Portfolio Effects and Merger Control: Full-line Forcing as an Entry-Deterrence Strategy*

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Abstract

The "portfolio effect theory" developed by the European Commission in merger control is at the center of a fierce international row with the US authorities who believe that this theory has no economic foundations.

This paper aims to provide a counter-argument and shows that full-line forcing may be used by the holder a comprehensive range of products as an entry deterrence device to maintain its monopoly power. However, due to buyer power on the retail market, this will happen only if entry is not profitable for the industry as a whole.

The effects on consumer welfare are ambiguous. Full-line forcing will reduce prices in the first period, but as it helps maintaining monopoly power, is harmful in the long-term.

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1 Introduction

The European Commission's decision in July 2001 to prohibit the proposed merger between *General Electric* and *Honeywell* has been the starting point of the fierce debate between the European and the U.S. competition authorities on the theory of "portfolio power" in conglomerate mergers. One of the motivations behind the decision was that "because of the lack of ability to match the bundled offers, rival component suppliers would lose market shares to the benefit of the merged entity.(...) As a result, the merger is likely to lead to market foreclosure on those existing aircraft platforms and subsequently to the elimination, or a the substantial lessening of competition."[1]

This "portfolio power" approach has first been introduced in 1996-97 by the European Commission in three major merger cases. It is worth noting that the U.S. authorities already rejected this theory at that time. One of the conclusions in the *Guinness / Grand Metropolitan* case (hereafter *GMG)*[2] was that, despite the lack of increase in market share in some individual product markets, the existence of such a portfolio may create or strengthen a dominant position.[3] The *GMG* decision clearly defines some of the benefits that the holder of a comprehensive portfolio may enjoy: economies of scale and scope in marketing activities, stronger position vis-à-vis its customers (the seller now accounts for a larger proportion of the buyer's turnover), and greater potential for tying or other bundling techniques. As denoted by Giotakos (1998), "the anti-competitive likelihood of portfolio effects is based on the proposition that the combined portfolio of products/brands of the merged firm represents an essential facility for the downstream agents in a manner that the individual product lines of the undertakings pre-merger did not". The holder of a complete line of products could for example impose exclusive contracts on the retailers or force them to buy the complete line (*full-line forcing*). The anti-competitive effects of this behavior are twofold. Firstly, the portfolio can be used to "reposition relatively weaker brands within the portfolio against the brands of the competitors at the same level of quality". In other words, the holder of the portfolio can try to impose brands that the retailer would otherwise not be willing to buy. The second aspect is the possible foreclosure effect. The complete range of products can be used to take up more space on

[1] See Giotakos et al. (2001) for a detailled presentation of the GE / Honeywell decision.

[2] Guinness / Grand Metropolitan (case IV/M.938). See also Coca-Cola / Amalgamated Beverages (case IV/M.796) and Coca-Cola / Carlsberg (case IV/M.833).

[3] Other possible sources of "portfolio power" have been identified by the European Commission in these cases: see Lexecon (1998) and OECD (2002) for a more comprehensive presentation of this theory.

the retailers' shelves in order to limit the space available to competitors and force them out of the market. This paper focuses on this second aspect.

However, the Commission's argument have been widely criticized. In its contribution to an OECD Best Practices Roundtable,[4] the U.S. Department of Justice made clear that they did not believe in this theory and that they were *"very concerned that the range effects theory of competitive injury that is gaining currency in certain jurisdictions places the interests of competitors ahead of those of consumers and will lead to blocking or deterring pro-competitive, efficiency-enhancing mergers."* They then argued that the Commission's arguments have no serious economic basis and are based on some predictions that the merger would drive competitors of the new entity out of the market which have no empirical or historical foundations.

It has to be acknowledged, that although there exists a thorough literature on the effects of tying and bundling, the economic theory of "portfolio power" itself is fairly limited. Rabassa (1999) proposes a first attempt to provide a formal argument in favor of this theory which are not related to tying. In a setup in which competing firms produce and sell different brands and where demand takes into account preferences for quality and variety (number of products available), she analyzes the horizontal effects of a merger on price and quality levels. She shows that when quality is a short run decision and therefore producers are able to modify the quality of their products after a merger, merger may have anti-competitive effects and may decrease consumers' surplus. She also shows that the post-merger market share of the new firm is higher than the pre-merger combined market share of the merging parties, thereby confirming the theory that a wider portfolio creates sur-additivity. However, this model considers direct interaction between producers and final consumers and only focuses on horizontal effects.

Different arguments, such has price discrimination and cost-savings have been provided to justify the use of tie-in sales or full-line forcing.[5,6] However, arguments more closely related to the "portfolio power" and the interactions between the merged entity and its competitor refers to the analysis of the market power aspects of tying. This literature

[4]See OECD (2002).

[5]Tying/bundling usually refers to goods that are used in fixed proportions (usually complementary goods), whereas full-line forcing refers to situation in which a consumer (usually a wholesaler or a retailer) is forced to buy the whole set of products proposed by a manufacturer.

[6]See for example Adams and Yellen (1976) or Mathewson and Winter (1997) for price discrimination issues, and Slade (1998) for cost-savings motives.

started with the long debate on the leverage theory: the intuition is that a multi-product monopolist may try to extend the monopoly power that he has in the tying-good market to eliminate competition in, or at least to extract additional monopoly rent from, the tied-good market. However this theory has been widely contested by the so-called Chicago School on the grounds that a monopoly profit can only be taken once. An important contribution by Whinston (1990) shows that the criticism are based on the assumption that firms operate under constant returns to scale and that market power leverage may profitably occur if there are economies of scale.

