$, with and without quality competition, where the latter case is recovered by setting $b = 0$. In the former case, we plot $E_I$ for $b = 0.5$ and $b = 1$. Figure 5b compares the efficiency of *Remedy II* in the same way. We see that both remedies become

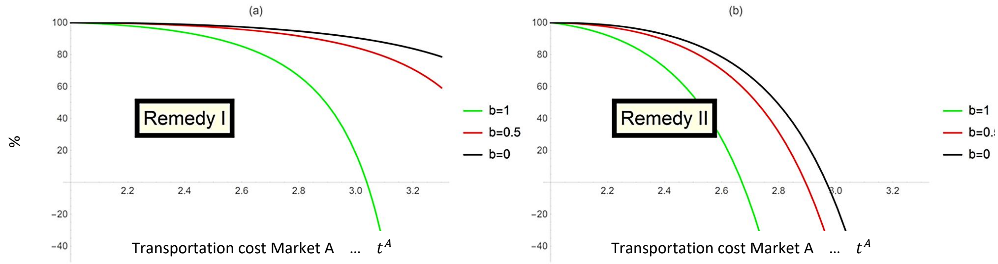


Figure 5: The efficiency of *Remedy I* (left panel) and *Remedy II* (right panel), measured as the share of the consumers' total loss from the merger that is remedied, with and without quality competition. We can see that both remedies become less efficient (in the sense that a smaller share of the overall harm is remedied) as the degree of local quality competition increases.

less efficient as we increase the intensity of quality competition. Thus, we can conclude that the introduction of quality competition does not necessarily improve the performance of local structural remedies, and it may sometimes make it worse.

To explain the intuition behind these results, we will use *Remedy I* as our case in point. In our numerical example, the impact of quality competition is two-fold: (i) The harmful effect of the unremedied merger is reduced (see discussion at the top of Section 5.2.1), and (ii) the harmful effect of the remedied merger is increased. Put together, this implies that the remedied merger performs worse relative to the unremedied merger after we introduce quality competition. We elaborate on the intuition for this in the following.

Since Market $A$ is the smaller market with weaker competition, the changes in store ownership brought about by *Remedy I* (see Figure 2) create (i) an incentive for Chain 4 to increase its national price (since it now owns a second store in the market with weak competition), and (ii) an incentive for Chain 2 to reduce the price at its remaining location in Market $B$ (where competition is tougher), all else being equal. These incentives are the same with and without quality competition.[16] However, because own quality and price are complementary strategies, quality competition

[16] Without quality competition, effect (ii) always dominates effect (i), as implied by Proposition 4.

produces two additional effects: (iii) Chain 4 will want to increase the quality levels at its three locations, and (iv) Chain 2 will have an incentive to reduce its quality level at its remaining location in Market $B$. These two additional effects also create second-order feedback effects in the sense that they *reinforce* the price responses given by (i) and (ii).

The overall impact of the additional effects created by quality competition is *a priori* unclear, since they benefit some consumers and harm others. In Market $B$, the post-merger responses always go in opposite directions for Chain 2 and 4, and thus they tend to cancel each other, both with and without quality competition, which therefore has relatively little impact on the effect of the remedied merger in Market $B$. In Market $A$, on the other hand, quality competition produces an inflated national price response from Chain 4. This can potentially only be countered by a comparable increase in Chain 4's quality levels. However, because the quality levels are already relatively low in Market $A$, which is the smaller and less competitive market, and because price and quality increase by the same rate (cf. Lemma 2), the quality increases in this market are of relatively little value to consumers (compared to the national price increase). Thus, the consumers in Market $A$ are left significantly worse off when we introduce quality competition. In sum, this explains how the remedied merger performs worse under quality competition in our example: On average, the consumers in Market $B$ are relatively weakly impacted, because the chains' responses go in opposite directions, whereas the consumers in Market $A$ are left with Chain 4's inflated national price response, without any comparable increase in local quality.

It is important to stress that these results are based on a numerical example and do not demonstrate general results within our model framework.[17] However, we believe that the example is relevant (as will be highlighted in the subsequent section), and we also believe it demonstrates an important insight: Even if the competition between retail firms involves rivalry along important local dimensions (in addition to the national price dimension), this does not necessarily mean that local divestitures perform

[17] If the smaller market is also the more competitive one, the results may move in the opposite direction, and the remedied merger may perform better with quality competition.

better as merger remedies. In fact, they may perform even worse.

# 6 Discussion

Our results demonstrate how local divestitures are generally inefficient merger remedies, and may cause unintended consequences, if the merging retail chains set their prices nationally. In fact, local divestitures may turn out to be counterproductive. This insight is important, as currently (or at least historically) competition authorities do consider and sometimes accept local divestitures as remedies in markets where we know that national pricing occurs, such as the grocery and other retail markets.

One early example from the UK is the Office of Fair Trading's (OFT) investigation of the merger between the grocery retail chains Co-op and Somerfield in 2008. The transaction meant that Co-op would take over about 900 Somerfield stores located in a large number of local markets throughout the UK. In 94 of the affected local markets the OFT identified concerns that the stores of the merging parties were sufficiently close local competitors that the elimination of competition between them would cause a "substantial lessening of competition" (SLC) at the local level (OFT, 2008).[18] The OFT was of the opinion that these merger-specific concerns would be resolved by means of divestments in the relevant local areas, and in the end they also decided to accept the offer from Co-op to divest more than 120 supermarket stores. It is worth noting that there were questions raised during the investigation to what extent the prices were locally or centrally decided. Co-op argued that their pricing policies meant that local pricing was not based on local competition, because they allocated all their stores to one of their several national "price bands," based on the format of the store. OFT's reply was twofold: First, they argued that they had not seen conclusive evidence that there was *no* prospect of "local price flexing" in any form.[19] Second, they replied that "pricing is only one of a number

[18] They also identified concerns in an additional 32 local areas where Somerfield and Co-op did not face each other directly, but in which competition was primarily between Somerfield and one of the other regional co-operatives that were members of the CRTG buying group (of which Co-op was itself a member). This brought the total number of problematic markets up to 126.

[19] Local price flexing here refers to the decision of a retailer to raise the price level in

of ways in which competitive harm might occur, such as a deterioration of non-price factors such as quality, range and service" (OFT, 2008: p. 13).

In a similar case the Norwegian Competition Authority (NCA) in 2015 investigated the merger between the Norwegian grocery retail chains Coop and ICA Norge. At the time Coop owned about 800 grocery stores across Norway, with an overall market share of about 23 percent; ICA owned about 550 stores, and had a market share of about 10 percent. The case was important, in particular because the Norwegian grocery retail industry was already very concentrated at the time.[20] During the investigation the NCA identified 90 local areas in which competition would be substantially harmed by the merger. As in the Co-op/Somerfield case, there were discussions during the investigation to what extent the prices were locally determined. The two chains imposed national maximum prices, which implied a high degree of uniformity across local markets. However, the NCA also noted that local market conditions naturally would affect the chains' national prices, and thus the merger might cause the national prices to increase. Moreover, the NCA argued that the use of new technologies, such as electronic shelf labels, over time would make it easier for the chains to adjust prices locally. In the end the NCA did not conclude whether prices would be raised nationally, locally, or both—instead they simply noted that prices would likely increase. Moreover, like the OFT in the Co-op/Somerfield case, they argued that the chains might exploit market power locally by adjusting non-price parameters such as quality and service. The NCA therefore concluded that divestitures would be necessary in the 90 local areas in which they had identified a lessening of competition. In the end the merger was conditionally accepted after Coop offered to divest 93 stores.

