Banning Price Discrimination by Dominant Firms*

Jan Bouckaert†, Hans Degryse‡, and Theon van Dijk§

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Abstract

This paper studies the welfare effects of price discrimination bans on firms with substantial market power – "dominant" firms. We analyze these bans using a two-period model where the market displays a competitive and a sheltered segment. A ban on "higher-prices-to-sheltered-consumers" decreases prices in the sheltered segment, relaxes competition in the competitive segment, increases the rival's profits, and may harm the dominant firm's profits. In contrast, a ban on "lower-prices-to-rival's-customers" decreases prices in the competitive segment, lowers rival's profits, and augments consumer surplus. Our paper shows that bans on price discrimination that take the form of selective price cuts above marginal cost may increase the dominant firm's share of the first-period market. Our findings also highlight that a dynamic two-period analysis may lead to opposite conclusions as compared to a static one-period analysis.

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†University of Antwerp, Department of Economics, Prinsstraat 13, B-2000 Antwerp, Belgium. jan.bouckaert@ua.ac.be.

‡Tilburg University, TILEC, K.U. Leuven and CESIfo, PO Box 90153, NL-5000 LE Tilburg, The Netherlands. H.Degryse@uvt.nl.

§Freelance Economic Consultant, Visiting Researcher University of Antwerp, Department of Economics, Prinsstraat 13, B-2000 Antwerp, Belgium. vandijkco@skynet.be .

1 Introduction

Firms with significant market power ("dominant" firms) are typically treated differently under competition law and regulation.[1] This different treatment sometimes translates into decisions or regulations imposing specific bans on price discrimination. For example, under Article 82 of the EC Treaty, which prohibits the abuse of a dominant position, dominant firms are considerably limited in their freedom to set prices in response to increased competition. Similarly, the Robinson-Patman Act in the United States restricts firms with monopoly power to charge different prices to different buyers. The European Commission, in a seminal decision upheld by the Courts, fined *AKZO* for abusing its dominant position by offering selective prices below average variable costs to its rival's customers only. Although the Commission's decision was largely driven by the predatory nature of *AKZO*'s pricing strategy, it also concluded that offering selective price cuts above average variable costs to competitors' main customers only, can be regarded as abusive. This has been the case for *Hilti* and *Compagnie Maritime Belge*, among others.[2] More importantly for the purpose of this paper, the Commission in its decision imposed *AKZO* to refrain from applying prices in the *EEC* which would result in its rival's customers paying to *AKZO* prices which are dissimilar to those being offered by *AKZO* to comparable customers.[3] Similar restraints on such targeted pricing were imposed on the two other mentioned firms. In another instance, before 1988, *British Gas* charged prices to its industrial customers, depending on their available alternatives (Monopolies and Mergers Commission, 1988). Customers with few possibilities to switch away from gas were charged higher prices compared to customers with dual-firing equipment. Following an investigation by the Monopolies and Mergers Commission, the freedom to price discriminate between these groups of customers was removed.[4]

Also, in liberalised sectors such as telecommunications or electricity, incumbent (dominant) firms often face regulatory restrictions to compete with entrants in their attempts to "win back" customers that switched. These restrictions consist of limiting the incumbent operator to se-

[1] Under EU competition law, a company in a dominant position has "a special responsibility not to allow its conduct to impair genuine undistorted competition in the Common Market." The dominant position referred to in Article 82 of the Treaty refers to a position of economic strength enjoyed by an undertaking which enables it to prevent effective competition being maintained on the relevant market by giving it the power to behave to an appreciable extent independently of its competitors, customers, and ultimately of its consumers (taken from *United Brands*, 1978).

[2] See Geradin and Petit (2006) for an extensive discussion on price discrimination in the context of Article 82.

[3] Case C-62/86, *AKZO Chemie BV v. Commission*, [1991] E.C.R. I-3359, [1993] 5 C.M.L.R. 215. See also Phlips and Moras (1993) for an extensive description and critical interpretation of the facts and the final decision.

[4] See also Dixon and Easaw (2001).

lectively offer lower prices to customers that moved their business relationship to a competitor, whilst at the same time maintaining higher prices on their captive consumers. For example, in order to prevent incumbent telephone or cable operators (like ILECs in the US) from engaging in such selective price-cutting behavior, the US Congress enacted in 1992 a uniform rate requirement in Section 623(d) of the Communications Act, where "[A] cable operator shall have a rate structure, for the provision of cable service, that is uniform throughout the geographic area in which cable service is provided over its cable system." Congress argued that the goal of Section 623(d) was "to prevent cable operators from dropping the rates in one portion of a franchise area to undercut a competitor temporarily."[5]

This paper studies the competitive and welfare effects of different bans on price discrimination, as illustrated above, when firms and consumers strategically anticipate that such bans will be imposed on the dominant firm.

Armstrong and Vickers (1993) consider the competitive and welfare effects of a ban on the dominant firm to price discriminate.[6] In their one-period model, the market consists of two segments. The first is the dominant firm's sheltered segment, where the dominant firm has a monopoly. The dominant firm, however, competes in prices with a price-taking entrant on the remaining competitive segment. They find that a ban on price discrimination decreases the price in the sheltered segment while, given entry, the price rises in the competitive segment. The reasoning is that with uniform pricing the incumbent monopolist protects its sheltered market and, consequently, responds less aggressively to entry. Prices, however, may fall in both segments when entry happens if and only if there is a ban on price discrimination. While the welfare effects from banning price discrimination are ambiguous, an important result in their model is that a ban on price discrimination generally results in entry on a larger scale.

We consider a two-period model in the spirit of Armstrong and Vickers (1993), with strategic

[5] Outside the US, there were several in-depth investigations by NRAs into win-back campaigns by incumbent telephone operators at the time of introduction of carrier (pre-) selection services. These have resulted in a number of cases in prohibitions and measures to make selective price cutting impossible (or at least more difficult). The Canadian Regulatory Authority in 2002 prohibited each local incumbent operator from trying to win back clients who had chosen carrier preselection, within a three-months period. See, for example, Decision CRTC 2006-69, by the Canadian Radio Television and Telecommunications Commission, where this winback rule is explained (http://www.crtc.gc.ca/archive/ENG/Decisions/2006/dt2006-69.htm) Similarly, the Spanish Commission for the Telecommunications Market (the NRA) decided in 2003 that Telefonica had to refrain from taking actions to win back any customer with carrier preselection from an alternative operator, until the expiration of a four-months period (Bird&Bird, 2003).

[6] See also Vickers (2005).

interaction on the competitive segment. Our motivation to make use of a two-period model is threefold. First, an analysis with more periods is appropriate given the observation that in many instances of competition, firms' pricing strategies essentially contain intertemporal aspects. In particular, when firms compete on a new market, they very often cannot judge consumers' relative preferences from the start. As a result, they charge uniform prices in the beginning and may engage in selective price setting only later on. Similarly, when an entrant becomes active on a competitive segment of the incumbent, both players can only tell apart customers with a high preference for the incumbent from others until the entrant has taken away some market share. In other words, when the incumbent wants to win back some of its previous customers, an intertemporal aspect inevitably appears. Second, bans on price discrimination may apply only after dominance is verified by competition authorities or complaints are received, which often occurs only after a certain time has evolved. Our two-period setting allows to investigate how firms and consumers strategically anticipate bans on dominant firms. Third, the use of a two-period model permits us to analyze the intertemporal effects of different bans on price discrimination imposed on the dominant firm. Our model sheds a light on whether specific price discrimination bans, like win-back bans or a ban on "higher-prices-to-sheltered-consumers", effectively deal with abuse of a dominant position.

In our model, the dominant firm charges the monopoly price on its sheltered market when it can set its prices unrestrainedly. On the competitive segment, however, the incumbent firm and the entrant compete with uniform prices in the first-period market and practice behavior-based price discrimination in the second period, as in Fudenberg and Tirole (2000). Without any imposed restriction on the prices charged, the dominant firm optimally sets two different prices in the first period and three prices in the second period. As a result, a qualification must be made as to how the incumbent's freedom to set prices becomes restricted following restraints imposed by e.g. a competition authority.

Therefore, we analyze and compare the competitive and welfare effects of two different bans on price discrimination, each prohibiting some form of price discrimination by the dominant firm. In each of the settings, we assume that the dominant firm wants to serve the sheltered segment and is active on the competitive segment. As a simplification, dominance is captured by a market share on the sheltered and competitive segment of more than 50% in period one. A price discrimination ban applies in the second period only, i.e. after (i) dominance is verified and (ii) a complaint has been made. In competition policy practice, a dominant firm can only be accused of abusing its dominant position after a complaint has been received or after an

independent investigation by the competition authority. However, since price discrimination in the second period is a dominant strategy for each firm and rivals have profit incentives to make complaints, firms and consumers anticipate that the dominant firm will be accused of abusing its dominant position as soon as it engages in selective price cutting.[7] The consumers and the two firms will thus anticipate that the dominant firm will abuse its dominant position. Accordingly, they will behave in each period as if the dominant firm gets restrained in the second period by a specific price discrimination ban. Another assumption we make is that the firm servicing the sheltered market finds it optimal to remain or become dominant. Thus, each firm optimally chooses its prices in both periods *anticipating* the prospect that the dominant firm will not be allowed to practice a particular mode of price discrimination in the second period.