More recently, a literature mostly inspired by the Microsoft case has developed on the dynamic effects of tying (dynamic leveraging). The idea is that a firm who has monopoly power on one market may want to reduce competition on related market in order to protect its monopoly power in the tying market or to extend it to the tied market. This theory has first been developed by Nalebuff (1999, 2000). Tying might now be harmful for the buyers because it limits the profitability of entry and thus reduces competition in the long term. A similar argument has been developed by Carlton and Waldman (2002). The basic framework is one in which a firm has monopoly power on two complementary markets but faces a threat of entry on one market at each period of the game. If the monopoly ties-in the sales of its two components it can prevent entry in both market and preserve its monopoly position: the idea is that entry can be profitable only if a firm is able to enter in both market at the same time since one component alone has no value for the consumers.[7]

Our paper extends this approach to the case of imperfectly substitutable products. We try to address the question of whether a multi-product firm, holding a comprehensive portfolio of brands and acting as a monopolist in one market, may force the retailers to buy the full range of products in order to raise barriers to entry and ensure that he will always remain alone in the monopolized market. Since product are substitutes and not perfect complements, a single firm could thus enter one market only and still make profit. However, firms have to deal with a unique retailer to access the final consumer: therefore, although the two goods are seen as substitutes for the final consumers they offer some complementarities for the retailer who needs to provide them both in its shelves.

This relates our papers to Shaffer (1991) and Vergé (2001) on the effects of full-line

[7]Using a similar framework ,Choi and Stefanidis (2001) shows that tying reduces the incentives for innovation thereby protecting the monopolist position.

forcing: Shaffer (1991) provides a first attempt to analyze full-line forcing in a vertical relationship between a multi-product monopolist and a unique retailer. An upstream monopolist selling differentiated products (imperfect substitutes) faces the retailer's bargaining power due to the opportunity cost of brand carrying (for example, the value of the shelf space). If this opportunity cost is common knowledge, brand-specific two-tariffs are not sufficient to maximize the manufacturer's profit and the retailer earns a strictly positive profit even though the producer can make a take-it-or-leave-it offer. This positive rent is attributable to shelf space scarcity but also to the retailer's discretion over brand choice. Shaffer also shows that full-line forcing (as with other vertical restraints like resale price maintenance or aggregate rebates) is a possible tool to avoid discretion of brand choice and therefore remove retailer's rent. However, this model does not account for competition between producers and therefore it cannot be used as such to analyze potential non-horizontal effects of portfolio power. Using a similar framework, Vergé (2001) shows that full-line forcing has a positive impact on consumers' surplus. In the absence of tie-in sales, the producer prefers to maintain prices above the monopoly level in order to reduce the retailer's rents. Full-line forcing allows the producer to fully restore its monopoly power and eliminate price distortions.

In a similar way to Carlton and Waldman, we assume that entry occurs first on the potentially tied market before occurring on the monopolized market. This plays a critical role in our model: the idea is that consumers are always sceptical when they see new products and prefer to stick with the well-known brands. A newcomer must therefore start losing money on a highly-competitive market before being able to gain reputation and compete with the established brand. If signalling is impossible the incumbent may want to tie-in the sales of the two products to prevent the entry of a newcomer and maintain its monopoly position in the future.

The paper is organized as follows: in section 2, we present the features of our dynamic model with the threat of entry. Once we have analyzed the possible second period equilibria (section 3), we analyze the rationale for full-line forcing. We first show that the incumbent producer cannot maintain its monopoly position without holding a comprehensive portfolio (section 4). We then show that full-line forcing can be used to prevent entry but that it is profitable only when entry would decrease the industry profit (section 5). The effects on the consumer surplus are presented in section 6 and section 7 concludes.

2 The Model

2.1 Goods and Consumers

We consider an economy in which two imperfectly substitutable goods, denoted H and L, are available. The inverse demand functions for goods H and L are denoted $P_{\mathsf{H}}(q_{\mathsf{H}}, q_{\mathsf{L}})$ and $P_{\mathsf{L}}(q_{\mathsf{H}}, q_{\mathsf{L}})$. Products H and L being imperfect substitutes, the two inverse demands are decreasing functions of both q_{H} and q_{L}. Although this assumption is not necessary, we suppose that for equal quantities, the consumers' willingness to pay is higher for product H $(P_{\mathsf{H}}(q,q) \geq P_{\mathsf{L}}(q,q))$. This specification allows us to consider this product as the most important and potentially more profitable. H can thus be seen as being the well-known or branded good, whereas L is the non-branded or generic good. We will hereafter refer to market for products H and L as the high- and low- demand markets respectively.

Let us denote by $\pi(q_{\mathsf{H}}, q_{\mathsf{L}}; w_{\mathsf{H}}, w_{\mathsf{L}})$ the profit that a monopolist producing the two goods at constant marginal costs w_{H} and w_{L} would realize if it sells quantities q_{H} and q_{L},that is:

$$\pi(q_{\mathsf{H}}, q_{\mathsf{L}}; w_{\mathsf{H}}, w_{\mathsf{L}}) = (P_{\mathsf{H}}(q_{\mathsf{H}}, q_{\mathsf{L}}) - w_{\mathsf{H}})\, q_{\mathsf{H}} + (P_{\mathsf{L}}(q_{\mathsf{H}}, q_{\mathsf{L}}) - w_{\mathsf{L}})\, q_{\mathsf{L}}$$

We assume that, for any value of w_{H} and w_{L}, this profit function is strictly concave in $(q_{\mathsf{H}}, q_{\mathsf{L}})$ and therefore reaches its maximum for a unique pair of quantities, $q_{\mathsf{H}}^{\mathsf{M}}(w_{\mathsf{H}}, w_{\mathsf{L}})$ and $q_{\mathsf{L}}^{\mathsf{M}}(w_{\mathsf{H}}, w_{\mathsf{L}})$. We also denote by $p_{\mathsf{H}}^{\mathsf{M}}(w_{\mathsf{H}}, w_{\mathsf{L}})$ and $p_{\mathsf{L}}^{\mathsf{M}}(w_{\mathsf{H}}, w_{\mathsf{L}})$ the optimal prices on markets H and L, and by $\pi^{\mathsf{M}}(w_{\mathsf{H}}, w_{\mathsf{L}})$ the profit made by the monopolist. Due to the concavity assumption, $q_{\mathsf{i}}^{\mathsf{M}}$ $(i = H, L)$ is increasing in w_{i} and decreasing in w_{j} $(j \neq i)$, whereas the profit $\pi^{\mathsf{M}}(w_{\mathsf{H}}, w_{\mathsf{L}})$ is a decreasing function of w_{H} and w_{L}.