Another example from the UK, but from a different industry, is the acquisition of Sainsbury's pharmacy business by Celesio's LloydsPharmacy in 2016. LloydsPharmacy operated around 1540 pharmacies in the UK at the time, and the acquisition meant that they would take over all of Sainsbury's 281 pharmacies (most of them operating out of Sainsbury's grocery

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a particular area in order to exploit local market power.

[20] In 2013 the four largest grocery chains in Norway had a joint market share of around 96 percent, according to the NCA (2015).

stores). During the investigation the Competition & Markets Authority (CMA) identified an SLC in a small number of local areas, only 12 in total. What makes the case interesting, however, is that the merging parties and the CMA all agreed that the non-price-regulated medicines (so-called Pharmacy-only medicines (P-medicines) and General sales list (GSL) medicines) were priced at nationally set levels, and that post-merger local price flexing was unlikely to occur. Still, the CMA was concerned that the pharmacies would have an incentive to reduce quality, range or service at the local level after the merger, and in particular in the 12 areas in which they had identified an SLC. In the end the CMA concluded that one local divestiture in each of the 12 relevant markets, which the parties had offered, would be an "effective and proportionate" remedy.

In the US the Federal Trade Commission (FTC) has investigated several mergers between large retail chains in the last few years, such as Office Depot/OfficeMax (FTC, 2013), Albertsons/Safeway (FTC, 2015a), Dollar Tree/Family Dollar (FTC, 2015b), Walgreens/Rite Aid (FTC, 2017), and 7-Eleven/Sunoco (FTC, 2018). Some of these mergers have been cleared after the parties agreed to divest stores, as in the Albertsons/Safeway grocery merger and the Dollar Tree/Family Dollar variety store merger. The FTC required Albertsons/Safeway to sell 168 stores, after finding that the merger would likely be anticompetitive in 130 local markets, while Dollar Tree/Family Dollar had to sell 330 stores, after the agency concluded that consumers would be harmed in many local markets spanning a total of 35 states (FTC, 2015a, 2015b). We may also note the recently announced $24.6 billion giant grocery merger between Kroger and Albertsons. In this case the companies have already publicly declared that in order to avoid a challenge from the FTC they are prepared to divest between 100 and 350 local supermarket stores before the deal's close, which is expected in early 2024. According to Reuters, the parties have even suggested that they may be willing to divest as many as 650 stores, if necessary, to secure approval. This case is interesting not just because of its size, but also because the companies have suggested that if they cannot find suitable buyers, they plan to divest stores by spinning them off as a standalone unit to its shareholders. The new unit would then effectively serve as a new entrant into the US grocery retail market. It is still an open question how the FTC will approach the case. However, in light of previous cases reviewed by the FTC, some commentators have suggested that a plan to divest stores in overlap areas may be enough to clear the merger.[21] These US examples are particularly relevant, given that DellaVigna and Gentzkow (2020) thoroughly document how grocery retail chains in the US charge prices that are essentially uniform across their stores, despite wide variation in local market conditions, with similar evidence presented also for pharmacies and mass-merchandise chains.

In our view there are two important takeaways from these examples that are relevant for our discussion: (i) Competition agencies seem to believe that local divestitures are often an appropriate merger remedy, even if store prices are not fully decided locally, and (ii) this belief is in part based on the authorities' concerns for local non-price competition, such as competition on quality, range and service. As we have demonstrated, this logic is flawed. In our model, if the prices are set nationally, local divestitures will in many cases be less effective in remedying the harm from mergers. Moreover, the introduction of local quality competition does not necessarily improve the effectiveness of local divestitures. On the contrary, local non-price competition will in many cases cause local divestitures to perform even worse. Finally, with national pricing we find that a local divestiture in many cases can turn counterproductive for the consumers located in the specific market that the remedy seeks to benefit, and it may also turn counterproductive for consumers on aggregate (across markets), in the sense that the total consumer surplus would have been higher under the unremedied merger.

The intuition for our results is derived from the following two mechanisms: (i) National pricing creates pricing externalities between different local markets, and (ii) the structure of a chain (i.e., the number of shops controlled by the chain, and their locations) will affect its national price level. As a consequence of the pricing externalities, a post-merger divestiture in Market $A$ will have uncertain consequences for the price levels in Market $B$, and *vice versa*. Moreover, a local divestiture in Market $A$ may, because of the specific chain structure of the buyer, have the unintended

[21] Our source on the developments surrounding the Albertsons/Kroger merger is Reuters, specifically Bartz et al. (2022) and Sen and Summerville (2022).

consequence of causing even more harm in Market $A$, compared to the unremedied merger.

In our model framework, a remedy can be counterproductive (not just less effective) if the following two conditions are met: (i) The market where the parties are direct competitors (Market $A$) is sufficiently small relative to the market where they are not direct competitors (Market $B$), and (ii) the degree of competition in the market where they are competitors is already sufficiently weak relative to the degree of competition in the other market. The parameters $m^A$ and $m^B$ in our model may be interpreted as the sizes of two different local markets. However, another potential interpretation is that the parameters simply reflect numbers of markets of different types (but of equal size): $m^A$ would then reflect the number of markets where the stores of the merging parties are direct competitors, and $m^B$ would be the number of markets in which the parties are not direct competitors. Yet another interpretation is that the parameters reflect both the number of markets *and* their size.[22] Under this interpretation, the case in which the ratio $m^A/m^B$ is sufficiently small seems to fit many real-life merger cases. In many proposed retail mergers a relatively modest number of local markets raises concern (at least compared to the total number of affected markets), and in many cases these are mostly small local markets, with small populations and a small number of stores.

Our analysis suggests that the authorities should be very cautious when reviewing structural remedies in retail markets in which national pricing is known to occur. The insights presented here are important not least because a divestiture, like any other merger, is costly both for the seller and for the buyer. It is also costly for the competition authorities, who need to review the effects of each proposed divestiture. In many cases it may be difficult to find a buyer, especially one who will be cleared by the competition authorities, and in other cases several buyers is needed to finalize a divestment plan. Structural remedies should therefore only be used if it is reasonably certain that they will have the intended effects and benefit the consumers.

[22]Note that this interpretation does not work as well with local quality competition, because of the presence of local quality costs.

# 7 Concluding remarks

A key tool for merger control in retail markets is structural remedies, which imply a divestiture of assets in those local markets where the merger is considered to cause competitive harm. In this paper we have shown that the effectiveness of such remedies depends crucially on firms' pricing policy—whether prices are set locally or nationally. Under local pricing, any competitive harm of a merger can, at least in principle, be fully rectified by appropriate structural remedies. This is not the case when retail chains use national (or regional) pricing. Not only are structural remedies then less effective, but they may also under some circumstances be counterproductive, in the sense that the competitive harm of a remedied merger is larger than the competitive harm of an unremedied one. These conclusions generally hold even if competition is multi-dimensional and there is a significant element of local competition along other dimensions than price, such as quality or service.