The first pricing restriction is a ban on "higher-prices-to-sheltered-consumers" which forbids price discrimination by the dominant firm between its first-period customers. That is, the dominant firm cannot charge a higher price to customers on the sheltered segment as compared to its first-period customers on the competitive segment. However, it can charge a different price in the competitive segment to expand business and attract new customers in the second period. The second restriction we consider is a ban on "lower-prices-to-rival's customers" which forbids price discrimination within the competitive segment. This ban reflects restrictions on win-back campaigns.

Our two-period analysis reveals the following results. First, a ban on "higher-prices-to-sheltered-consumers" decreases competition on the competitive segment and increases the rival's profits. As a result, the ban "relaxes competition" and may have an *exploitative effect* on the competitive segment. This ban harms the dominant firm when its profits on the sheltered segment are sufficiently important. It increases the dominant firm's first-period market share while reducing its market share in the second period. By building up more period-one market share in the competitive segment, the dominant firm guarantees itself higher prices on its sheltered segment in the second period. Although this ban increases consumer surplus on the sheltered segment, the sum of consumer and producer surplus decreases on the competitive segment. The reasoning is that discounted average prices increase and fewer consumers are served by their

[7] For example, in the *UK*, Oftel announced that it would intervene promptly against *British Telecom* as soon as it started at setting up anti-competitive win-back campaigns. (see Bird&Bird, 2003.) In 2004 Ofcom investigated a complaint by *Tele2* that *BT* had misused information provided in the context of interconnection by approaching customers that had switched from *BT* to *Tele2*. Although Ofcom did not find a breach of information rules by *BT*, this case illustrates that Ofcom scrutinizes *BT*'s win-back strategies. See http://www.ofcom.org.uk/bulletins/comp_bull_index/comp_bull_ccases/closed_all/cw_747/

most preferred supplier.

Second, a ban on "lower-prices-to-rival's customers" relaxes second-period competition on the competitive segment. Competition over both periods, however, is harsher compared to complete pricing flexibility as first-period demand becomes substantially more elastic. The ban on "lower-prices-to-rival's customers" therefore may discourage entry and produce an *exclusionary effect* on the competitive segment.

The Discussion section also deals with a general price discrimination ban that imposes uniform pricing. This ban is a combination of the two pricing restrictions – ban on "lower-prices-to-rival's customers" and ban on "higher-prices-to-sheltered-consumers". It refrains the dominant firm from setting different prices across the two segments and within the competitive segment. Such a general ban decreases each firm's profits in the competitive segment when the sheltered segment is small, but is profit augmenting when the size of the sheltered market is large.

Our paper highlights that evaluations of price discrimination bans may heavily depend on the type of the ban. Moreover, the results of a dynamic two-period model may lead to opposite conclusions than those from a static one-period model. In particular, when there is a ban on "higher-prices-to-sheltered-consumers", discounted average prices on the competitive segment are higher. This result is in line with Armstrong and Vickers (1993), who show that, given entry, a ban on price discrimination in a one-period model typically facilitates competitors on the competitive segment. However, our two-period analysis shows that competition intensifies when the dominant firm is restricted by a ban on "lower-prices-to-rival's customers", so that both firms obtain lower profits. In addition, total (consumer) welfare increases with the ban as more consumers are served by their most preferred provider.

Another related paper is Chen (2006) who uses a dynamic model to study the problem of price discrimination with asymmetric firms. In his model, the incumbent has a monopoly position in the sheltered segment and competes in prices for consumers with a more efficient firm on the competitive segment. Firms can engage in behavior-based price discrimination by observing consumers' purchase history. Chen's model shows that when the more efficient firm on the competitive segment does not exit, price discrimination is welfare enhancing. Our analysis and findings contrast in two respects. First, our model considers a price discrimination ban for the dominant firm only, while in Chen's model a ban restricts both firms' pricing strategies symmetrically. Second, we show that restricting the dominant firm's possibility to price discriminate may increase consumer welfare even when the rival firm remains in the market.

The remainder of the paper is organized as follows. Section 2 presents the model and explains

the effects of the two different price discrimination bans imposed on the dominant firm. Section 3 presents a welfare analysis. In Section 4 we compare the different outcomes and provide a policy discussion. Section 5 concludes.

2 Modelling price discrimination bans by dominant firms

Consider two firms, A and B, that are active on the market during two periods. The entire market has mass 1 in each period, and consumers have inelastic and unit demand. Firm A operates on two market segments. It is a monopolist on the *sheltered segment* which has mass a, where $0 \leq a \leq 1$. Absent any ban, firm A optimally charges the consumers' willingness to pay w on this sheltered segment in each period. The second segment is the *competitive segment* and has mass $1 - a$. This competitive segment is modelled using a Hotelling framework where consumers' willingness to pay v is sufficiently high to cover the competitive segment. We assume that $v \leq w$ on the competitive segment to avoid that the price on the sheltered segment would be lower than on the competitive segment. Consumers are distributed uniformly with density $1-a$ on a line with unit length, and incur transportation costs t per unit of distance. Consumers have fixed preferences over time, and firms and consumers discount the future at rate $0 \leq \delta < 1$. Firms A and B are located at opposing ends of the unit interval, with A located at 0 and B at 1. The marginal costs for the two firms on both segments are normalized to zero. Firms compete during two periods on the competitive segment. Absent any ban, firms charge uniform prices in the first period and have a dominant strategy to resort in the second period to behavior-based price discrimination (as in Fudenberg and Tirole (2000)).[8] This modelling framework has two possible interpretations. The first interpretation is that firm A competes with firm B on a new market. The second interpretation is that firm A had a former monopoly and firm B competes on (e.g. the liberalized) part of its market. Both interpretations fit our model.

We analyze two different price discrimination bans that occur in practice – a ban on "higher-prices-to-sheltered-consumers" and a ban on "lower-prices-to-rival's customers". To investigate the impact of each of these bans on competition and firms' pricing behavior, we compare each ban to the benchmark model where firms can set their prices in an unconstrained fashion.

As explained in the Introduction, our model analyzes the effects when firm A allegedly abuses its dominant position after the first period. That is, the price discrimination ban applies in the

[8] See also Armstrong (2005), Fudenberg and Villas-Boas (2005), and Stole (2005) for extensive overviews on behavior-based price discrimination.

second period only. We analyze the dynamic effects of the different bans as both firms and consumers anticipate that firm A will face a specific ban in the second period. That is, both firms' first-period pricing decisions reflect the anticipated ban on price discrimination in the second period. For convenience, we will from now on label firm A as the dominant firm. As the proofs of the propositions are straightforward, we incorporate them as much as possible into the text.

2.1 No Ban

Our analysis without ban allows complete pricing freedom for both firms. We consider the sheltered and competitive segments separately as there are no price restrictions between these two segments. Firm A is a monopolist on its sheltered segment and only faces competition on the competitive segment.

Firm A charges a price w on its *sheltered segment* in both periods. Since it is optimal for A to serve the entire sheltered segment, firm A's total discounted profits on the sheltered segment (denoted by subscript s) equal

$$\Pi_s^A = a(1+\delta)w.$$

Both firms A and B are active on the *competitive segment*. Following Fudenberg and Tirole (2000), we first discuss second-period competition before turning to first-period competition. To deal with second-period competition, assume that first-period competition results in firm A serving customers who are located "to the left of x" and firm B those "to the right of x". As the dominant firm A does not face a ban on selective price cutting, both firms will maximize their profits by practicing behavior-based price discrimination in the second period. That is, both firms charge different prices to their own first-period customers and to rival's customers. Since both firms can tell apart customers having positions to the left and right of x, there are two indifferent consumers. The first indifferent consumer is at $0 \leq \alpha \leq x$ and characterized by

$$p_2^{AA} + t\alpha = p_2^{AB} + t(1-\alpha)$$

where p_2^{AA} and p_2^{AB} is A's and B's second-period price (the right superscript), respectively, charged to firm A's first-period consumers (the left superscript). The second indifferent consumer is at $x \leq \beta \leq 1$ and satisfies

$$p_2^{BA} + t\beta = p_2^{BB} + t(1-\beta)$$

where p_2^{BA} and p_2^{BB} is A's and B's second-period price, respectively, charged to B's first-period consumers.

Firm A maximizes its second-period profits on the competitive segment (subscript c)

$$\Pi_{2c}^{A}(p_2^{AA}, p_2^{BA}) = (1-a)\left[p_2^{AA}\alpha + p_2^{BA}(\beta - x)\right]$$

whereas firm B will maximize

$$\Pi_{2c}^{B}(p_2^{BB}, p_2^{AB}) = (1-a)\left[p_2^{BB}(1-\beta) + p_2^{AB}(x-\alpha)\right].$$

The interior solution, for given x, that results from the first-order conditions, yields equilibrium prices[9]

$$p_2^{AA} = \frac{t(1+2x)}{3}\ ,\ p_2^{BA} = \frac{t(3-4x)}{3}\ ,\ p_2^{AB} = \frac{t(4x-1)}{3}\ ,\text{ and } p_2^{BB} = \frac{t(3-2x)}{3}.$$

The resulting second-period profits on the competitive segment for firm i, with $i = A, B$, are

$$\Pi_2^i = (1-a)\,\frac{5t(2x^2-2x+1)}{9}.$$

We now turn to first-period competition when consumers and firms anticipate second-period behavior. The forward-looking first-period indifferent consumer on the competitive segment is located at x such that

$$p_1^A + tx + \delta[p_2^{AB} + t(1-x)] = p_1^B + t(1-x) + \delta[p_2^{BA} + tx],$$

where δ reflects the discount rate, and p_1^i is firm i's first-period price, with $i = A, B$. The indifferent consumer anticipates that if she visits firm i in the first period, it will be optimal for her to visit the other firm in the second period in order to benefit from its poaching price. After substitution of both firms' second-period prices, one obtains firm A's first-period market share on the competitive segment:

$$x = \frac{3(p_1^B - p_1^A) + t\,(3+\delta)}{2t(3+\delta)}.$$

Firm A maximizes the following total discounted profit on the competitive segment

$$\Pi_{c}^{A}(p_1^A, p_1^B) = (1-a)\left[p_1^A x + \delta\left(p_2^{AA}\alpha + p_2^{BA}(\beta - x)\right)\right]$$

whereas firm B maximizes

$$\Pi_{c}^{B}(p_1^B, p_1^A) = (1-a)\left[p_1^B(1-x) + \delta\left(p_2^{BB}(1-\beta) + p_2^{AB}(x-\alpha)\right)\right].$$

[9] We will only consider the internal solution, wherefrom the first-order conditions are necessary and sufficient. In other words, x should not be too large. In particular, $x \leq 3/4$. See Fudenberg and Tirole (2000) for an extensive analysis on the conditions for an interior solution.