If the production cost of one product (let say w_{L}) is too high, or if the producer cannot propose this good, it maximizes

$$\pi(q_{\mathsf{H}}, 0; w_{\mathsf{H}}, w_{\mathsf{L}}) = (P_{\mathsf{H}}(q_{\mathsf{H}}, 0) - w_{\mathsf{H}})\, q_{\mathsf{H}}.$$

Under our assumption, this is a concave function of q_{H} which reaches its maximum for a unique value of q_{H}. We will denote by $q_{\mathsf{H}}^{\mathsf{M}}(w_{\mathsf{H}}, \emptyset)$ this optimal quantity, by $p_{\mathsf{H}}^{\mathsf{M}}(w_{\mathsf{H}}, \emptyset)$ the price at which it is sold and by $\pi_{\mathsf{H}}^{\mathsf{M}}(w_{\mathsf{H}}, \emptyset)$ the corresponding profit. $q_{\mathsf{L}}^{\mathsf{M}}(\emptyset, w_{\mathsf{L}})$, $p_{\mathsf{L}}^{\mathsf{M}}(\emptyset, w_{\mathsf{L}})$ and $\pi_{\mathsf{L}}^{\mathsf{M}}(\emptyset, w_{\mathsf{L}})$ are defined in a similar way.[8]

[8]Notice that in these cases we have: $q_{\mathsf{L}}^{\mathsf{M}}(w_{\mathsf{H}}, \emptyset) = q_{\mathsf{H}}^{\mathsf{M}}(\emptyset, w_{\mathsf{L}}) = 0$ and the prices $p_{\mathsf{L}}^{\mathsf{M}}(w_{\mathsf{H}}, \emptyset)$ and $p_{\mathsf{H}}^{\mathsf{M}}(\emptyset, w_{\mathsf{L}})$ are irrelevant.

We moreover assume that the inverse demand functions are such that the prices $p_{\mathsf{H}}^{\mathsf{M}}(w_{\mathsf{H}}, w_{\mathsf{L}})$ and $p_{\mathsf{L}}^{\mathsf{M}}(w_{\mathsf{H}}, w_{\mathsf{L}})$ are increasing function of w_{H} and w_{L}.[9]

2.2 Firms

The production sector consists of three types of firms, all of them operating under constant returns to scale.

- **Competitive Fringe**

  Perfectly substitutable manufacturers produce good L at the same marginal cost c.

- **Incumbent** (I)

  The incumbent manufacturer I produces good H at a marginal $c_{\mathsf{I}} > c$. It is assumed that it is more costly to produce good H (high demand) because it involves either more sophisticated ingredients to improve the actual quality of the product or more costly packaging in order to convince consumers of its higher value.

  The incumbent manufacturer can also acquire the technology to produce the low-demand good L at zero cost. One such possibility is to merge with one manufacturer from the competitive fringe.

- **Entrant** (E)

  Manufacturer E produces a "new" good at marginal cost $c \leq c_{\mathsf{E}} \leq c_{\mathsf{I}}$. We assume that the consumers' tastes are based on experience and that they are not only extremely risk-averse when they try a new product, but also have a strong bias against new comers. Moreover, there is no way to signal the product's potential value to the consumers other than by testing it. A rational for this is the following: consumers live only one period and do not like new products. However, if some consumers have tried the product in the first period, they are able to inform the next generation of consumers about the actual type of the product. In this case, if the entrant's product is actually sold during one period, all second-period consumers will be informed of the actual type of the entrant's product and the entrant will now access the high-demand market. If the product has never been sold before, there

[9]The costs w_{H} and w_{L} can take any value including $\emptyset$ ($\emptyset$ stands for the absence of the product and corresponds to very high values of the production cost).

is no chance that the consumers' tastes change and the entrant's product is thus a low-demand product.

We also assume that the marginal costs and the demand functions satisfy the following conditions:

- (H_1) : $\forall c_{\mathsf{E}} \in [c, c_{\mathsf{I}}]$,the quantities $q_{\mathsf{H}}^{\mathsf{M}}(c_{\mathsf{E}}, c)$, $q_{\mathsf{L}}^{\mathsf{M}}(c_{\mathsf{E}}, c)$, $q_{\mathsf{H}}^{\mathsf{M}}(c_{\mathsf{I}}, c_{\mathsf{E}})$, $q_{\mathsf{L}}^{\mathsf{M}}(c_{\mathsf{I}}, c_{\mathsf{E}})$ are strictly positive.[10]
- (H_2) : If the incumbent decides not to sell its product during the first period, the integrated structure consisting of the entrant ancd the retailer prefers to sell the entrant's product rather than the competitive fringe's low-demand product, that is:[11]

$$\forall c_{\mathsf{E}} \in [c, c_{\mathsf{I}}], \qquad \pi^{\mathsf{M}}(\emptyset, c_{\mathsf{E}}) + \pi^{\mathsf{M}}(c_{\mathsf{E}}, c) > 2\pi^{\mathsf{M}}(\emptyset, c).$$

Even though it is more costly to sell the entrant's product on the low-demand market, the benefits generated during the second period are higher than the short term losses. This hypothesis ensures that it is impossible for the incumbent I to deter entry when it produces the high-demand good only.

2.3 Timing

The producers cannot directly sell the goods to the final consumers and have to sell them through a unique retailer. This distributor operates under constant returns to scale, and, without loss of generality, we normalize the marginal distribution cost to 0. In addition, we consider shelf space as a scarce resource and assume that the retailer can carry at most two different products. The producers thus have to compete in order to gain access to this essential facility.[12] The objective of this section is to analyze the incentives for full-line forcing when the incumbent I produces the two types of goods.

[10]These conditions imply that $q_{\mathsf{H}}^{\mathsf{M}}(c_{\mathsf{E}}, \emptyset)$ and $q_{\mathsf{L}}^{\mathsf{M}}(\emptyset, c_{\mathsf{E}})$ are positive. The first two conditions are relatively natural since they ensure that the products are viable. The last two are not essential and just make the presentation easier, but do not affect the results.

[11]Notice that because π^{M} is a decreasing function of the costs, this condition needs to hold for $c_{\mathsf{E}} = c_{\mathsf{I}}$ only.

[12]This assumption is not crucial, but allows us to avoid questions related to market sharing when several producers offer the same tariff.