Our results are derived from a stylized model that depicts a particular market and industry structure. This is a necessity, since the set of possible market structures, above all in terms of store ownership structure across different local markets, is infinitely large. Whereas all the details of our results are unlikely to survive under any possible market structure, our model is nevertheless structurally rich enough to illustrate and identify some very general mechanisms and insights. The use of structural remedies for merger control in retail markets relies on the underlying logic that the competitive harm of a merger can be remedied in those local markets that are the source of this harm (i.e., in the local markets where the merger leads to less competition). However, this logic does not work in retails markets where the chains set prices nationally. The reason is that the optimally chosen national price is a *weighted* average of the optimally set local prices, which in turn means that national price setting is affected by store ownership structure across local markets. This implies that any change in store ownership structure, which necessarily follows from any structural remedy, will have price effects not only in the local market where the remedy is implemented, but in other markets as well.

When structural remedies lead to cross-market externalities, due to national pricing, such remedies are not only less effective, but their effects are also much more complex and less predictable. This implies, in turn, that the choice of an optimal remedy—even if it is not fully effective—is a much more difficult task. This is to some extent illustrated in our model where two remedies that are completely equivalent under local pricing have different effects under national pricing. In a structurally richer model, the set of potential candidates for the most effective remedy might be very large, and the optimal one might even involve divestitures in *other* local markets than the ones from which the competitive harm of the merger originates. This suggests that the presence of national pricing should fundamentally change the way antitrust authorities think about structural remedies in merger control. In a general sense, this is the main message of our paper.

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# Appendix

## Proof of Proposition 2

Define as $\Delta p_i$ the difference between the equilibrium post- and pre-merger prices of Chain $i$. A comparison of (16)-(19) and (12) then yields

$$\Delta p_1 = \frac{\alpha\beta\left(t^A - t^B\right)\left(5\alpha\left(2\alpha + 3\beta\right) + 4\beta^2\right)}{4\left(\alpha + \beta\right)\left(\alpha\beta\left(249\alpha + 200\beta\right) + 48\left(2\alpha^3 + \beta^3\right)\right)}, \tag{A1}$$

$$\Delta p_2 = -\frac{\alpha\left(t^A - t^B\right)\left(4\alpha + 5\beta\right)\left(3\alpha\left(4\alpha + 5\beta\right) + 4\beta^2\right)}{4\left(\alpha + \beta\right)\left(\alpha\beta\left(249\alpha + 200\beta\right) + 48\left(2\alpha^3 + \beta^3\right)\right)}, \tag{A2}$$

$$\Delta p_3 = -\frac{\alpha\beta\left(t^A - t^B\right)\left(\beta\left(2\alpha + 5\beta\right) + 4\beta^2\right)}{4\left(\alpha + \beta\right)\left(\alpha\beta\left(249\alpha + 200\beta\right) + 48\left(2\alpha^3 + \beta^3\right)\right)}, \tag{A3}$$

$$\Delta p_4 = \frac{\alpha\beta\left(t^A - t^B\right)\left(5\alpha + 4\beta\right)\left(4\alpha + 5\beta\right)}{4\left(\alpha + \beta\right)\left(\alpha\beta\left(249\alpha + 200\beta\right) + 48\left(2\alpha^3 + \beta^3\right)\right)}. \tag{A4}$$

It is easily confirmed that $\Delta p_1 > (<)\, 0$, $\Delta p_2 < (>)\, 0$, $\Delta p_3 < (>)\, 0$ and $\Delta p_4 > (<)\, 0$ if $t^A > (<)\, t^B$.

## Proof of Proposition 3

Once more, define as $\Delta p_i$ the difference between the equilibrium post- and pre-merger prices of Chain $i$. Additionally, define $\Delta p_E$ as the difference between the post-merger price of the new entrant and the pre-merger price set by the previous owner of the store. A comparison of (20)-(24) and (12) then yields

$$\Delta p_1 = -\Delta p_4 = \frac{5\alpha\beta\left(t^A - t^B\right)}{12\left(16\left(\alpha^2+\beta^2\right)+33\alpha\beta\right)}, \tag{A5}$$

$$\Delta p_2 = -\frac{\beta\left(t^A - t^B\right)\left[24\alpha^2+25\beta^2+51\alpha\beta\right]}{12\left(\alpha+\beta\right)\left(16\left(\alpha^2+\beta^2\right)+33\alpha\beta\right)}, \tag{A6}$$

$$\Delta p_3 = -\frac{\alpha\beta\left(t^A - t^B\right)\left(\alpha-\beta\right)}{12\left(\alpha+\beta\right)\left(16\left(\alpha^2+\beta^2\right)+33\alpha\beta\right)}, \tag{A7}$$

$$\Delta p_E = \frac{\beta\left(t^A - t^B\right)\left[25\alpha^2+24\beta^2+51\alpha\beta\right]}{12\left(\alpha+\beta\right)\left(16\left(\alpha^2+\beta^2\right)+33\alpha\beta\right)}. \tag{A8}$$

It is easily confirmed that $\Delta p_1 > (<)\, 0$, $\Delta p_2 < (>)\, 0$, $\Delta p_4 < (>)\, 0$ and $\Delta p_E > (<)\, 0$ if $t^A > (<)\, 0$, whereas $\Delta p_3 > 0$ if (i) $t^A > t^B$ and $\alpha < \beta$, which implies $m^A/m^B < t^A/t^B$ or (ii) $t^A < t^B$ and $\alpha > \beta$, which implies $m^A/m^B > t^A/t^B$; otherwise, $\Delta p_3 < 0$.

## Proof of Proposition 4

The average paid retail price is defined as

$$\overline{p} := \frac{\sum_j \sum_i p_i q_i^j}{m^A + m^B}. \tag{A9}$$

Define $\Delta\overline{p}_r$ as the difference between the post- and pre-merger average price, where the latter is given by (12), under *Remedy* $r$. Using the equilibrium price expressions derived in Section 4, the average price differences under *Remedy I* and *Remedy II*, respectively, are given by

$$\Delta\overline{p}_I = \frac{\begin{bmatrix} (85\alpha+13\beta)\,16\beta^4 \\ +(288\alpha+1265\beta)\,2\alpha^4 \\ +(4280\alpha+3477\beta)\,(\alpha\beta)^2 \end{bmatrix} m^B t^B \left[m^A\left(t^A-t^B\right)\right]^2}{4\left(m^A+m^B\right)\left(\alpha+\beta\right)\left(\left(\alpha\beta\left(249\alpha+200\beta\right)+48\left(2\alpha^3+\beta^3\right)\right)\right)^2} \tag{A10}$$

and

$$\Delta\overline{p}_{II}=\frac{\left[\begin{array}{c}144\left(\alpha^{4}+\beta^{4}\right)+988\left(\alpha\beta\right)^{2}\\+637\alpha\beta\left(\alpha^{2}+\beta^{2}\right)\end{array}\right]m^{A}m^{B}\left(t^{A}-t^{B}\right)^{2}}{36\left(m^{A}+m^{B}\right)\left(\alpha+\beta\right)\left(\left(\alpha\beta\left(249\alpha+200\beta\right)+48\left(2\alpha^{3}+\beta^{3}\right)\right)\right)^{2}}. \tag{A11}$$

Evidently, $\Delta\overline{p}_{I}>0$ and $\Delta\overline{p}_{II}>0$ for all $t^{A}\neq t^{B}$. Furthermore, since the pre-merger equilibrium is symmetric and the post-merger equilibrium is asymmetric, aggregate transportation costs always increase as a result of a merger (regardless of whether *Remedy I* or *II* is implemented). A higher average price combined with higher aggregate transportation costs must necessarily imply a reduction in the total consumers' surplus.