From the first-order conditions, an interior solution results in

$$p_1^i = \frac{t\,(\delta + 3)}{3}.$$

Second-period equilibrium prices then become

$$p_2^{AA} = p_2^{BB} = \frac{2t}{3} \text{ and } p_2^{BA} = p_2^{AB} = \frac{t}{3}.$$

Discounted profits for both firms on the competitive segment amount to

$$\Pi_c^i = (1-a)\,\frac{t(8\delta + 9)}{18}.$$

In equilibrium, both firms serve in a symmetric way half of the competitive segment, or $x = 1/2$, and enjoy identical profits on that segment. In the second period, one third of consumers on the competitive segment switch supplier since $\alpha = 1/3$ and $\beta = 2/3$.

Firms' total discounted profits on the *entire market* stem from adding up the results on the competitive and sheltered segments:

$$\Pi^A = a(1+\delta)w + (1-a)\,\frac{t(8\delta + 9)}{18} \text{ and } \Pi^B = (1-a)\,\frac{t(8\delta + 9)}{18}.$$

It is clear that A generates greater profits than B as it enjoys a monopoly position on its sheltered market. Firm A serves its sheltered segment and half of the competitive segment. Therefore its total market share becomes $a + 0.5(1-a)$. Firms' total market share remain identical in the first and second period even though they do not serve the same set of consumers.

2.2 Ban on "higher-prices-to-sheltered-consumers"

In this section the dominant firm A faces a ban after the first period and is no longer allowed *to charge higher prices to its sheltered consumers* in the second period. This ban implies that A has to set an identical second-period price to all of its *first-period* consumers *across the two segments*. That is, firm A charges a second-period price $p_2'^{AA}$ to its first-period customers from both the sheltered and competitive segments, where the " $'$ " superscript indicates ban on "higher-prices-to-sheltered-consumers". Therefore, firm A can no longer treat its sheltered segment independent from the competitive segment in the second period. The ban still allows firm A to poach B's first-period customers at a different price in the competitive segment. Thus, our modelling approach implies that the ban only becomes effective in the second period. In other words, after the firm has become dominant in the first period. Firm B, in contrast, is

not restricted in its price-setting behavior in any period. Moreover, it is a dominant strategy for firm B to practice price discrimination in the second period. Figures 1 and 2 illustrate the effects of the ban on market shares and prices in both periods.

Firm A's sheltered segment is served at a price w in the first period. The ban implies, however, that A can only charge $p_2'^{AA} < v < w$ in the second period.[10]

Consider the competitive segment. Suppose first-period competition results in firm A serving consumers to the left of x'. There are two indifferent consumers in the second period. The first indifferent consumer is at $0 \leq \alpha' \leq x'$ and characterized by

$$p_2'^{AA} + t\alpha' = p_2'^{AB} + t(1-\alpha')$$

where $p_2'^{AA}$ and $p_2'^{AB}$ is A's and B's second-period price, respectively, charged to consumers who purchased from A in the first period. It is crucial to point out that $p_2'^{AA}$ is also charged to A's sheltered segment. The other indifferent consumer is at $x' \leq \beta' \leq 1$ and satisfies

$$p_2'^{BA} + t\beta' = p_2'^{BB} + t(1-\beta')$$

where $p_2'^{BA}$ and $p_2'^{BB}$ is A's and B's second-period price, respectively, charged to consumers who purchased from B in period 1. Firm A maximizes its second-period profits on the entire market

$$\Pi_2'^{A}(p_2'^{AA}, p_2'^{BA}) = p_2'^{AA}\left[a + (1-a)\,\alpha'\right] + p_2'^{BA}\left[(1-a)(\beta' - x')\right]$$

and firm B maximizes

$$\Pi_2^{B}(p_2'^{BB}, p_2'^{AB}) = (1-a)\left[p_2'^{BB}(1-\beta') + p_2'^{AB}(x'-\alpha')\right].$$

The equilibrium prices that result are

$$\begin{aligned} p_2'^{AA} &= \frac{t\left[2x'(a-1) - 3a - 1\right]}{3(a-1)}\,,\; p_2'^{AB} = \frac{t\left[4x'(a-1) - 3a + 1\right]}{3(a-1)} \text{ and} \\ p_2'^{BA} &= \frac{t(3-4x')}{3}\,,\; p_2'^{BB} = \frac{t(3-2x')}{3} \end{aligned}$$

for firm A and B, respectively. We now turn to first-period competition. The first-period indifferent consumer anticipates that when visiting firm A in the first period and paying a price

[10] We implicitly impose two assumptions on firm A's behavior. The first is that firm A will find it optimal to lower its price on the sheltered segment when the ban applies. This seems reasonable as otherwise the sheltered segment would have a lower price than the competitive segment without ban. Second, we assume that firm A finds it optimal to be active on the competitive segment when the ban applies. This will happen as long as a is not too large and/or consumers' willingness to pay on the sheltered segment is not too high.

$p_1'^A$ he will receive a poaching price $p_2'^{AB}$ in the second period by firm B. By visiting firm B in the first period and paying $p_1'^B$, the indifferent consumer anticipates he will pay a price $p_2'^{BA}$ that is charged by firm A to new customers. Formally,

$$p_1'^A + tx' + \delta[p_2'^{AB} + t(1-x')] = p_1'^B + t(1-x') + \delta[p_2'^{BA} + tx']$$

or, by substituting expected second-period prices,

$$x' = \frac{3a(p_1'^A - p_1'^B - t(\delta+1)) + t(\delta+3) - 3(p_1'^A - p_1'^B)}{2t(1-a)(\delta+3)}.$$

From the necessary first-order conditions, it follows that

$$\begin{aligned} p_1'^A &= \frac{t\,(\delta+3)}{3\,(1-a)} - \frac{ta\left(81+36\delta-17\delta^2\right)}{3\,(1-a)\,(27-11\delta)} < \frac{t\,(\delta+3)}{3} \text{ and} \\ p_2'^B &= \frac{t\,(\delta+3)}{3\,(1-a)} - \frac{ta\left(81-48\delta-5\delta^2\right)}{3\,(1-a)\,(27-11\delta)} > \frac{t\,(\delta+3)}{3} \end{aligned}$$

are the first-period prices for firm A and B, respectively.As can be verified, both firms' first-period prices are always positive. Firm A's price is higher without ban, whereas the opposite holds for firm B's first-period price. Firm A's first-period market share on the competitive segment is

$$x' = \frac{1}{2\,(1-a)} - \frac{3a(9-7\delta)}{2(1-a)(27-11\delta)},$$

which is larger than 0.5. Firm A's second-period market share on the competitive segment entails

$$\alpha' + \beta' - x' = \frac{1}{2\,(1-a)} - \frac{15a(3-\delta)}{2(1-a)(27-11\delta)},$$

and is smaller than 0.5. Firm A's total market share on both segments is therefore decreasing over the two periods. The average market share over the two periods on the competitive segment is lower than 0.5 suggesting that the ban *reduces* firm A's dominance as measured by market share.

Several observations are worth mentioning. The ban to "higher-prices-to-sheltered-consumers" leads to firms charging different first-period prices. The dominant firm A sets lower prices than firm B. The reasoning stems from two forces. First, the indifferent consumer anticipates aggressive second-period poaching by firm A when opting for firm B in the first period as $x' > 0.5$. Second, choosing for A in the first period leads to less aggressive second-period poaching by firm B as $x' > 0.5$.

The equilibrium second-period prices become

$$\begin{aligned}
p_2'^{AA} &= \frac{2t}{3(1-a)}\left[1+\frac{3a\,(9-2\delta)}{27-11\delta}\right] > \frac{2t}{3} \\
p_2'^{BA} &= \frac{t}{3(1-a)}\left[1-\frac{9a\,(3+\delta)}{27-11\delta}\right] < \frac{t}{3} \\
p_2'^{BB} &= \frac{2t}{3(1-a)}\left[1-\frac{3a\,(9-2\delta)}{27-11\delta}\right] < \frac{2t}{3} \\
p_2'^{AB} &= \frac{t}{3(1-a)}\left[1+\frac{9a\,(3+\delta)}{27-11\delta}\right] > \frac{t}{3}.
\end{aligned}$$

Equilibrium profits realized by both firms on the entire market read as

$$\begin{aligned}
\Pi'^{A} &= aw + (1-a)\,\frac{t(8\delta+9)}{18} + \frac{2at\delta\left[a\left(82\delta^2-198\delta+243\right)+352\delta^2-1953\delta+2673\right]}{9(1-a)\left(27-11\delta\right)^2} \quad (1) \\
\Pi'^{B} &= (1-a)\,\frac{t(8\delta+9)}{18} - \frac{2at\delta\left[a\left(182\delta^2-648\delta+243\right)-253\delta+9(113\delta-108)\right]}{9(1-a)\left(27-11\delta\right)^2}.
\end{aligned}$$

The impact of the ban on "higher-prices-to-sheltered-consumers" as compared to the scenario where the dominant firm A can price discriminate between its first-period customers can be summarized in the following Proposition. Figures 1 and 2 illustrate Proposition 1. Both figures graphically outline the main price differences between the no-ban case and a ban on "higher-prices-to-sheltered-consumers" for the first and the second period, respectively.