We analyze a two-period game in which the sequence of the events is the same for both periods:[13]

1. The incumbent producer I makes take-it-or-leave-it offers to the retailer.
2. The entrant E and the competitive fringe make take-it-or-leave-it offers to the retailer.[14]
3. The retailer accepts at most two offers, sets the retail prices and orders quantities so as to satisfy demand. The contracts are enforced.

Each offer made by the entrant or by one of the competitive producers (operating on the low-demand market) is a two-part tariff (w, F), where F is a fixed fee paid by the retailer in order to be allowed to resell the product and a per unit price w. The incumbent can either sell the two products separately and thus offers two product-specific two-part tariffs, or sell them under a unique contract (full-line forcing) consisting of a unique fixed fee and a per unit wholesale price for each product. The offers are publicly observable.

3 Second Period Equilibrium

The second period corresponds to a static situation in which competition between producers is affected by the type of products actually sold on the market during the first period. More specifically, it depends on whether the entrant was active or not on the low-demand market.

3.1 The Entrant has not been active in period 1

Assume first that the entrant's product was not available on the retailer's shelves during the first period. If the product is proposed on the shelves during the second period, it

[13]The two periods only differ with respect to the number of active players on each market. In period one, the incumbent acts as a monopolist on the high-demand market and faces competition from the entrant E and the competitive fringe on the low-demand market. If the entrant is inactive on the low-demand market during this first period, the incumbent remains a monopolist on the high-demand market in the second period. Otherwise, it faces competition from the entrant on this high-demand market.

[14]Assuming that offers are made simultaneously would lead to multiple equilibria, and our equilibrium would then correspond to the most favourable equilibrium for the incumbent. This would just reinforce our results.

will therefore be considered as a low quality product, that is, as a perfect substitute for the products offered by the producers of the competitive fringe. The entrant producing at a higher cost, $c_{\mathsf{E}} \geq c$, will thus leave the market.

This situation is thus very similar to Shaffer (1991) except that the low-demand market is now perfectly competitive. Everything thus happens as if the retailer were able to produce the low-demand product by itself at cost c. It can then decide to reject the wholesale contract offered by the incumbent, sell the low-demand product only and secure a profit equal to $\pi^{\mathsf{M}}(\emptyset, c)$.

The incumbent makes a take-it-or-leave-it offer to the retailer to sell its high-demand product and possibly its low-demand product. Since the incumbent makes a take-it-or-leave-it offer and can offer a two-part tariff, it is able to recover the total industry profit through the fixed fee, except for the minimal secured profit $\pi^{\mathsf{M}}(\emptyset, c)$. The best the incumbent can do is thus to ensure that the retailer charges prices that maximize the total industry profit. This leads to the following lemma:

Lemma 1 *If the entrant has not been active in the first period, the second period equilibrium is such that the incumbent manufacturer I charges wholesale prices equal to the marginal product costs* ($w_{\mathsf{H}} = c_{\mathsf{I}}$ *and* $w_{\mathsf{L}} = c$), *and sets fixed fees such that the second period profits are:*

$$\pi_{\mathsf{I}}^{2}(N) = \pi^{\mathsf{M}}(c_{\mathsf{I}}, c) - \pi^{\mathsf{M}}(\emptyset, c), \ \pi_{\mathsf{E}}^{2}(N) = 0 \ \textit{and} \ \pi_{\mathsf{R}}^{2}(N) = \pi^{\mathsf{M}}(\emptyset, c).$$

The existence of the competitive fringe on the low-demand market prevents the use of full-line forcing and makes it pointless for the incumbent to produce the low-demand product. This allows us to focus on the potential anti-competitive effects of full-line forcing in isolation and get rid off the possible welfare improving effects of such restraints used as a counter-effect for the retailer's ability to select the product proposed on its shelves (in contrast to Shaffer(1991) and Vergé (2001)).

3.2 The Entrant has been active in period 1

Suppose now that the producer E was active, that is, its product was available on the retailer's shelves and a strictly positive quantity of this product was sold to the final consumers during the first period. In period 2, the new consumers are now informed about the value of this product and consider it as a perfect substitute for the incumbent's high-demand product.

On the low-demand market, the producers of the competitive fringe are still willing to sell their product at the marginal production cost c. On the other hand, on the high-demand market, there is competition between an efficient firm - the entrant producing at marginal cost c_{E} - and the inefficient incumbent producing at marginal cost c_{I}. Since, the two products are perfectly substitutable, the price competition between the two firms reduces their bargaining position vis-à-vis the retailer, even though they are able to make take-it-or-leave-it offers to the downstream firm. As I is now the inefficient firm, everything happens as if the incumbent just sells out its firm to the retailer. The retailer is therefore able to secure a profit equal to $\pi^{\mathsf{M}}(c_{\mathsf{I}}, c)$. The entrant will therefore ensure that the retailer charges the industry maximizing prices (by selling its product at marginal cost). These results are summarized in the following lemma:

Lemma 2 *If the entrant has been active in the first period, the second period equilibrium is such that the entrant charges a wholesale price equal to its marginal product cost* $(w_{\mathsf{H}} = c_{\mathsf{E}})$, *and sets a fixed fee such that the second period profits are:*

$$\pi_{\mathsf{I}}^2(A) = 0,\ \pi_{\mathsf{E}}^2(A) = \pi^{\mathsf{M}}(c_{\mathsf{E}}, c) - \pi^{\mathsf{M}}(c_{\mathsf{I}}, c) \ \text{ and } \pi_{\mathsf{R}}^2(A) = \pi^{\mathsf{M}}(c_{\mathsf{I}}, c).$$