## Proof of Proposition 5

Consider first a merger with *Remedy I.* The Nash equilibrium prices are given by (16)-(19). The corresponding store demand in each market is found by substituting these prices into (2), and the corresponding average price is given by

$$\overline{p}_{I}:=\frac{p_{1}\left(q_{1}^{A}+q_{1}^{B}\right)+p_{2}q_{2}^{B}+p_{3}\left(q_{3}^{A}+q_{3}^{B}\right)+p_{4}\left(q_{2}^{A}+q_{4}^{A}+q_{4}^{B}\right)}{m^{A}+m^{B}}, \tag{A12}$$

where $q_{2}^{A}$ is the post-merger equilibrium demand for the store owned by Chain 2 before the merger and owned by Chain 4 after the (remedied) merger. The equilibrium consumers' surplus in Market $A$ is given by

$$CS_{I}^{A}=m^{A}\left(\begin{array}{c}\int_{0}^{x_{1,2}^{A}}\left(v-p_{1}-t^{A}y\right)dy+\int_{x_{1,2}^{A}}^{\frac{1}{4}}\left(v-p_{4}-t^{A}\left(\frac{1}{4}-y\right)\right)dy\\+\int_{\frac{1}{4}}^{x_{2,3}^{A}}\left(v-p_{4}-t^{A}\left(y-\frac{1}{4}\right)\right)dy+\int_{x_{2,3}^{A}}^{\frac{1}{2}}\left(v-p_{3}-t^{A}\left(\frac{1}{2}-y\right)\right)dy\\+\int_{\frac{1}{2}}^{x_{3,4}^{A}}\left(v-p_{3}-t^{A}\left(y-\frac{1}{2}\right)\right)dy+\int_{x_{3,4}^{A}}^{\frac{3}{4}}\left(v-p_{4}-t^{A}\left(\frac{3}{4}-y\right)\right)dy\\+\int_{\frac{3}{4}}^{x_{4,1}^{A}}\left(v-p_{4}-t^{A}\left(y-\frac{3}{4}\right)\right)dy+\int_{x_{4,1}^{A}}^{1}\left(v-p_{1}-t^{A}\left(1-y\right)\right)dy\end{array}\right), \tag{A13}$$

where

$$x_{1,2}^{A}=\frac{1}{8}-\left(\frac{p_{1}-p_{4}}{2t^{A}}\right) \tag{A14}$$

is the location of the consumer who is indifferent between Store 1 and Store 2 (now owned by Chain 4),

$$x_{2,3}^{A} = \frac{3}{8} - \left(\frac{p_4 - p_3}{2t^A}\right) \tag{A15}$$

is the location of the consumer who is indifferent between Store 2 (now owned by Chain 4) and Store 3,

$$x_{3,4}^{A} = \frac{5}{8} - \left(\frac{p_3 - p_4}{2t^A}\right) \tag{A16}$$

is the location of the consumer who is indifferent between Store 3 and Store 4, and

$$x_{4,1}^{A} = \frac{7}{8} - \left(\frac{p_1 - p_4}{2t^A}\right) \tag{A17}$$

is the location of the consumer who is indifferent between Store 4 and Store 1. Similarly, the equilibrium consumers' surplus in Market $B$ is

$$CS_I^B = m^B \left( \begin{array}{c} \int_0^{x_{1,3}^B} \left(v - p_1 - t^B y\right) dy + \int_{x_{1,3}^B}^{\frac{1}{4}} \left(v - p_3 - t^B \left(\frac{1}{4} - y\right)\right) dy \\ + \int_{\frac{1}{4}}^{x_{3,2}^B} \left(v - p_3 - t^B \left(y - \frac{1}{4}\right)\right) dy + \int_{x_{3,2}^B}^{\frac{1}{2}} \left(v - p_2 - t^B \left(\frac{1}{2} - y\right)\right) dy \\ + \int_{\frac{1}{2}}^{x_{2,4}^B} \left(v - p_2 - t^B \left(y - \frac{1}{2}\right)\right) dy + \int_{x_{2,4}^B}^{\frac{3}{4}} \left(v - p_4 - t^B \left(\frac{3}{4} - y\right)\right) dy \\ + \int_{\frac{3}{4}}^{x_{4,1}^B} \left(v - p_4 - t^B \left(y - \frac{3}{4}\right)\right) dy + \int_{x_{4,1}^B}^{1} \left(v - p_1 - t^B (1 - y)\right) dy \end{array} \right), \tag{A18}$$

where

$$x_{1,3}^{B} = \frac{1}{8} - \left(\frac{p_1 - p_3}{2t^B}\right) \tag{A19}$$

is the location of the consumer who is indifferent between Store 1 and Store 3,

$$x_{3,2}^{B} = \frac{3}{8} - \left(\frac{p_3 - p_2}{2t^B}\right) \tag{A20}$$

is the location of the consumer who is indifferent between Store 3 and Store 2,

$$x_{2,4}^{B} = \frac{5}{8} - \left(\frac{p_2 - p_4}{2t^B}\right) \tag{A21}$$

is the location of the consumer who is indifferent between Store 2 and Store 4, and

$$x_{4,1}^{B} = \frac{7}{8} - \left(\frac{p_1 - p_4}{2t^B}\right) \tag{A22}$$

is the location of the consumer who is indifferent between Store 4 and Store 1.

Consider next a merger with *Remedy II*, which implies that the Nash equilibrium prices are given by (20)-(24). The corresponding store demand in each market is found by substituting these prices into (2), and the corresponding average price is given by

$$\overline{p}_{II} := \frac{p_1\left(q_1^A + q_1^B\right) + p_2 q_2^B + p_3\left(q_3^A + q_3^B\right) + p_4\left(q_4^A + q_4^B\right) + p_E q_E^A}{m^A + m^B}, \tag{A23}$$

where $q_E^A$ is the post-merger equilibrium demand for the store owned by Chain 2 before the merger and owned by the new entrant $E$ after the (remedied) merger. The equilibrium consumers' surplus in Market $A$, denoted $CS_{II}^A$, is given by the same expression as in (A13) for $CS_I^A$, with the exception that $p_4$ is replaced by $p_E$ in the second and third terms of (A13) and in the corresponding indifferent consumer locations in (A14)-(A15). On the other hand, the equilibrium consumers' surplus in Market $B$, denoted $CS_{II}^B$, is identical to the expression in (A18) for $CS_I^B$ (but obviously evaluated at a different set of equilibrium prices).