Proposition 1. *A ban on "higher-prices-to-sheltered-consumers" increases the rival's profits. It harms the dominant firm when its profits on the sheltered segment are substantial. The ban increases the dominant firm's first-period market share but reduces its second-period market share.*

Three remarks are noteworthy. First, a *profit comparison* learns that the dominant firm A prefers complete flexibility when $w \geq \bar{w}$ where $\bar{w}$ satisfies $\Pi^A - \Pi'^A = 0$. Although the ban reduces the dominant firm's profits on the sheltered segment, it reduces the rival's aggressiveness and sufficiently increases the dominant firm's profits on the competitive segment. However, when $w < \bar{w}$ its profits strictly increase. As a result, the dominant firm prefers to have its hands tied by this particular ban and set a uniform price for all its first-period customers. Firm B, in contrast, benefits from such a ban as its profits are higher and anticipation of this ban encourages entry. In other words, the ban makes the dominant firm less aggressive resulting in larger profits for firm B.

Second, the ban also produces interesting *differential intertemporal effects*. The ban on "higher-prices-to-sheltered-consumers" relaxes second-period competition on A's first-period

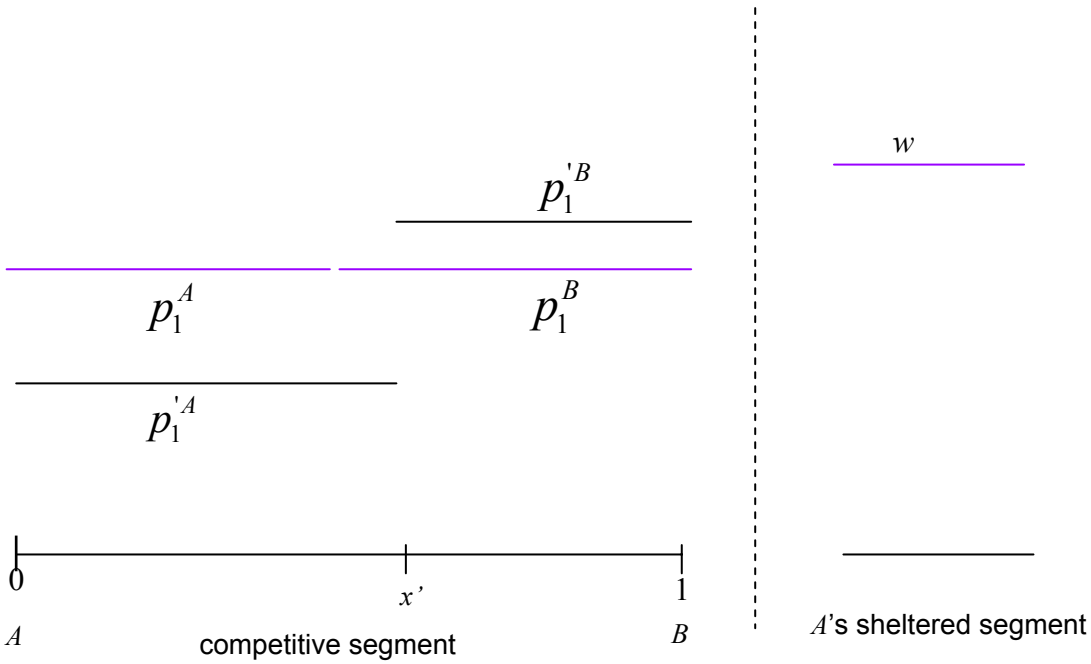

Fig. 1 'Higher-prices-to-sheltered-consumers' ban: first period

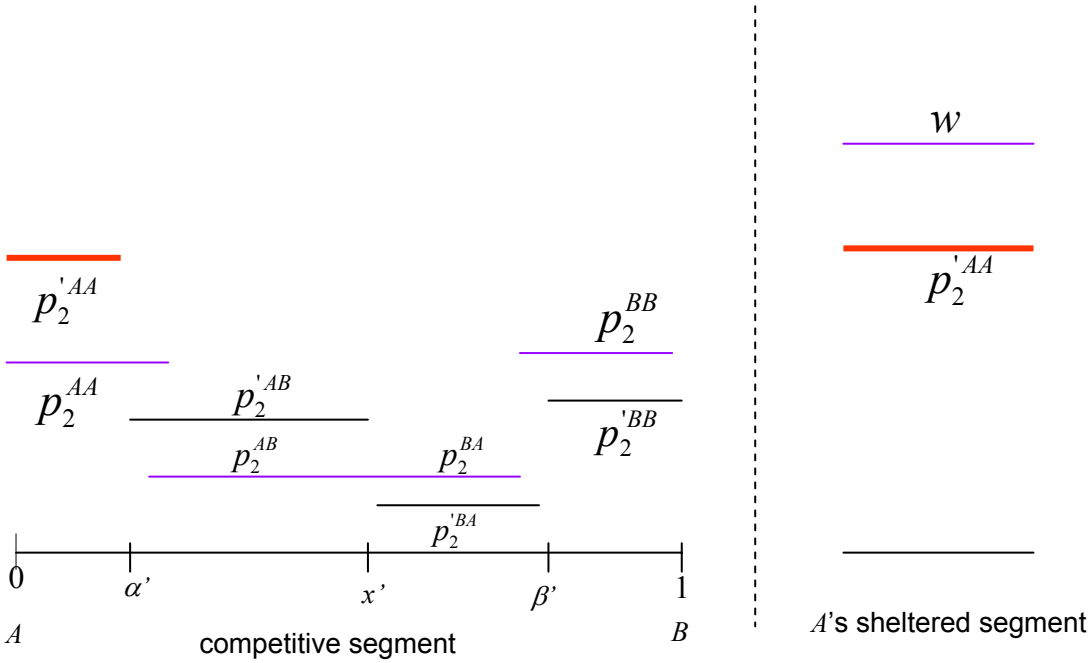

Fig. 2 'Higher-prices-to-sheltered-consumers' ban: second period

competitive segment. This results stems from two forces. First, firm A becomes less aggressive as the ban implies that it sets an identical price to all its first-period customers. Second, x' is larger than 0.5 softening firm B's reaction. In contrast, second-period competition on B's first-period market becomes more intense. The reasoning is that x' is larger than 0.5 implying a more aggressive poaching price by firm A. First-period competition with a ban compared to no ban leads to lower prices by the dominant firm and higher prices by the rival firm. The reasoning stems from two forces. On the one hand, firm A wants to build up first-period market share as the ban implies higher second-period prices on those customers. On the other hand, forward-looking consumers anticipate less aggressive second-period poaching by firm B and more aggressive poaching by firm A. This decreases consumer price sensitivity and gives the marginal consumer a preference for B at equal first-period prices.

Finally, anticipation of a ban on "higher-prices-to-sheltered-consumers" *increases the dominant firm's first-period market share*. That is, next to the sheltered segment, the dominant firm serves more than half of the competitive segment in the first period.

2.3 Ban on "lower-prices-to-rival's-customers"

In this section we assume that the dominant firm A is no longer allowed *to set lower prices to its rival's customers*. With such a ban, dominant firm A cannot cut prices selectively *within the competitive segment*. Firm A however can charge different prices across the sheltered segment and the competitive segment. Firm B does not face a ban and has a dominant strategy to engage in price discrimination. Technically, this implies that firm A is restricted to charge a single price $p_2''^A$ to rival's first-period customers and its own first-period customers on the competitive segment, while firm B can charge the discriminating prices $p_2''^{BB}$ and $p_2''^{AB}$. The " $''$ " superscript denotes ban on "lower-prices-to-rival's-customers". Figures 3 and 4 illustrate the effects of this ban on market shares and prices in both periods.

It should be clear that the *sheltered segment* can be treated independently from the competitive segment. Firm A optimally charges w in both periods such that its discounted profits on the sheltered segment become

$$\Pi_s''^A = a(1+\delta)w.$$

Suppose first-period competition on the *competitive segment* leads to firm A serving consumers

to the left of x''. The first indifferent consumer is located at α'' such that

$$p_2''^A + t\alpha'' = p_2''^{AB} + t(1-\alpha'')$$

while the second indifferent consumer located at β'' is characterized by

$$p_2''^A + t\beta'' = p_2''^{BB} + t(1-\beta'').$$

Firm A maximizes its second-period profits on the competitive segment

$$\Pi_{2c}''^A(p_2''^A) = (1-a)\, p_2''^A \left[\alpha'' + \beta'' - x''\right]$$

and firm B maximizes

$$\Pi_{2c}''^B(p_2''^{BB}, p_2''^{AB}) = (1-a)\left[p_2''^{BB}(1-\beta'') + p_2''^{AB}(x''-\alpha'')\right].$$

The first-order conditions for the interior solution result in

$$p_2''^A = \frac{t(2-x'')}{3}\ ,\ p_2''^{AB} = \frac{t\,(5x''-1)}{6}, \text{ and } p_2''^{BB} = \frac{t(5-x'')}{6}. \tag{2}$$

It is clear that the second-period prices are independent from a as the sheltered and competitive segments can be treated as independent markets.