Comparison of the profits in the two cases shows that the incumbent I has more to lose $(\pi^{\mathsf{M}}(c_{\mathsf{I}}, c) - \pi^{\mathsf{M}}(\emptyset, c))$ than the entrant has to gain $\left(\pi^{\mathsf{M}}(c_{\mathsf{E}}, c) - \pi^{\mathsf{M}}(c_{\mathsf{I}}, c)\right)$, provided that the cost differential $c_{\mathsf{I}} - c_{\mathsf{E}}$ is not too high. This could create incentives for the incumbent to act strategically and distort his prices or force the retailer to buy his complete line of products in order to ensure that the entrant is inactive in the first period and thus protect its monopoly position in the second period. However, the existence of the monopolist retailer modifies the incentives. It is indeed not relevant to compare the differences in profits for the incumbent and the entrant without taking the retailer into account. On the account of its profit being greater due to the competition on the high-demand market, the retailer has incentives to ensure that the entrant is active in the first period. The relevant comparison is therefore between the industry profits. The entrant being more efficient than the incumbent on the high-demand market implies that entry is always profitable (for the industry as a whole) in the second period. However, the entrant is less efficient than the competitive fringe on the low-demand market, hence entry decreases the first period joint profits, and is globally profitable if an only if

$$\Delta(c_{\mathsf{E}}) \equiv \pi^{\mathsf{M}}(c_{\mathsf{I}}, c_{\mathsf{E}}) + \pi^{\mathsf{M}}(c_{\mathsf{E}}, c) - 2\pi^{\mathsf{M}}(c_{\mathsf{I}}, c) \geq 0.$$

4 Equilibrium Without Portfolio Power

Let us first assume that the incumbent produces only the high-demand good. Because, its second period profit is higher when the producer E has been active in period one, the retailer can always decides to trade-off some of the short term profit that might be lost when entry occurs, for a higher profit in the longer term due to competition on the high-demand market. If it has not accepted the entrant's offer, it is not able to affect the future profit and the retailer's pricing decisions are thus identical to the second period (or static) decisions. However, it is always optimal to facilitate entry if the entrant's offer has been accepted. Moreover, even if $q_{\mathsf{L}}^{\mathsf{M}}(w_{\mathsf{I}}, w_{\mathsf{E}}) = 0$, it is almost costless to sell an infinitesimal quantity of the entrant's product, and this yields a much higher second period profit.

Given this optimal pricing policy, the producer I has two options in the first period:

(i) either it decides to "accommodate entry" and maximizes the profit during this first period, with the result that it will have to quit the market during the second period as the new entrant is now more efficient on the high-demand market;

(ii) or it distorts its first period profits in order to save its monopoly position on the high-demand market in the second period.

However, as the retailer can also increase its second period profit by accepting the entrant's offer in the first period, entry deterrence is impossible under the assumption (H_2), as proved in the following lemma:

Lemma 3 *The incumbent cannot maintain its monopoly position if it produces only the high-demand product.*

Proof. See Appendix A. ■

The intuition behind this result is straightforward. If the incumbent wants to maintain its monopoly position, it has to ensure that the retailer is never willing to sell the entrant's product even if it can get this product at marginal cost in any of the two periods. This is however impossible because the retailer would have an incentive to sell an infinitesimal quantity of the entrant's good in the first period to increase substantially its second period profit. Although this strategy reduces its first period profit because the entrant is less efficient than the competitive fringe, hypothesis (H_2) ensures that the increase in the second period profit is sufficiently large to compensate the first period loss.

As the incumbent cannot deter entry during the first period, the first period situation is a standard common agency problem in which the incumbent and the entrant deal with the same retailer to reach the final consumers. It is therefore optimal to charge wholesale prices equal to the marginal production costs ($w_H = c_I$ and $w_E = c_E$) to ensure that the retailer will then set the retail prices that maximize the total industry profits. Each retailer sets its franchise fee in order to ensure that the retailer will accept its contract in addition to the competitor's contract. Finally, the existence of the competitive fringe ensures that the retailer can always secure a minimal profit by rejecting both offers. This leads to the following proposition:

Proposition 4 *If the incumbent produces only the high-demand good, both the incumbent I and the entrant E charge wholesale prices equal to their respective marginal production costs, c_I and c_E, and franchise fees such that these two offers are accepted. The intertemporal profits are then:*

- *for the incumbent I :* $\pi_I(A) = \pi_I^1 = \pi^M(c_I, c_E) - \pi^M(\emptyset, c_E)$;
- *for the entrant E :* $\pi_E(A) = \pi^M(c_E, c) + \pi^M(\emptyset, c_E) - 2\pi^M(\emptyset, c)$;
- *for the retailer :* $\pi_R(A) = 2\pi^M(\emptyset, c)$.

Proof. See Appendix B. ■

This situation is a standard common agency problem except that the existence of the competitive fringe which is more efficient than the entrant on the low-demand market ($c_E \geq c$), further limits the maximum fixed fee the entrant can set. The incumbent I makes the first offer and therefore obtains a profit equal to the profit generated by its product $\left(\pi^M(c_I, c_E) - \pi^M(\emptyset, c_E)\right)$, whereas the entrant has to ensure that the retailer prefers to accept its offer rather than that of the competitive fringe only. It therefore has to compensate the retailer for the loss incurred in the first period.

5 Portfolio Power and Full-line Forcing

Assume now that the incumbent manufacturer I produces the two types of goods (H and L) and can offer, either two product-specific two-part tariffs, or a unique tariff *(full-line forcing)*. It is straightforward to see that, if the incumbent decides to sell its low-demand product in the first period in order to maintain its monopoly position on product H, it is as least as profitable to use a unique tariff than it is to offer two product-specific contracts. The producer can indeed replicate the equilibrium generated with the two contracts $(w_{\mathsf{H}}, F_{\mathsf{H}})$ and $(w_{\mathsf{L}}, F_{\mathsf{L}})$, by offering the unique tariff $(w_{\mathsf{H}}, w_{\mathsf{L}}, F_{\mathsf{H}}+F_{\mathsf{L}})$. Moreover, full-line forcing allows to relax one of the constraints on the maximum franchise fees that the incumbent can set because it does not need to ensure that the retailer chooses its low-demand product rather than the entrant's.[15]