A comparison of average prices under the two remedies yields

$$\overline{p}_I - \overline{p}_{II} = -\frac{m^A m^B \beta\left(t^A - t^B\right)^2 (3\alpha + 2\beta)(5\alpha + 6\beta)\Phi}{36\left(m^A + m^B\right)(\alpha + \beta)\left(16\left(\alpha^2 + \beta^2\right) + 33\alpha\beta\right)^2 \Theta^2}, \tag{A24}$$

where

$$\begin{aligned}\Phi := {} & 27648\beta^7 + 936064\alpha^2\beta^5 + 1597461\alpha^5\beta^2 + 96768\alpha^7 \\ & + 248256\alpha\beta^6 + 606768\alpha^6\beta + 2284216\alpha^4\beta^3 + 1912204\alpha^3\beta^4\end{aligned} \tag{A25}$$

and

$$\Theta := 96\alpha^3 + 48\beta^3 + 200\alpha\beta^2 + 249\alpha^2\beta. \tag{A26}$$

A similar comparison of total consumers' surplus, where we define

$$\Delta CS_{I,II} := CS_I^A + CS_I^B - CS_{II}^A - CS_{II}^B,$$

yields

$$\Delta CS_{I,II} = \frac{m^A m^B \beta \left(t^A - t^B\right)^2 (5\alpha + 6\beta)(3\alpha + 2\beta)\Psi}{72(\alpha+\beta)\left(16\left(\alpha^2+\beta^2\right) + 33\alpha\beta\right)^2 \Theta^2}, \tag{A27}$$

where

$$\begin{aligned}\Psi :=\ & 5182516\alpha^3\beta^4 + 82944\beta^7 + 2626240\alpha^2\beta^5 + 235008\alpha^7 \\ & + 721728\alpha\beta^6 + 1508496\alpha^6\beta + 5996944\alpha^4\beta^3 + 4075359\alpha^5\beta^2. \end{aligned} \tag{A28}$$

It is easily confirmed that a merger with *Remedy I* yields a strictly higher average price and a strictly lower consumers' surplus than a merger with *Remedy II*, as long as the degree of competition intensity differs between the two markets ($t^A \neq t^B$).

## Proof of Proposition 6

After an unremedied merger, the Nash equilibrium prices are given by (14)-(15). Since $p_1 = p_2$ and $p_3 = p_4$, the consumers' surplus in Market $A$ can be defined as

$$CS_m^A = 2m^A \left( \begin{array}{c} \int_0^{\frac{1}{8}} \left(v - p_1 - t^A y\right) dy + \int_{\frac{1}{4}}^{\widehat{x}_{2,3}^A} \left(v - p_2 - t^A\left(y - \frac{1}{4}\right)\right) dy \\ + \int_{\frac{1}{2}}^{\frac{5}{8}} \left(v - p_3 - t^A\left(y - \frac{1}{2}\right)\right) dy \\ + \int_{\frac{3}{4}}^{x_{4,1}^A} \left(v - p_4 - t^A\left(y - \frac{3}{4}\right)\right) dy \end{array} \right), \tag{A29}$$

where

$$\widehat{x}_{2,3}^A = \frac{3}{8} - \left(\frac{p_2 - p_3}{2t^A}\right) \tag{A30}$$

is the location of the consumer who is indifferent between Store 2 and Store 3 in Market $A$, and where $x_{4,1}^A$ is given by (A17). Similarly, by using the symmetry properties of the equilibrium, the consumers' surplus in Market

$B$ can be defined as

$$CS_m^B = 4m^B \left( \int_0^{x_{1,3}^B} \left(v - p_1 - t^B y\right) dy + \int_{x_{1,3}^B}^{\frac{1}{4}} \left(v - p_3 - t^B \left(\frac{1}{4} - y\right)\right) dy \right), \tag{A31}$$

where $x_{1,3}^B$ is given by (A19). Similarly, using the equilibrium prices given by (14)-(15), the average price in the unremedied post-merger equilibrium, denoted $\overline{p}_m$, is given by

$$\overline{p}_m = \frac{\left(17\alpha^2 + 36\beta^2 + 51\alpha\beta\right)\left(m^A + m^B\right)\tau}{2\left(\alpha + 2\beta\right)\left(5\alpha + 6\beta\right)^2}, \tag{A32}$$

The equilibrium average price and consumers' surplus if *Remedy II* is implemented alongside the merger were derived in the proof of Proposition 5.

Define $\Delta\overline{p}_{II,m} := \overline{p}_{II} - \overline{p}_m$ as the effect of *Remedy II* on the average price. This effect is given by

$$\Delta\overline{p}_{II,m} = \frac{\left(\kappa m^B - \eta\tau\right) m^A}{36\left(m^A + m^B\right)\left(\alpha + \beta\right)\left(\alpha + 2\beta\right)\left(5\alpha + 6\beta\right)^2 \left(16\left(\alpha^2 + \beta^2\right) + 33\alpha\beta\right)^2}, \tag{A33}$$

where

$$\begin{aligned} \kappa := {} & \left(3600\alpha + 11029\beta\right)\alpha^6 \left(t^B\right)^2 \\ & + \left(10368\beta^2 + 144876\alpha^2 + 68328\alpha\beta\right)\beta^5 \left(t^A\right)^2 \end{aligned} \tag{A34}$$

and

$$\begin{aligned} \eta := {} & 20736m^A\alpha^7 + 20736m^B\beta^7 + 48672m^B\alpha^7 + 31104\left(m^B\right)^2\beta^6 t^B \\ & + 340854\alpha^2\beta^4\left(m^B\right)^2 t^B + 834648\alpha^2\beta^5 m^B + 354410\alpha^6\beta m^B \\ & + 1601728\alpha^3\beta^4 m^B - 42686\alpha^2\beta^5 m^A + 183912\alpha^4\beta^2 t^B\left(m^B\right)^2 \\ & + 1731174\alpha^4\beta^3 m^B + 292857\alpha^3\beta^4 m^A + 1070982\alpha^5\beta^2 m^B \\ & + 514008\alpha^4\beta^3 m^A + 386492\alpha^5\beta^2 m^A + 219600\alpha\beta^6 m^B \\ & + 141840\alpha^6\beta m^A + 162648\alpha\beta^5\left(m^B\right)^2 t^B + 28206\alpha^5\beta\left(m^B\right)^2 t^B \\ & + 357580\alpha^3\beta^3\left(m^B\right)^2 t^B. \end{aligned} \tag{A35}$$

Similarly, define

$$\Delta CS_{II,m} := CS_{II}^{A} + CS_{II}^{B} - CS_{m}^{A} - CS_{m}^{B}$$

as the effect of *Remedy II* on total consumers' surplus. This effect is given by

$$\Delta CS_{II,m} = -\frac{\left(\gamma m^{B} - \mu\tau\right) m^{A}}{72\left(\alpha+\beta\right)\left(\alpha+2\beta\right)\left(5\alpha+6\beta\right)^{2}\left(16\left(\alpha^{2}+\beta^{2}\right)+33\alpha\beta\right)^{2}}, \tag{A36}$$

where

$$\gamma := 10800\alpha^{7}\left(t^{B}\right)^{2} + 31104\beta^{7}\left(t^{A}\right)^{2} + 459228\alpha^{2}\beta^{5}\left(t^{A}\right)^{2} + 40029\alpha^{5}\beta^{2}\left(t^{B}\right)^{2} + 200952\alpha\beta^{6}\left(t^{A}\right)^{2} + 50119\alpha^{6}\beta\left(t^{B}\right)^{2} \tag{A37}$$