We now turn to first-period competition. The forward-looking first-period indifferent consumer on the competitive segment is located at x'' such that

$$p_1''^A + tx'' + \delta[p_2''^{AB} + t(1-x'')] = p_1''^B + t(1-x'') + \delta[p_2''^A + tx''].$$

Remark that the marginal consumer opting for firm B in the first period expects to be poached by firm A at a price $p_2''^A$ "only". This price is relatively high as it is identical to the price charged by A to its first-period customers on the competitive market. In visiting firm A in the first-period, the indifferent consumer anticipates a more attractive second-period poaching price by firm B. After substitution of both firms' second-period prices, one obtains firm A's first-period market share on the competitive segment and equals

$$x'' = \frac{6(p_1''^B - p_1''^A) + t\,(6-\delta)}{t(12-5\delta)}. \tag{3}$$

Firm A maximizes the following total discounted profit on the competitive segment

$$\Pi_c''^A(p_1''^A, p_1''^B) = (1-a)\left[p_1''^A x'' + \delta p_2''^A\left(\alpha'' + \left(\beta'' - x''\right)\right)\right]$$

whereas firm B maximizes

$$\Pi_c''^B(p_1''^B, p_1''^A) = (1-a)\left[p_1''^B(1-x'') + \delta\left(p_2''^{BB}(1-\beta'') + p_2''^{AB}(x''-\alpha'')\right)\right].$$

From the first-order conditions, an interior solution results in

$$p_1''^A = \frac{t\,(12-\delta)}{12} \text{ and } p_1''^B = \frac{t\,(3-\delta)}{3}.$$

Second-period equilibrium prices then become

$$p_2''^A = \frac{t}{2}\ , p_2''^{AB} = \frac{t}{4}, \text{ and } p_2''^{BB} = \frac{3t}{4}.$$

Discounted profits for both firms on the competitive segment amount to

$$\Pi_c''^A = (1-a)\,\frac{t(5\delta+12)}{24} \text{ and } \Pi_c''^B = (1-a)\,\frac{t(7\delta+24)}{48}.$$

In equilibrium, both firms serve half of the competitive market segment, or $x'' = 0.5$, but their profits differ. Firm A enjoys larger profits than firm B even though it faces a ban. The reasoning is that the ban allows firm A to *commit not* to price discriminate within the competitive segment. In the second period, one fourth of the consumers on the competitive segment switch supplier since $\alpha'' = 3/8$ and $\beta'' = 5/8$.

Firms' total discounted profits on the *entire market* stem from adding up the results on the competitive and sheltered segments, rersulting in

$$\Pi''^A = a(1+\delta)w + (1-a)\,\frac{t(5\delta+12)}{24} \text{ and } \Pi''^B = (1-a)\,\frac{t(7\delta+24)}{48}.$$

It is clear that dominant firm A generates higher profits than B. The reasoning is that (i) it enjoys a monopoly position on its sheltered market and (ii) obtains higher profits on the competitive market. Firm A serves its sheltered segment and half of the competitive segment such that its total market share becomes $a + 0.5(1-a)$. Firm A's total market share remains identical over the two periods although it does not serve the same consumers in every period.

We address the impact of the ban on "lower-prices-to-rival's customers" by making a *comparison* with the outcome where the dominant firm A can charge discriminatory prices in the competitive segment. Proposition 2 summarizes the main insights. Figures 3 and 4 illustrate Proposition 2. Both figures graphically outline the main price differences between the no-ban case and a ban on "lower-prices-to-rival's customers" for the first and the second period, respectively.

Proposition 2. *A ban on "lower-prices-to-rival's-customers" harms the dominant firm's profits. This ban also lowers rival's profits. The dominant firm's market share on the competitive segment remains unaffected.*

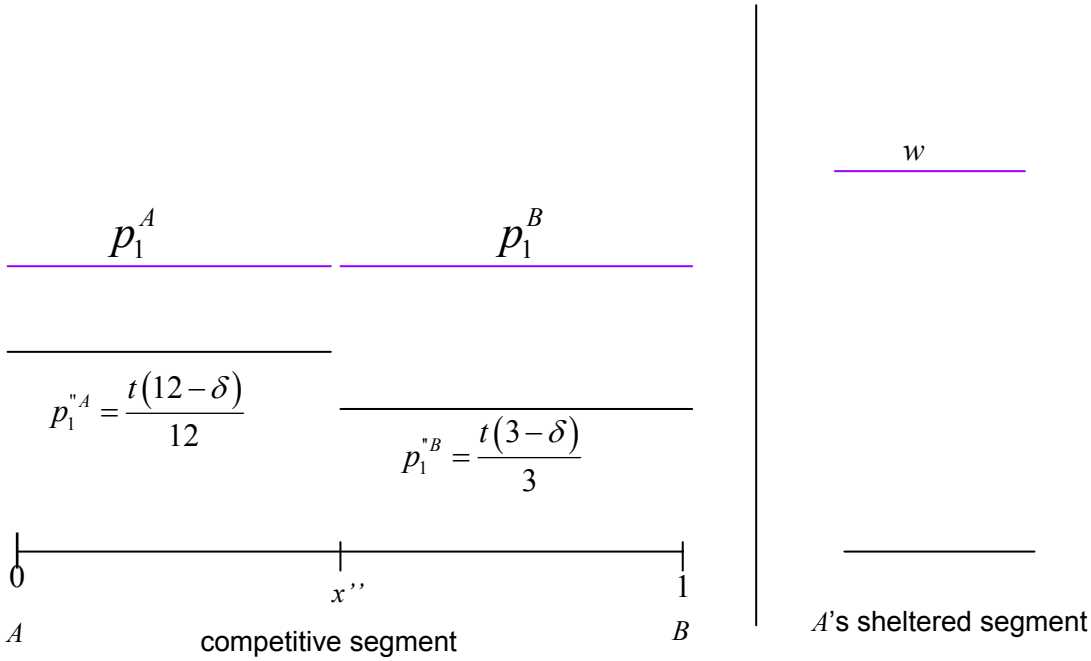

Fig. 3 'Lower-prices-to-rival's-customers' ban: first period

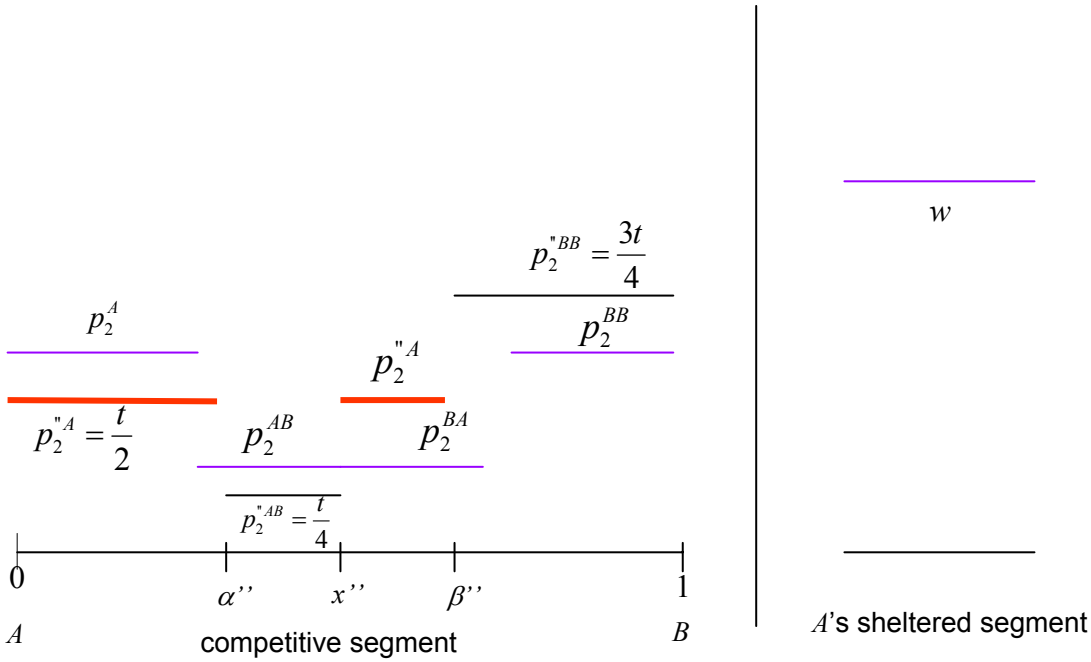

Fig. 4 'Lower-prices-to-rival's-customers' ban: second period

The ban on "lower-prices-to-rival's customers" leads to harsher competition as both firms' profits are unambiguously lower when the ban applies. This finding is entirely determined by the competitive segment as the ban leaves firm A's profits on the sheltered segment unaffected. In the second period, firm A's profits decrease from $5t/18$ without ban to $t/4$ while firm B's profits increase to $5t/16$.[11] First-period demand, however, becomes much more elastic as a result of the ban. To see this, we compare the price sensitivity of the marginal consumer in the static model to this two-period model. Given the second-period prices as expressed in (2) and the price $p_1''^B$ charged by firm B in the first period, suppose firm A changes its first-period price slightly to $p_1''^A - \epsilon$. The marginal consumer is now located at $x'' = 0.5 + \gamma$, where γ measures the marginal consumer's sensitivity to this price change. From Eq. (3), γ satisfies

$$p_1''^A - \varepsilon + t(0.5+\gamma) + \delta(\frac{t\,(5(0.5+\gamma)-1)}{6} + t(0.5-\gamma)) =$$

$$p_1''^B + (0.5-\gamma)t + \delta(\frac{t(3/2-\gamma)}{3} + t(0.5+\gamma))$$

or

$$\gamma = \frac{6\varepsilon}{t(12-5\delta)}.$$

Clearly, when $\varepsilon = 0$ it follows that $\gamma = 0$. Put differently, although the equilibrium first-period prices differ, both firms equally share the competitive segment. However, when $\varepsilon \neq 0$, a forward-looking consumer reacts much more sensitive to a price change as opposed to the static model where $\delta = 0$ and $\gamma = \varepsilon/2t$. The reason is that when the dominant firm decreases its first-period price by one unit, the second-period poaching price of the other firm goes up by less than one unit, as can be seen from (2).[12] This explains why both firms charge more competitive prices in the first period as compared to the static model.