If the incumbent makes a unique offer, it has to ensure that the retailer is willing to accept it even though the entrant would then be ready to give up its technology to the distributor. Under hypothesis (H_2), the profit the retailer can secure (that is the profit it would realize if it rejects the incumbent's offer) is $\underline{\pi}_{\mathsf{R}} = \pi^{\mathsf{M}}(\emptyset, c_{\mathsf{E}}) + \pi^{\mathsf{M}}(c_{\mathsf{E}}, c)$. Once again, the incumbent can recover the industry profit minus this secured profit $\underline{\pi}_{\mathsf{R}}$ through the franchise fee. It will therefore set wholesale prices equal to its marginal costs ($w_{\mathsf{H}} = c_{\mathsf{I}}$ and $w_{\mathsf{L}} = c$), and charge a franchise fee such that

$$\pi^{\mathsf{M}}(c_{\mathsf{I}}, c) - F_{\mathsf{HL}} + \pi^{\mathsf{M}}(\emptyset, c) = \pi^{\mathsf{M}}(\emptyset, c_{\mathsf{E}}) + \pi^{\mathsf{M}}(c_{\mathsf{E}}, c),$$

that is,

$$F_{\mathsf{HL}} = \pi^{\mathsf{M}}(c_{\mathsf{I}}, c) + \pi^{\mathsf{M}}(\emptyset, c) - \pi^{\mathsf{M}}(\emptyset, c_{\mathsf{E}}) - \pi^{\mathsf{M}}(c_{\mathsf{E}}, c).$$

The maximum profit the incumbent can obtain when it produces both types of goods is therefore

$$\pi_{\mathsf{I}}(FLF) = 2\pi^{\mathsf{M}}(c_{\mathsf{I}}, c) - \pi^{\mathsf{M}}(\emptyset, c_{\mathsf{E}}) - \pi^{\mathsf{M}}(c_{\mathsf{E}}, c).$$

In order to decide whether to force the retailer to buy its complete line of products (FLF) or to let the entrant be active in the first period (A), the incumbent compares this profit $\pi_{\mathsf{I}}(FLF)$, with the profit $\pi_{\mathsf{I}}(A)$ given by proposition 4. This leads to the following result:

Proposition 5 *The incumbent manufacturer decides to produce both types of goods and thus ties their sales if and only if entry would decrease the inter-temporal industry profit, that is when* $c_{\mathsf{E}} \geq c_{\mathsf{E}}^{\mathsf{M}}$, *where* $c < c_{\mathsf{E}}^{\mathsf{M}} < c_{\mathsf{I}}$ *is the unique solution of:*

$$\pi^{\mathsf{M}}\left(c_{\mathsf{I}}, c_{\mathsf{E}}^{\mathsf{M}}\right) + \pi^{\mathsf{M}}\left(c_{\mathsf{E}}^{\mathsf{M}}, c\right) = 2\pi^{\mathsf{M}}(c_{\mathsf{I}}, c) \Leftrightarrow \Delta(c_{\mathsf{E}}^{\mathsf{M}}) = 0.$$

Proof. The two profits the incumbent compares are:

$$\pi_{\mathsf{I}}(FLF) = 2\pi^{\mathsf{M}}(c_{\mathsf{I}}, c) - \pi^{\mathsf{M}}(\emptyset, c_{\mathsf{E}}) - \pi^{\mathsf{M}}(c_{\mathsf{E}}, c) \text{ and } \pi_{\mathsf{I}}(A) = \pi^{\mathsf{M}}(c_{\mathsf{I}}, c_{\mathsf{E}}) - \pi^{\mathsf{M}}(\emptyset, c_{\mathsf{E}}).$$

[15] We show in appendix C that full-line forcing does strictly better (from the incumbent's point of view) that product-specific two-part tariffs.

Therefore

$$\pi_I(FLF) \geq \pi_I(A) \Leftrightarrow \pi^M(c_E, c) + \pi^M(c_I, c_E) \leq 2\pi^M(c_I, c) \Leftrightarrow \Delta(c_E) \leq 0.$$

The left hand term of the inequality is a decreasing function of the entrant's cost c_E. Moreover, this inequality is not satisfied for $c_E = c$ $\left(\pi^M(c,c) \geq \pi^M(c_I, c)\right)$, but is satisfied for $c_E = c_I$ $\left(\pi^M(c_I, c_I) \leq \pi^M(c_I, c)\right)$. ■

The existence of a comprehensive portfolio of brands (for example following a merger between the incumbent and one of the competitive producers) creates incentives for full-line forcing and allows the holder of such portfolio to strategically deter entry to maintain its monopoly position on the highly profitable market.

The portfolio of brands creates incentives for tying, as this helps the incumbent to reduce the retailer's rent in the same spirit as Shaffer (1991). Full-line forcing eliminates the retailer's capacity to select the products it resells thereby eliminating such rents. In the absence of any entry threat (i.e. no potential entrant), the monopolist I has no incentives to produce the low-demand good as it cannot extend its monopoly power on this market. Potential entry slightly modifies the analysis. It is now necessary to consider the interactions between the incumbent, the entrant and the retailer, the role of the competitive fringe being limited. The relevant outside option to be considered is now the joint profit that the entrant and the retailer could make in the absence of the incumbent, that is, $\pi^M(\emptyset, c_E) + \pi^M(c_E, c)$. If the incumbent can force the retailer to buy its complete line of products, it ensures that the retailer only earns this reservation profit only. If it is legally obliged to offer two different tariffs, it has to convince the retailer to sell not only its high-demand good but also its low-demand product instead of the entrant's product. Despite being more efficient than the entrant on the low-demand market (which allows it to deter entry if the entrant's cost is too close from c_I), the retailer's capacity to choose the products it proposes on its shelves is restored and the incumbent has to give up a rent to ensure that the retailer sells its generic product. Tying eliminates this rent thereby restoring the incumbent's monopoly power.

Moreover, the portfolio of brand allows the incumbent to deter entry and maintain its monopoly. When it only produces the high-demand good, the incumbent cannot deter entry, because the retailer always has incentives to resell the entrant's product (at least an infinitesimal quantity) in order to increase its second period profit. Tying reinforces the incumbent's bargaining position. If the retailer decides to reject the incumbent's offer, it forsakes the opportunity of proposing the high-demand product on its shelves. If the entrant is sufficiently efficient, the pair entrant-retailer has a lot to gain in the second period by selling the entrant's good on the low-demand market in the first period. The extra profit can then compensate for the absence of a high-demand product during the first period. In that case, it is too expensive for the incumbent to deter entry. But if the entrant's production cost is large enough, the benefit to the retailer is low in the second period and entry deterrence is therefore not very costly. It is thus a profitable strategy since the second period gain (the incumbent maintains its monopoly position) compensates for the cost of deterrence. The incumbent therefore decides to force the retailer to sell its complete line of products.