and

$$\begin{aligned}\mu := {} & 493231\left(\alpha\beta\right)^{3}\left(m^{B}\right)^{2}t^{B} + 62208\beta^{7}m^{B} + 109152\alpha^{7}m^{B} \\ & + 51840\beta^{6}\left(m^{B}\right)^{2}t^{B} + 43776\alpha^{7}m^{A} + 2012856\alpha^{2}\beta^{5}m^{B} \\ & + 3718756\alpha^{3}\beta^{4}m^{B} - 328910\alpha^{2}\beta^{5}m^{A} + 179958\alpha^{4}\beta^{2}\left(m^{B}\right)^{2}t^{B} \\ & + 3933732\alpha^{4}\beta^{3}m^{B} + 385743\alpha^{3}\beta^{4}m^{A} + 2406288\alpha^{5}\beta^{2}m^{B} \\ & + 943680\alpha^{4}\beta^{3}m^{A} + 766532\alpha^{5}\beta^{2}m^{A} + 567792\alpha\beta^{6}m^{B} \\ & + 291888\alpha^{6}\beta m^{A} + 263304\alpha\beta^{5}\left(m^{B}\right)^{2}t^{B} + 793166\alpha^{6}\beta m^{B} \\ & + 524040\alpha^{2}\beta^{4}\left(m^{B}\right)^{2}t^{B}.\end{aligned} \tag{A38}$$

The sign of $\Delta\overline{p}_{II,m}$ is determined by the sign of $\left(\kappa m^{B} - \eta\tau\right)$, whereas the sign of $\Delta CS_{II,m}$ is determined by the sign of $\left(\gamma m^{B} - \mu\tau\right)$. It is straightforward to verify that $\lim_{m^{B}\to 0}\Delta\overline{p}_{II,m} < 0$, $\lim_{m^{B}\to 0}\Delta CS_{II,m} > 0$, $\lim_{t^{A}\to 0}\Delta\overline{p}_{II,m} > 0$, $\lim_{t^{A}\to 0}\Delta CS_{II,m} < 0$, $\lim_{t^{B}\to 0}\Delta\overline{p}_{II,m} > 0$, $\lim_{t^{B}\to 0}\Delta CS_{II,m} < 0$, $\lim_{t^{B}\to t^{A}}\Delta\overline{p}_{II,m} < 0$ and $\lim_{t^{B}\to t^{A}}\Delta CS_{II,m} > 0$. Thus, $\Delta\overline{p}_{II,m} > 0$ and $CS_{II,m} < 0$ only if markets are asymmetric, with a sufficiently high degree of competition in one of them, and Market $B$ is sufficiently large.

However, since $\Delta\overline{p}_{II,m} > 0$ and $CS_{II,m} < 0$ requires a sufficient degree of market asymmetry, it remains to show that the national pricing equilibrium actually exists for this particular set of parameters. Equilibrium existence requires that none of the chains has any incentive to unilaterally deviate from the candidate equilibrium and choose a price that implies zero demand for one or more of the chain's stores in one of the markets. The absence of such deviation incentives must hold in three different equilibria: (i) pre-merger, (ii) post-merger without remedies, and (iii) post-merger with *Remedy II*. In the following we consider deviation incentives in each of the equilibria in turn.

(i) In the *pre-merger Nash equilibrium* the profit Chain $i$ is

$$\pi_i = \frac{\left(m^A + m^B\right)^2 \tau}{16\left(\alpha + \beta\right)}. \tag{A39}$$

Since the equilibrium is symmetric, the incentives for unilateral deviation is the same for every chain. If Chain $i$ unilaterally deviates by withdrawing from Market $A$, the optimal deviation price solves

$$\max_{p_i} \widehat{\pi}_i^B = p_i q_i^B \tag{A40}$$

and is given by

$$\widehat{p}_i^B = \frac{\left(\alpha + 2\beta + m^A t^A\right) t^B}{8\left(\alpha + \beta\right)}, \tag{A41}$$

which yields a deviation profit of

$$\widehat{\pi}_i^B = \frac{\left(\alpha + 2\beta + m^A t^A\right)^2 m^B t^B}{64\left(\alpha + \beta\right)^2}. \tag{A42}$$

Alternatively, if this chain deviates by withdrawing from Market $B$, the optimal deviation price solves

$$\max_{p_i} \widehat{\pi}_i^A = p_i q_i^A \tag{A43}$$

and is given by

$$\widehat{p}_i^A = \frac{\left(2\alpha + \beta\right) t^A + \beta t^B}{8\alpha + 8\beta}, \tag{A44}$$

which yields a deviation profit of

$$\widehat{\pi}_i^A = \frac{\left(2\alpha + \beta + m^B t^B\right)^2 m^A t^A}{64\left(\alpha + \beta\right)^2}. \tag{A45}$$

(ii) In the *post-merger equilibrium without remedies*, the profits in the Nash equilibrium are

$$\pi_1 = \pi_2 = \frac{(2\alpha + 3\beta)^2 \left(m^A + m^B\right)^2 \tau}{2(\alpha + 2\beta)(5\alpha + 6\beta)^2} \tag{A46}$$

and

$$\pi_3 = \pi_4 = \frac{9\tau \left(m^A + m^B\right)^2 (\alpha + \beta)}{4(5\alpha + 6\beta)^2}. \tag{A47}$$

There are three types of potentially profitable deviation in the equilibrium. The merger participants (Chain 1 and 2) can withdraw one store from one of the markets, or they can withdraw both stores from one of the markets. Furthermore, one of the remaining chains (3 or 4) can withdraw its store from one of the markets. Consider first the case where the merged chains withdraw both stores from Market $A$. In this case, the optimal deviation prices solve

$$\max_{p_1, p_2} \widehat{\pi}_1^B + \widehat{\pi}_2^B = p_1 q_1^B + p_2 q_2^B \tag{A48}$$

and are given by

$$\widehat{p}_1^B = \widehat{p}_2^B = \frac{6\alpha t^A + (5\alpha + 12\beta) t^B}{40\alpha + 48\beta}, \tag{A49}$$

which yield a deviation profit of

$$\widehat{\pi}_1^B = \widehat{\pi}_2^B = \frac{\left(5\alpha + 12\beta + 6m^A t^A\right)^2 m^B t^B}{64(5\alpha + 6\beta)^2}. \tag{A50}$$

Alternatively, if the merged chains withdraw both stores from Market $B$, the optimal deviation prices solve

$$\max_{p_1, p_2} \widehat{\pi}_1^A + \widehat{\pi}_2^A = p_1 q_1^A + p_2 q_2^A \tag{A51}$$

and are given by

$$\widehat{p}_1^A = \widehat{p}_2^A = \frac{6\beta t^A + \left(8m^A + 3m^B\right) \tau}{20\alpha + 24\beta}, \tag{A52}$$

which yield a deviation profit of

$$\widehat{\pi}_1^A = \widehat{\pi}_2^A = \frac{\left(8\alpha + 6\beta + 3m^B t^B\right)^2 m^A t^A}{32\left(5\alpha + 6\beta\right)^2}. \tag{A53}$$

Another possible deviation for the merged chains is to withdraw only one of the stores from one of the markets. Because of symmetry, the incentive to withdraw only Store 1 from one of the markets is the same as the incentives to withdraw only Store 2 from one of the markets. Suppose that Store 2 is withdrawn from Market $A$. This implies that the remaining Store 1 in Market $A$ faces a new demand given by

$$\widehat{q}_1^A = m^A \left[\frac{3}{8} + \left(\frac{p_3 + p_4 - 2p_1}{2t^A}\right)\right]. \tag{A54}$$