It is interesting to observe that the ban generates a differential impact on second-period pricing of both firms' first-period customers. Second-period competition for firm A's first-period customers is more pronounced when the ban applies. The reasoning is that firm A's pricing becomes more aggressive as it can charge only one price to keep first-period customers and

[11] See also Armstrong (2005), Sections 3.4 and 5.1.

[12] In Fudenberg and Tirole's (2000) model, the opposite holds. Armstrong (2005) shows that $\gamma = \varepsilon/(2t(1+\delta/3))$ so that the marginal consumer is *less* sensitive to a first-period price change as compared to the static model. That is, a first-period price cut of one unit by firm A benefits the marginal consumer's current utility but is harmful in the next period as the second-period poaching price of firm B goes *up* by more than one unit.

poach firm B's first-period customers. In contrast, second-period competition for B's first-period customers is relaxed. This explains why it is optimal for firm B to charge first-period prices below firm A's.

We can therefore conclude that a ban on "lower-prices-to-rival's-customers" lowers firm all firms' discounted profits and as such disfavors entry when anticipated.

3 Welfare

In this section we provide a welfare analysis of the bans on "higher-prices-to-sheltered-consumers" and "lower-prices-to-rival's customers". We compare each of the bans to the no-ban setting. Our findings are presented in the following two propositions.

Proposition 3. *The ban on "higher-prices-to-sheltered-consumers" increases consumer surplus on the sheltered segment. On the competitive segment, the ban (i) reduces consumer surplus and increases producer surplus, and (ii) decreases total welfare as fewer consumers get served by their most preferred provider.*

Proof:

The ban on higher-prices-to-sheltered-consumers reduces prices on the sheltered segment, implying that consumer welfare on the sheltered segment increases. We first consider the competitive segment.

(i) Consumer Surplus. We first display the consumers' financial and non-financial expenditures on the competitive segment without ban. The sum of financial and non-financial outlays equals

$$\frac{t(1-a)\left(43\delta+45\right)}{36}. \tag{4}$$

Consumers' financial outlays are identical to firms' profits on the competitive segment and equal

$$(1-a)\,\frac{t(8\delta+9)}{9}. \tag{5}$$

Non-financial outlays are the discounted total transportation costs, that equal

$$(1-a)\,\frac{t(11\delta+9)}{36} = \frac{(1-a)t}{4} + (1-a)\,\delta t\left[\frac{2}{3}\frac{1}{6} + \frac{1}{3}\frac{7}{12}\right]. \tag{6}$$

The first term at the RHS of the above expression represents the first-period transportation costs. The second term displays the discounted second-period transportation costs, where 2/3 of the consumer population needs to travel a distance of 1/6 on average whereas the remaining 1/3 of the population needs to travel a distance of 7/12 on average.

With a ban on higher-prices-to-sheltered-consumers, total outlays become

$$\frac{t}{36\left(1-a\right)}\left[\frac{3a^{2}\left(853\delta^{3}-1887\delta^{2}-4293\delta+10935\right)}{\left(27-11\delta\right)^{2}}-6a\left(11\delta+15\right)+\left(43\delta+45\right)\right]. \qquad (7)$$

These outlays can be decomposed into financial outlays (the sum of firms' profits on the competitive segment) represented by

$$\frac{t}{9\left(1-a\right)}\left[\frac{3a^{2}\left(124\delta^{3}-3\delta^{2}-1296\delta+2187\right)}{\left(27-11\delta\right)^{2}}-6a\left(2\delta+3\right)+\left(8\delta+9\right)\right] \qquad (8)$$

and non-financial outlays, which can be written down as

$$\begin{aligned}&\left(1-a\right)t\left[x'\left(\frac{x'}{2}\right)+\left(1-x'\right)\left(\frac{1-x'}{2}\right)\right]+\\&\left(1-a\right)\delta t\left[\alpha'\frac{\alpha'}{2}+\left(x'-\alpha'\right)\left(\frac{2-x'-\alpha'}{2}\right)+\left(\beta'-x'\right)\left(\frac{\beta'+x'}{2}\right)+\left(1-\beta'\right)\left(\frac{1-\beta'}{2}\right)\right]\\&=\frac{t}{36\left(1-a\right)}\left[\frac{9a^{2}\left(119\delta^{3}-625\delta^{2}+297\delta+729\right)}{\left(27-11\delta\right)^{2}}-18a\left(1+\delta\right)+\left(11\delta+9\right)\right]. \qquad (9)\end{aligned}$$

The first term of the LHS of the above expression represents the first-period transportation costs. The second term of the LHS are the discounted second-period transportation costs, taking into account consumers purchase decisions.

A comparison of total consumer expenditures with and without the ban on higher-prices-to-sheltered-consumers shows that the total consumer expenditures are higher when the ban applies. Comparison of Eq. (5) with Eq. (7) shows that producer surplus is higher with ban on higher-prices-to-sheltered-consumers.

(ii) Consumer and Producer Surplus. The unweighted sum of producer and consumer surplus is identical to the transportation costs incurred by customers. Comparison of Eq. (6) with Eq. (9) shows that transportation costs are higher with ban than without ban. This completes the proof.

Proposition 3 shows that a ban on "higher-prices-to-sheltered-consumers" generates redistributive effects. It favours sheltered consumers by introducing competition through a price-

discrimination ban. This introduction, however, is at the expense of consumers in the competitive segment where competition decreases and, in addition, more inefficient allocation takes place. That is, the discounted average prices are higher across the two periods so that profits increase. Finally, fewer consumers get served by their most nearby provider.

Proposition 4. *The ban on "lower-prices-to-rival's customers" does not affect social welfare on the sheltered segment. On the competitive segment, however, the ban (i) increases consumer surplus but reduces producer surplus, and (ii) increases total welfare as more consumers are served by their most preferred provider.*

Proof:

The ban on "lower-prices-to-rival's customers" does not change firm A's pricing on the sheltered segment. Consequently, social welfare on the sheltered segment remains identical to the welfare in the absence of this ban. The ban, however, changes pricing behavior and consumers' decisions on the competitive segment.

(i) Consumer Surplus. The consumers' financial and non-financial expenditures on the competitive segment without ban are given by Eq. (4). With a ban on "lower-prices-to-rival's customers", total outlays become

$$\frac{t(1-a)\left(61\delta+120\right)}{96}. \tag{10}$$

These outlays can be decomposed into financial outlays (the sum of firms' profits on the competitive segment)

$$\frac{t(1-a)\left(17\delta+48\right)}{48},$$

and non-financial outlays

$$\frac{(1-a)t}{4}+(1-a)\,\delta t\left[\frac{3}{4}\frac{3}{16}+\frac{1}{4}\frac{9}{16}\right]=\frac{t(1-a)\left(9\delta+8\right)}{32}. \tag{11}$$

The first term of the LHS of the above expression reflects the first-period transportation costs. The second term represents the discounted second-period transportation costs: 3/4 of the consumer population needs to travel the distance 3/16 on average, whereas 1/4 needs to travel a distance 9/16 on average.

A simple comparison of Eqs. (4) and (10) shows that the consumer outlays are higher without ban. The discounted average prices are lower. In particular, average prices in the first-period are lower. The average second-period prices on A's first-period customer base are lower, whereas

they are higher on B's first-period customer base. In addition, more consumers are served by their most preferred provider. The ban on "lower-prices-to-rival's customers", therefore, is consumer friendly and generates a higher consumer surplus.

Consider now the producer surplus. The above expressions show that profits are higher without ban. Thus the ban intensifies competition on the competitive segment.

(ii) Consumer and Producer Surplus. The effect on total welfare from introducing this ban amounts to a comparison of the transportation costs incurred by the consumers. The equations (6) and (11) show that transportation costs are lower with a ban on "lower-prices-to-rival's customers" than without ban. This completes the proof.

Proposition 4 shows that the ban on "lower-prices-to-rival's customers" provides greater total welfare and consumer welfare. This result stems from two complementary forces. First, the ban improves the second-period allocation of consumers as fewer consumers visit their non-nearby provider. Second, overall competition with ban on "lower-prices-to-rival's customers" is greater than without ban.