6 Welfare Analysis

Let us now analyze the effects of the comprehensive portfolio on the social welfare. The only relevant the incumbent actually uses its new bargaining power and ties the sales of the two products to protect its monopoly position. This happens only when the entrant is not efficient enough, more precisely when entry would not increase the profit of the industry. The "portfolio effect" on the total profits is thus positive.

For the consumers, the effect is however ambiguous. If entry does not occur because of full-line forcing, the impact on consumers' surplus is positive in the first period. The low-product good is indeed produced by the incumbent at lower cost than the entrant's production cost, and retail prices are therefore lower ($p_{\mathsf{H}}^{\mathsf{M}}(c_{\mathsf{I}}, c)$ and $p_{\mathsf{L}}^{\mathsf{M}}(c_{\mathsf{I}}, c)$, instead of $p_{\mathsf{H}}^{\mathsf{M}}(c_{\mathsf{I}}, c_{\mathsf{E}})$ and $p_{\mathsf{L}}^{\mathsf{M}}(c_{\mathsf{I}}, c_{\mathsf{E}})$). In the second period, the incumbent maintains its monopoly position on the high-demand market, and the effect on consumer surplus is therefore negative: prices stay at a higher level ($p_{\mathsf{H}}^{\mathsf{M}}(c_{\mathsf{I}}, c)$ and $p_{\mathsf{L}}^{\mathsf{M}}(c_{\mathsf{I}}, c)$) than if entry had occurred ($p_{\mathsf{H}}^{\mathsf{M}}(c_{\mathsf{E}}, c)$ and $p_{\mathsf{L}}^{\mathsf{M}}(c_{\mathsf{E}}, c)$). The global effect is thus ambiguous. This effect would be positive for very low values of c_{E}: in this case, the first period negative effect is almost null. However, this is exactly when the incumbent does not find it profitable to produce the low-demand good and to use its portfolio power. The total effect on inter-temporal consumer surplus decreases when c_{E}, and it is thus impossible to draw general conclusions when c_{E} is higher to $c_{\mathsf{E}}^{\mathsf{M}}$.

It is nevertheless possible to determine this sign of the effect for specific functional forms of the demand functions. If, for example, demands are linear, consumers' surplus is indeed equal to half of the monopoly profit. The incumbent produces both goods and ties their sales in order to exclude the competitor if and only if entry is not profitable from the perspective of the aggregate monopoly profit. In that case, the existence of a portfolio of brands and foreclosure lead to higher monopoly profits and therefore to higher consumers' surplus. Tying is profitable for the incumbent only if it is socially profitable.

An other case, is when the two markets are completely independent, that is, when the demand in one market depends only on the price of that product. In this case the "monopoly" profit $\pi^{\mathsf{M}}(w_{\mathsf{H}}, w_{\mathsf{L}})$ is simply the sum of the "monopoly" profits for each of the two markets, that is,

$$\pi^{\mathsf{M}}(w_{\mathsf{H}}, w_{\mathsf{L}}) = \pi_{\mathsf{H}}^{\mathsf{M}}(w_{\mathsf{H}}) + \pi_{\mathsf{L}}^{\mathsf{M}}(w_{\mathsf{L}}).$$

Using these notations, we can reconsider our previous analysis: entry is not efficient, and "portfolio power" thus occurs when

$$\pi_{\mathsf{H}}^{\mathsf{M}}(c_{\mathsf{E}}) - \pi_{\mathsf{H}}^{\mathsf{M}}(c_{\mathsf{I}}) \leq \pi_{\mathsf{L}}^{\mathsf{M}}(c) - \pi_{\mathsf{L}}^{\mathsf{M}}(c_{\mathsf{E}}),$$

that is when the benefits of entry on the high-demand market (in the second period) are lower than the loss on the low-demand market. The effect on consumer surplus can also be decomposed in two parts: the effect on market H and the effect on market L. The total impact of "portfolio power on the consumers is thus:

$$\Delta CS = \left(CS_{\mathsf{L}}^{\mathsf{M}}(c) - CS_{\mathsf{L}}^{\mathsf{M}}(c_{\mathsf{E}})\right) - \left(CS_{\mathsf{H}}^{\mathsf{M}}(c_{\mathsf{E}}) - CS_{\mathsf{H}}^{\mathsf{M}}(c_{\mathsf{I}})\right).$$

It is in general impossible to conclude, but if the demand functions on each market are iso-elastic (and we denote by ε_{H} and ε_{L} the elasticities on market H and L respectively), we can show that

$$CS_{\mathsf{H}}^{\mathsf{M}}(w_{\mathsf{H}}) = \frac{\varepsilon_{\mathsf{H}}}{\varepsilon_{\mathsf{H}} - 1}\pi_{\mathsf{H}}^{\mathsf{M}}(w_{\mathsf{H}}) \text{ and } CS_{\mathsf{L}}^{\mathsf{M}}(w_{\mathsf{L}}) = \frac{\varepsilon_{\mathsf{L}}}{\varepsilon_{\mathsf{L}} - 1}\pi_{\mathsf{L}}^{\mathsf{M}}(w_{\mathsf{L}}).$$

Therefore, the effect of "portfolio power"on consumers can be rewritten:

$$\Delta CS = \frac{\varepsilon_{\mathsf{L}}}{\varepsilon_{\mathsf{L}} - 1}\left(\pi_{\mathsf{L}}^{\mathsf{M}}(c) - \pi_{\mathsf{L}}^{\mathsf{M}}(c_{\mathsf{E}})\right) - \frac{\varepsilon_{\mathsf{H}}}{\varepsilon_{\mathsf{H}} - 1}\left(\pi_{\mathsf{H}}^{\mathsf{M}}(c_{\mathsf{E}}) - \pi_{\mathsf{H}}^{\mathsf{M}}(c_{\mathsf{I}})\right).$$

This shows that the effect can be either positive or negative depending on the relative sizes of the price elasticities of demand on the two markets. In particular, it is more likely to be negative (resp. positive) when the demand on the high-demand market is relatively more elastic than the demand on the low-demand market.