The optimal deviation prices then solve

$$\max_{p_1, p_2} \widehat{\pi}_1 + \widehat{\pi}_2^B = p_1\left(\widehat{q}_1^A + q_1^B\right) + p_2 q_2^B \tag{A55}$$

and are given by

$$\widehat{p}_1 = \frac{\left(27\alpha + 30\beta\right) m^A + \left(22\alpha + 24\beta\right) m^B}{16\left(\alpha + \beta\right)\left(5\alpha + 6\beta\right)}\tau \tag{A56}$$

and

$$\widehat{p}_2^B = \frac{5\alpha + 12\beta + 6m^A t^A}{8\left(5\alpha + 6\beta\right)} t^B, \tag{A57}$$

which yield deviation profits of

$$\widehat{\pi}_1 = \frac{\left(\left(27\alpha + 30\beta\right) m^A + \left(22\alpha + 24\beta\right) m^B\right)^2}{256\left(\alpha + \beta\right)\left(5\alpha + 6\beta\right)^2}\tau \tag{A58}$$

and

$$\widehat{\pi}_2^B = \frac{\left(5\alpha + 12\beta + 6m^A t^A\right)^2}{64\left(5\alpha + 6\beta\right)^2} m^B t^B. \tag{A59}$$

If the merger participants instead withdraw Store 2 from Market $B$, this does not affect the demand functions for the remaining stores of the two chains (since Store 1 and Store 2 do not compete directly with each other in Market $B$). The optimal deviation prices in this case solve

$$\max_{p_1,p_2} \widehat{\pi}_1 + \widehat{\pi}_2^A = p_1\left(q_1^A + q_1^B\right) + p_2 q_2^A \tag{A60}$$

and are given by

$$\widehat{p}_1 = \frac{(24\alpha + 30\beta)\, m^A + (19\alpha + 24\beta)\, m^B}{4\,(3\alpha + 4\beta)\,(5\alpha + 6\beta)}\tau, \tag{A61}$$

and

$$\widehat{p}_2^A = \frac{12\alpha^2 + 6\beta^2 + 20\alpha\beta + (7\alpha + 9\beta)\, m^B t^B}{2\,(3\alpha + 4\beta)\,(5\alpha + 6\beta)} t^A, \tag{A62}$$

yielding deviation profits

$$\widehat{\pi}_1 = \frac{\tau\left(m^A + m^B\right)(2\alpha + 3\beta)\left((24\alpha + 30\beta)\, m^A + (19\alpha + 24\beta)\, m^B\right)}{8\,(3\alpha + 4\beta)\,(5\alpha + 6\beta)^2} \tag{A63}$$

and

$$\widehat{\pi}_2^A = \frac{m^A t^A\left(8\alpha + 6\beta + 3m^B t^B\right)\left(12\alpha^2 + 6\beta^2 + 20\alpha\beta + (7\alpha + 9\beta)\, m^B t^B\right)}{16\,(3\alpha + 4\beta)\,(5\alpha + 6\beta)^2}. \tag{A64}$$

Finally, consider the incentives for one of the non-merged chains to withdraw its store from one of the markets. Because of symmetry, these incentives are the same for Chain 3 and Chain 4. Suppose that Chain 3 withdraws its store from Market $A$. In this case, the optimal deviation price solves

$$\max_{p_3} \widehat{\pi}_3^B = p_3 q_3^B \tag{A65}$$

and is given by

$$\widehat{p}_3^B = \frac{5\alpha^2 + 24\beta^2 + 24\alpha\beta + (8\alpha + 12\beta)\, m^A t^A}{8\,(\alpha + 2\beta)\,(5\alpha + 6\beta)} t^B, \tag{A66}$$

which yields a deviation profit of

$$\widehat{\pi}_3^B = \frac{\left(5\alpha^2 + 24\beta^2 + 24\alpha\beta + (8\alpha + 12\beta)\, m^A t^A\right)^2}{64\,(\alpha + 2\beta)^2\,(5\alpha + 6\beta)^2} m^B t^B. \tag{A67}$$

Suppose instead that Chain 3 withdraws its store from Market $B$. In this case, the optimal deviation price solves

$$\max_{p_3} \widehat{\pi}_3^A = p_3 q_3^A \tag{A68}$$

and is given by

$$\widehat{p}_3^A = \frac{\left(12\alpha^2 + 12\beta^2 + 28\alpha\beta + (7\alpha + 12\beta) m^B t^B\right)}{8(\alpha + 2\beta)(5\alpha + 6\beta)} t^A, \tag{A69}$$

which yields a deviation profit of

$$\widehat{\pi}_3^A = \frac{\left(12\alpha^2 + 12\beta^2 + 28\alpha\beta + (7\alpha + 12\beta) m^B t^B\right)^2}{64(\alpha + 2\beta)^2 (5\alpha + 6\beta)^2} m^A t^A. \tag{A70}$$

(iii) If the merger is implemented with *Remedy II*, there are three chains with stores in both markets, who could therefore potentially benefit from a unilateral deviation: Chain 1 (one of the merger participants), Chain 3 and Chain 4. In the candidate Nash equilibrium, the profits of these three chains are

$$\pi_1 = \frac{\left[\left(48\alpha^2 + 53\beta^2 + 104\alpha\beta\right) m^A + \left(43\alpha^2 + 48\beta^2 + 94\alpha\beta\right) m^B\right]^2 \tau}{144(\alpha + \beta)\left(16\left(\alpha^2 + \beta^2\right) + 33\alpha\beta\right)^2}, \tag{A71}$$

$$\pi_3 = \frac{\left[\left(48\alpha^2 + 49\beta^2 + 98\alpha\beta\right) m^A + \left(49\alpha^2 + 48\beta^2 + 98\alpha\beta\right) m^B\right]^2 \tau}{144(\alpha + \beta)\left(16\left(\alpha^2 + \beta^2\right) + 33\alpha\beta\right)^2} \tag{A72}$$

and

$$\pi_4 = \frac{\left[\left(48\alpha^2 + 43\beta^2 + 94\alpha\beta\right) m^A + \left(53\alpha^2 + 48\beta^2 + 104\alpha\beta\right) m^B\right]^2 \tau}{144(\alpha + \beta)\left(16\left(\alpha^2 + \beta^2\right) + 33\alpha\beta\right)^2}. \tag{A73}$$

If the merged chain withdraws Store 1 from Market $A$, the optimal deviation price solves

$$\max_{p_1} \widehat{\pi}_1^B = p_1 q_1^B \tag{A74}$$

and is given by

$$\widehat{p}_1^B = \frac{\begin{bmatrix} 24\alpha^3 + 48\beta^3 + 124\alpha\beta^2 + 99\alpha^2\beta \\ + \left(24\alpha^2 + 23\beta^2 + 48\beta m^A t^A\right) m^A t^A \end{bmatrix} t^B}{12\left(\alpha+\beta\right)\left(16\left(\alpha^2+\beta^2\right) + 33\alpha\beta\right)}, \tag{A75}$$

which yields a deviation profit of

$$\widehat{\pi}_1^B = \frac{\begin{bmatrix} 24\alpha^3 + 48\beta^3 + 124\alpha\beta^2 + 99\alpha^2\beta \\ + \left(24\alpha^2 + 23\beta^2 + 48\beta m^A t^A\right) m^A t^A \end{bmatrix}^2 m^B t^B}{144\left(\alpha+\beta\right)^2\left(16\left(\alpha^2+\beta^2\right) + 33\alpha\beta\right)^2}. \tag{A76}$$