4 Discussion and Policy implications

We start our *discussion* by highlighting the intertemporal effects of each ban. That is, we point out how incorporating the expectation of a ban into firms' strategies may reverse some of the static one-period findings, even leading to unintended results. Afterwards, we turn to a comparison of the implications of the different bans. Third, we present the results of a ban that would impose "uniform pricing" by the dominant firm, a ban that combines the ban on "lower-prices-to-rival's customers" and on "higher-prices-to- sheltered-consumers".

Consider first the intertemporal effects of the ban on "higher-prices-to-sheltered-consumers". Recall that this ban lowers prices on the sheltered segment, and therefore protects sheltered consumers. However, this protection comes at the cost of relaxing overall competition on the competitive segment. The ban therefore facilitates rivals in overcoming fixed entry costs. The lower degree of rivalry on the competitive segment, however, exhibits also interesting dynamic and redistributional effects (see Figures 1 and 2) compared to the no-ban benchmark. Firm A's first-period consumers benefit from lower first-period prices while firm B's consumers pay higher first-period prices. The opposite happens in the second period as firm B's first-period customers enjoy lower prices while firm A's first-period customers are harmed.

Our analysis so far assumed that firms and consumers rationally anticipate the ban on

"higer-prices-to-sheltered-consumers". Consider now how our second-period findings would be modified when firms would not be able to behave strategically from period one onwards. A first implication is that, without anticipation, there are no intertemporal linkages or dynamic effects between the two periods. To see this, suppose that the market would have been equally divided in the first period or $x' = 0.5$. This assumption allows us to identify the marginal effects anticipation generate on second-period outcomes, as deviations from $x' = 0.5$ in our setting stem from first-period strategic behavior. To understand the marginal effects, it should be clear that any deviation of x' from 0.5 produces opposing effects in A's (the "left") and B's (the "right") segments. In particular, when $x' > 0.5$, competition increases in the "right" segment but relaxes in the "left" segment. The reasoning is that a rival's poaching strategy increases in your own first-period market share on the competitive segment. Anticipation of the ban on "higer-prices-to-sheltered-consumers", however, gives the dominant firm incentives to build-up first period market share to protect its sheltered market from future competition. As a result, it charges low prices in the first period, leading to more relax second-period competition in A's hinterland. However, sharper second-period competition in B's hinterland takes place. Consequently, firm A's first-period market share endogenously increases as a result of the ban on "higer-prices-to-sheltered-consumers". Therefore, although the ban decreases A's profits, the interemporal effects lead to higher first-period market shares for the dominant firm, partly undermining the ban's goal.

Second, consider the ban on "lower-prices-to-rival's-customers". Typically, the motivation by regulators to introduce this ban has been to actively encourage entry and by competition authorities to enable entry and/or to prevent exit of at least as efficient competitors. Our analysis shows that this ban leaves the sheltered segment unaffected, but leads to more intense competition on the competitive segment. Therefore, a ban on "lower-prices-ro-rival's-customers" results in more difficult entry as entry costs may no longer be covered by the decrease in profits. This suggests the ban may miss its intended purpose.[13]

How to reconcile this finding? First, when we consider second-period competition only, the ban intensifies competition in A's hinterland but relaxes competition in B's hinterland. The

[13] Relatedly, our model assumes that with a ban on "higher-prices-to-sheltered-consumers", the dominant firm maximizes its profits by competing on the competitive segment. Chen (2006) also considers the opposite case where the dominant firm finds it optimal to serve the sheltered segment only with a price discrimination ban. This leaves its rival with a monopoly on the competitive segment. A ban on "higher-prices-to-sheltered-consumers" then results in a monopoly on both segments. Clearly, such a ban harms consumer welfare and may miss its intented purpose.

reasoning is that A's price now is set both to serve its hinterland (its strong market) and to poach rival's customers (its weak market). This ban decreases A's price in its strong market, and increases A's price in its weak market. These second-period results are identical to those of a static analysis where only second-period competition would be considered since $x'' = 0.5$. Thus, a ban on "lower-prices-ro-rival's customers" indeed facilitates entry as compared to no ban when applying a static (second-period) analysis only. This second-period result is in line with Thisse and Vives (1988) who analyze oligopolistic price discrimination with asymmetric best-responses in a static framework.[14] They also find that when one firm is prohibited to price discriminate, competition decreases. Second, when we take into account the first-period effects, however, the results revert. Recall that anticipation of the ban, when competition takes place in the first period**,** does not modify second-period competition. However, first-period competition itself incorporates the presence of a ban in the second period. Indeed, first-period demand with a ban on "lower-prices-ro-rival's-customers" is much more elastic than without ban. This increased price sensitivity leads to harsher first-period competition. Summing up, firm B's total profits are lower as this first-period pro-competitive effect outweighs the increased second-period profits realized in B's hinterland.

Third, consider the combinations of both bans (worked out in the Appendix). This ban imposes on firm A a uniform second-period price. The results hinge on the size of the sheltered market. Consider, first a small-sized sheltered market (low a). Intuitively, this ban then comes close to the ban on "lower-prices-to-rival's customer" as the sheltered segment is relatively unimportant. The ban then leads to lower second-period prices in A's hinterland and sheltered market. Therefore, sheltered consumers strongly benefit from such a ban. In contrast, second-period prices increase in B's hinterland. Without dynamic effects (i.e. when $\widetilde{x} = 0.5$), the latter increase would even become larger. Therefore, with a static analysis the ban reaches its two goals – protecting sheltered consumers and entry would be enhanced. First-period competition, however, is much sharper than without ban. This harsher first-period competition dominates, generating overall lower profits for firm B. Therefore, for low a, our dynamic model shows that the ban does not ease entry. Second, consider a larger-sized sheltered market (high a). Intuitively, in this case, the main forces are similar to those of a ban on "higher-prices-to-

[14] Corts (1998) introduces the notion of asymmetric best-responses, where one firm's weak market is the other firm's strong market, and vice versa. In such a setting, price discrimination may result in lower profits for all firms as compared to the equilibrium profits under uniform pricing. See also Bester and Petrakis (1996) for a one-period duopoly model where price discrimination decreases every firm's profits.

sheltered-consumers". Firm B's profits are higher compared to the no-ban case. This ban therefore indeed facilitates and protects entry. The goal of protecting sheltered consumers is still met but to a lesser extent. With a large sheltered market, all second-period prices increase compared to the no-ban scenario. This implies that firm B's second-period profits increase due to the ban. This increase can be decomposed into two components. First, firm B's profits are also higher when applying a static analysis only (i.e. $\widetilde{x} = 0.5$). Second, the dynamic effects through a $\widetilde{x} > 0.5$ stimulate firm B's profits even further. Also, all first-period prices are higher than without ban.

As far as the *policy implications* are concerned, the key question is whether or not competition policy should ban "higher-prices-to-sheltered-consumers" and/or ban "lower-prices-to-rival's customers". The answer to this question depends, amongst others, on the objectives of competition policy. Does competition policy take consumer surplus or total surplus as its standard to assess practices against? Does competition policy have an explicit redistributive purpose. For example, should sheltered consumers be protected at the cost of consumers at the competitive segment?[15]

If the objective of competition policy is (1) to optimize consumer surplus; and (2) not to redistribute surplus between groups of consumers, then the ban on "lower-prices-to- rival's customers" serves to meet this objective. Whether or not a ban on "higher-prices-to-sheltered-consumers" should be imposed is ambiguous and depends on the relative consumer surplus changes due to the ban in the sheltered and competitive segments.

Another point that is relevant for competition policy is that a static analysis is not appropriate to assess competitive practices that essentially exhibit intertemporal features. In our model, from a static point of view a ban on price discrimination encourages entry. From a dynamic perspective, however, our paper shows that this is not necessarily the case. The ban on "higher-prices-to-sheltered-consumers" indeed encourages entry. The ban on "lower-prices-to-rival's customers", on the contrary, is exclusionary as it discourages entry by reducing entrants' profits.

A final related point is that prohibiting certain business practices by dominant firms can have various effects that ideally should all be taken into account. To give an example, although the ban on "lower-prices to- rival's customers" is "exclusionary" in the sense that it discourages entry, at the same time it reduces "exploitative" damage due to above-marginal-cost pricing because it intensifies competition. Policy discussions on legality or illegality of certain practices

[15] See Farrell and Katz (2006) for a discussion of these and related issues.

should take all these effects into account and be presented as trade-offs.

There is much debate on both sides of the Atlantic whether or not selective price cuts above marginal cost can enhance consumer surplus. Following the *Brooke* and *American Airlines* cases in the US, it looks as if the current US position is that selective price cuts above marginal cost in response to competitive threats should be allowed. Consequently, the ban on "lower-prices-to-rival's customers" is not enforced under US antitrust policy even though it would lead to higher consumer surplus. Under EC competition policy this form of selective price cuts may be prohibited (see e.g. *Compagnie Maritime Belge*).

5 Conclusions

In his call for a stronger economic basis on abuse of market power, Vickers (2005) observes that "the natural and mostly desirable response to competition by dominant firms will often involve (above-cost) price discrimination. This suggests that hostility to this *form* of response to competition would be wrong, but that in limited economic circumstances the evidence as a whole might justify a finding of abuse... Which circumstances is a matter in need of more economic analysis".[16] This paper aims at contributing to this call by studying the effects on competition of two specific bans prohibiting above marginal cost price discrimination by a dominant firm which have been used in recent competition and regulation cases.