Alternatively, if this chain withdraws Store 1 from Market $B$, the optimal deviation price solves

$$\max_{p_1} \widehat{\pi}_1^A = p_1 q_1^A \tag{A77}$$

and is given by

$$\widehat{p}_1^A = \frac{\begin{bmatrix} 48\alpha^3 + 30\beta^3 + 109\alpha\beta^2 + 128\alpha^2\beta \\ + \left(19\alpha^2 + 18\beta^2 + 38\alpha\beta\right) m^B t^B \end{bmatrix} t^A}{12\left(\alpha+\beta\right)\left(16\left(\alpha^2+\beta^2\right) + 33\alpha\beta\right)}, \tag{A78}$$

which yields a deviation profit of

$$\widehat{\pi}_1^A = \frac{\begin{bmatrix} 48\alpha^3 + 30\beta^3 + 109\alpha\beta^2 + 128\alpha^2\beta \\ + \left(19\alpha^2 + 18\beta^2 + 38\alpha\beta\right) m^B t^B \end{bmatrix}^2 m^A t^A}{144\left(\alpha+\beta\right)^2\left(16\left(\alpha^2+\beta^2\right) + 33\alpha\beta\right)^2}. \tag{A79}$$

If Chain 3 withdraws from Market $A$, the optimal deviation price solves

$$\max_{p_3} \widehat{\pi}_3^B = p_3 q_3^B \tag{A80}$$

and is given by

$$\widehat{p}_3^B = \frac{\begin{bmatrix} 30\alpha^3 + 48\beta^3 + 128\alpha\beta^2 + 109\alpha^2\beta \\ + \left(18\alpha^2 + 19\beta^2 + 38\alpha\beta\right) m^A t^A \end{bmatrix} t^B}{12\left(\alpha+\beta\right)\left(16\left(\alpha^2+\beta^2\right) + 33\alpha\beta\right)}, \tag{A81}$$

which yields a deviation profit of

$$\widehat{\pi}_3^B = \frac{\left[\begin{array}{c} 30\alpha^3 + 48\beta^3 + 128\alpha\beta^2 + 109\alpha^2\beta \\ + \left(18\alpha^2 + 19\beta^2 + 38\alpha\beta\right) m^A t^A \end{array}\right]^2 m^B t^B}{144\left(\alpha+\beta\right)^2 \left(16\left(\alpha^2+\beta^2\right) + 33\alpha\beta\right)^2} \tag{A82}$$

If instead Chain 3 withdraws from Market $B$, the optimal deviation price solves

$$\max_{p_3} \widehat{\pi}_3^A = p_3 q_3^A \tag{A83}$$

and is given by

$$\widehat{p}_3^A = \frac{\left[\begin{array}{c} 48\alpha^3 + 30\beta^3 + 109\alpha\beta^2 + 128\alpha^2\beta \\ + \left(19\alpha^2 + 18\beta^2 + 38\alpha\beta\right) m^B t^B \end{array}\right] t^A}{12\left(\alpha+\beta\right) \left(16\left(\alpha^2+\beta^2\right) + 33\alpha\beta\right)}, \tag{A84}$$

which yields a deviation profit of

$$\widehat{\pi}_3^A = \frac{\left[\begin{array}{c} 48\alpha^3 + 30\beta^3 + 109\alpha\beta^2 + 128\alpha^2\beta \\ + \left(19\alpha^2 + 18\beta^2 + 38\alpha\beta\right) m^B t^B \end{array}\right]^2 m^A t^A}{144\left(\alpha+\beta\right)^2 \left(16\left(\alpha^2+\beta^2\right) + 33\alpha\beta\right)^2}. \tag{A85}$$

Finally, if Chain 4 withdraws from Market $A$, the optimal deviation price solves

$$\max_{p_4} \widehat{\pi}_4^B = p_4 q_4^B \tag{A86}$$

and is given by

$$\widehat{p}_4^B = \frac{\left[\begin{array}{c} 30\alpha^3 + 48\beta^3 + 128\alpha\beta^2 + 109\alpha^2\beta \\ + \left(18\alpha^2 + 19\beta^2 + 38\alpha\beta\right) m^A t^A \end{array}\right] t^B}{12\left(\alpha+\beta\right) \left(16\left(\alpha^2+\beta^2\right) + 33\alpha\beta\right)}, \tag{A87}$$

which yields a deviation profit of

$$\widehat{\pi}_4^B = \frac{\left[\begin{array}{c} 30\alpha^3 + 48\beta^3 + 128\alpha\beta^2 + 109\alpha^2\beta \\ + \left(18\alpha^2 + 19\beta^2 + 38\alpha\beta\right) m^A t^A \end{array}\right]^2 m^B t^B}{144\left(\alpha+\beta\right)^2 \left(16\left(\alpha^2+\beta^2\right) + 33\alpha\beta\right)^2}. \tag{A88}$$

If the chain instead withdraws from Market $B$, the optimal deviation price solves

$$\max_{p_4} \widehat{\pi}_4^A = p_4 q_4^A \tag{A89}$$

and is given by

$$\widehat{p}_4^A = \frac{\begin{bmatrix} 48\alpha^3 + 24\beta^3 + 99\alpha\beta^2 + 124\alpha^2\beta \\ + \left(23\alpha^2 + 24\beta^2 + 48\alpha\beta\right) m^B t^B \end{bmatrix} t^A}{12\left(\alpha+\beta\right)\left(16\left(\alpha^2+\beta^2\right) + 33\alpha\beta\right)}, \tag{A90}$$

which yields a deviation profit of

$$\widehat{\pi}_4^A = \frac{\begin{bmatrix} 48\alpha^3 + 24\beta^3 + 99\alpha\beta^2 + 124\alpha^2\beta \\ + \left(23\alpha^2 + 24\beta^2 + 48\alpha\beta\right) m^B t^B \end{bmatrix}^2 m^A t^A}{144\left(\alpha+\beta\right)^2\left(16\left(\alpha^2+\beta^2\right) + 33\alpha\beta\right)^2}. \tag{A99}$$

Consider the set of parameter values defined by the absence of profitable deviations in all cases considered above. Proposition 6 is valid if the intersection of this set and the parameter set defined by $\Delta\overline{p}_{II,m} > 0$ and $CS_{II,m} < 0$ is non-empty. A single example suffices to show that this is indeed the case. Let $m^A = 0.5$, $m^B = 1.5$, $t^A = 3.5$ and $t^B = 0.5$, which implies that Market $A$ is considerably smaller and with a lower degree of competition than Market $B$. For this particular example, it is easily confirmed that all three Nash equilibria considered above exist (i.e, there are no profitable deviations for any chain in any of the three candidate equilibria). Furthermore, this particular example yields $\Delta\overline{p}_{II,m} \approx 0.008$ and $\Delta CS_{II,m} \approx -0.025$.