In particular, we study the competitive and welfare effects of two bans on price discrimination, when firms and consumers strategically anticipate that such bans will be imposed on the dominant firm. We analyze these bans using a two-period model where the market exhibits a competitive and a sheltered segment. The first ban forbids the dominant firm to charge higher prices to its sheltered consumers. This ban decreases competition on the competitive segment and increases the initial market share of the dominant firm. Furthermore, this ban has a redistributive effect on welfare: while consumer surplus on the sheltered segment increases, the sum of consumer and producer surplus decreases on the competitive segment.

The second pricing restriction is a ban on "lower-prices-to-rival's customers", motivated by prohibitions of win-back campaigns. While competition policy authorities have designed this ban to protect competitors and stimulate entry, we show that this ban leads to more intense competition. This result shows that a dynamic approach is key to take account of all effects, as a static one-period analysis shows that competition relaxes on the competitive segment.

[16] See Vickers (2005), page F257.

6 Appendix: general ban on price discrimination

A general ban on price discrimination implies that firm A can neither price discriminate *across* its sheltered segment and the competitive segment nor *within* the competitive segment. Therefore firm A is restricted to uniform pricing in the second period. It is clear that this ban introduces a link between the sheltered segment and the competitive segment.

Firm A optimally serves its sheltered segment at price w in the first period. The ban implies however that firm A sets a price $\widetilde{p}_2^A < w$ for all its second-period customers, including the sheltered segment. The "$\widetilde{\ }$ " on top of the symbol denotes ban on "higher- prices-to-sheltered-consumers-and-rival's-customers".

Consider the competitive segment. Suppose first-period competition leads to firm A serving consumers to the left of $\widetilde{x}$, wherefrom B served consumers to the right of $\widetilde{x}$. In the second period, there are two indifferent consumers. The first is located at $0 \leq \widetilde{\alpha} \leq \widetilde{x}$ and characterized by

$$\widetilde{p}_2^A + t\widetilde{\alpha} = \widetilde{p}_2^{AB} + t(1 - \widetilde{\alpha})$$

while the second indifferent consumer located at $\widetilde{\beta}$ is characterized by

$$\widetilde{p}_2^A + t\widetilde{\beta} = \widetilde{p}_2^{BB} + t(1 - \widetilde{\beta}).$$

Firm A maximizes its second-period profits on both segments

$$\widetilde{\Pi}_2^A(\widetilde{p}_2^A) = \widetilde{p}_2^A \left[a + (1-a)\left(\widetilde{\alpha} + \widetilde{\beta} - \widetilde{x}\right)\right]$$

and firm B maximizes

$$\widetilde{\Pi}_2^B(\widetilde{p}_2^{BB}, \widetilde{p}_2^{AB}) = (1-a)\left[\widetilde{p}_2^{BB}(1 - \widetilde{\beta}) + \widetilde{p}_2^{AB}(\widetilde{x} - \widetilde{\alpha})\right].$$

The first-order conditions result in

$$\begin{aligned}
\widetilde{p}_2^A &= \frac{t(2 - \widetilde{x}\,(1-a))}{3\,(1-a)} \\
\widetilde{p}_2^{AB} &= \frac{t\,(5\widetilde{x}\,(1-a) + 3a - 1)}{6} \\
\widetilde{p}_2^{BB} &= \frac{t(5 - \widetilde{x}\,(1-a) - 3a)}{6\,(1-a)}.
\end{aligned}$$

Second-period prices depend on a as the ban implies uniform pricing between the sheltered and the competitive segment for firm A. Observe that when $a = 0$, the model coincides with the ban on "lower-prices-to-rival's customers".

We now turn to first-period competition. The forward-looking first-period indifferent consumer on the competitive segment is located at $\widetilde{x}$ such that

$$\widetilde{p}_1^A + t\widetilde{x} + \delta[\widetilde{p}_2^{AB} + t(1-\widetilde{x})] = \widetilde{p}_1^B + t(1-\widetilde{x}) + \delta[\widetilde{p}_2^A + t\widetilde{x}].$$

Remark that the indifferent consumer opting for firm B expects to be poached by firm A at a price $\widetilde{p}_2^A$ "only". This price is not very aggressive as it is identical to the price charged by A to its first-period customers on both the competitive and sheltered segments. In visiting firm A in the first-period, the indifferent consumer anticipates a more attractive second-period poaching price by firm B. After substitution of both firms' second-period prices, one obtains firm A's first-period market share on the competitive segment:

$$\widetilde{x} = \frac{6(\widetilde{p}_1^B - \widetilde{p}_1^A) + t\,(6-\delta) - a\left(2(\widetilde{p}_1^A - \widetilde{p}_1^B) + 3t\,(\delta-2)\right)}{t(12-5\delta)\,(1-a)}.$$

Firm A maximizes the following total discounted profit on both segments

$$\widetilde{\Pi}^A(\widetilde{p}_1^A, \widetilde{p}_1^B) = aw + (1-a)\,\widetilde{p}_1^A\widetilde{x} + \delta\widetilde{p}_2^A\left[a + (1-a)\left(\widetilde{\alpha} + \left(\widetilde{\beta} - \widetilde{x}\right)\right)\right]$$

whereas firm B maximizes

$$\widetilde{\Pi}^B(\widetilde{p}_1^B, \widetilde{p}_1^A) = (1-a)\left[\widetilde{p}_1^B(1-\widetilde{x}) + \delta\left[\widetilde{p}_2^{BB}(1-\widetilde{\beta}) + \widetilde{p}_2^{AB}(\widetilde{x}-\widetilde{\alpha})\right]\right].$$

From the first-order conditions, an interior solution results in

$$\begin{aligned}
\widetilde{p}_1^A &= \frac{t\,(12-\delta)}{12} + \frac{at\delta\,(156-89\delta)}{6\,(1-a)\,(54-31\delta)} \\
\widetilde{p}_1^B &= \frac{t\,(3-\delta)}{3} + \frac{2at\delta\,(15-8\delta)}{3\,(1-a)\,(54-31\delta)}.
\end{aligned}$$

Competition with a ban on "higher- prices-to-sheltered-consumers-and-rival's-customers" leads to different first-period prices charged by both firms. Dominant firm A's prices outweigh its rival's as $\widetilde{p}_1^A > \widetilde{p}_1^B$. The reasoning stems from the anticipated second-period poaching behavior by both firms. Similar to the ban on "lower-prices-to-rival's customers", consumers anticipate that the poaching price by dominant firm A is less aggressive than by rival firm B. This force however is now even stronger as the poaching aggressiveness of dominant firm A decreases in a.

Firm A's first-period market share on the competitive segment is

$$\widetilde{x} = \frac{1}{2\,(1-a)} - \frac{3a(18-11\delta)}{2(1-a)(54-31\delta)},$$

which is larger than 0.5. As a consequence, firm A's second-period market share on the competitive segment entails

$$\widetilde{\alpha}+\widetilde{\beta}-\widetilde{x}=\frac{1}{2\left(1-a\right)}-\frac{3a(30-17\delta)}{2(1-a)(54-31\delta)},$$

and smaller than 0.5. Firm A's total market share on both segments is therefore decreasing from period one to period two, showing that the ban increases the initial dominance but reduces firm A's dominance over time.

Second-period equilibrium prices become

$$\begin{aligned}\widetilde{p}_2^A &= \frac{t}{2\left(1-a\right)}\left[1+\frac{a\left(18-11\delta\right)}{54-31\delta}\right]\\ \widetilde{p}_2^{AB} &= \frac{t}{4\left(1-a\right)}\left[1+\frac{a\left(18-7\delta\right)}{54-31\delta}\right]\\ \widetilde{p}_2^{BB} &= \frac{3t}{4\left(1-a\right)}\left[1-\frac{a\left(30-17\delta\right)}{54-31\delta}\right].\end{aligned}$$

Discounted profits for both firms on both segments amount to

$$\begin{aligned}\widetilde{\Pi}^A &= aw+\left(1-a\right)\frac{t(5\delta+12)}{24}-\frac{at\delta\left[2a\left(1372\delta^2-4809\delta+4212\right)-3\left(1767\delta^2-6178\delta+5400\right)\right]}{6\left(1-a\right)\left(54-31\delta\right)^2}\\ \widetilde{\Pi}^B &= \left(1-a\right)\frac{t(7\delta+24)}{48}-\frac{at\delta\left[6a\left(569\delta^2-1983\delta+1728\right)-4681\delta^2+6\left(2723\delta-2376\right)\right]}{12\left(1-a\right)\left(54-31\delta\right)^2}.\end{aligned}$$

We provide now a *comparison* of the ban on "higher- prices-to-sheltered-consumers-and-rival's-customers" with our base case scenario. Recall that when $a=0$, the ban effectively becomes identical to a ban to "lower-prices-to-rival's customers". In that case, prices are lower in the first period and on firm B's first-period segment. Second-period prices on firm A's first-period segment are higher compared to the base case scenario. Overall competition is harsher compared to the base case, implying that such a ban discourages entry. All prices on the competitive segment increase in a revealing that the results on the intensity of competition and the price levels hinge on the size of the sheltered market a. For low enough a, overall competition will still be harsher than in the base case making the ban entry deterring. For high enough a, however, competition will be less severe such that the rival firm's profits are higher than in the base case. That is firm B enjoys higher overall profits than under the base case when the ban sufficiently lowers the aggressiveness of the dominant firm A. The ban also produces interesting intertemporal effects. Anticipation of a ban on "higher- prices-to-sheltered-consumers-and-rival's-customers" leads to larger first-period market shares. That is the dominant firm serves more than half of the competitive segment in addition to its sheltered segment. Second-period dominance becomes less important as $\widetilde{x}<0.5$.

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