7 Concluding Remarks

This paper has shown that full-line forcing can be used in order to maintain the monopoly power on the primary market. The idea is that a incumbent monopolist can try to be active in a different but related market (substitutable goods) in order to avoid entry in this related market. The objective is not to extend its monopoly to this secondary market, but to make sure that a more efficient entrant will not have access to its monopolized and highly profitable market in the future. Although our framework is different since firms have to sell their goods through a monopolized retail sector and thus do not directly compete for consumers, our results can been seen as an extension to Carlton and Waldman (2002) to the case of imperfectly substitutable goods.

Although our analysis do not allows us to conclude that "portfolio power" is always harmful for the consumers in our context, we think that the results raise an important question in merger control. The welfare analysis of portfolio effects shows that the impact on consumer surplus can be either positive or negative demand on the specific form of the demand functions. Moreover, even when the two markets are independent, the effect can still be either positive or negative depending the relative sizes of the price elasticities of demand. This suggests that the analysis of conglomerate mergers cannot be limited to the computation of the different market shares or the Herfindhal index (and thus to the definition of the product and geographic markets).

An important feature of our model is the structure of the retail market. Since this market is monopolized, the unique retailer plays an important role in preventing the incumbent manufacturer to use its portfolio in order to prevent efficient entry. The existence of buyer power makes it therefore less likely for the "portfolio power" to have a negative impact on consumer surplus. The results would probably be slightly different if the retail market was to be more competitive. Let us for think of what is likely to happen if the producers compete directly for consumers. In this case, a portfolio of product could be used to make "predation" more efficient. The incumbent manufacturer can use its two prices to make it impossible for the entrant to access the low demand market in the first place: by selling at a very low price on this low demand market, it imposes to the entrant to make huge losses in the first period. If the entrant is not efficient enough, these losses would easily be larger than the potential second period benefits. Although, the welfare effect are not clear (we have again a positive effect in the first period due to the predatory behaviour), the "portfolio power" effect seems much more likely to be negative. This suggests that the potential for anti-competitive practices after the merger (between the incumbent and a low-demand product manufacturer) strongly depends on the existence of some buyer power. This seems to be in line with some of the European Commission's conclusions in the *GMG* case.

Providing an exhaustive analysis of the validity of the "portfolio effect" theory was far beyond the scope of this paper. We believe however, that it provides a useful counter-argument to the view that this theory cannot have any economic foundations, and that, although tying might have anti-competitive effects, it cannot be profitably used in equilibrium. We think that our results confirm that "portfolio power" may arise and have harmful effects for the consumers and should therefore be analyzed in detail when it appears to be necessary. However, this theory has to be handled with care by the competition authorities since the effects might also be positive for both the firms and the consumers.

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A Proof of Lemma 3

In order to deter entry, the producer I has to ensure that the retailer is never willing to sell even an infinitesimal quantity of the entrant's product on the low-demand market, even if the entrant is ready to give its technology to the retailer for free (or alternatively is ready to sell its good at marginal cost in the two periods). Only one option is available: the producer I has to convince the retailer to distribute its product and the competitive fringe's low-demand product. The other two alternatives are indeed impossible to realize; they involve convincing the retailer to distribute only:

- its product H : the retailer would always prefer to sell an infinitesimal quantity of the entrant's product as this does not affect its first period profit $\left(\pi^{\mathsf{M}}(w_{\mathsf{I}}, \emptyset) - F_{\mathsf{I}}\right)$ but strictly increases its future profit ($\pi^{\mathsf{M}}(c_{\mathsf{E}}, c)$ au lieu de $\pi^{\mathsf{M}}(\emptyset, c)$).
- the competitive fringe's product: this would violate assumption (H_2).

If the retailer distributes the incumbent's and the competitive fringe's products, its total profit is:

$$\pi(I + CF) = \pi^{\mathsf{M}}(w_{\mathsf{I}}, c) - F_{\mathsf{I}} + \pi^{\mathsf{M}}(\emptyset, c).$$

If it tries to distribute a strictly positive quantity of the entrant's product; it resell either an infinitesimal quantity, or $q_{\mathsf{L}}^{\mathsf{M}}(w_{\mathsf{I}}, c_{\mathsf{E}})$. Its profit is then :

$$\begin{aligned} \text{either} \quad &: \quad \pi\left(I + E, q_{\mathsf{L}}^1 = 0^+\right) = \pi^{\mathsf{M}}(w_{\mathsf{I}}, \emptyset) - F_{\mathsf{I}} + \pi^{\mathsf{M}}(c_{\mathsf{E}}, c); \\ \text{or} \quad &: \quad \pi\left(I + E, q_{\mathsf{L}}^1 = q_{\mathsf{L}}^{\mathsf{M}}\right) = \pi^{\mathsf{M}}(w_{\mathsf{I}}, c_{\mathsf{E}}) - F_{\mathsf{I}} + \pi^{\mathsf{M}}(c_{\mathsf{E}}, c). \end{aligned}$$

The incumbent can therefore deter entry only if:

$$\pi^{\mathsf{M}}(w_{\mathsf{I}}, c) - \pi^{\mathsf{M}}(w_{\mathsf{I}}, \emptyset) \geq \pi^{\mathsf{M}}(\emptyset, c) + \pi^{\mathsf{M}}(c_{\mathsf{E}}, c) \tag{1}$$

$$\text{and } \pi^{\mathsf{M}}(w_{\mathsf{I}}, c) - \pi^{\mathsf{M}}(w_{\mathsf{I}}, c_{\mathsf{E}}) \geq \pi^{\mathsf{M}}(\emptyset, c) + \pi^{\mathsf{M}}(c_{\mathsf{E}}, c). \tag{2}$$

However, using the envelop theorem, we have:

$$\frac{\partial \pi^{\mathsf{M}}(w_{\mathsf{H}}, w_{\mathsf{L}})}{\partial w_{\mathsf{H}}} = -q_{\mathsf{H}}^{\mathsf{M}}(w_{\mathsf{H}}, w_{\mathsf{L}}).$$

This imply that the the left-hand terms of the two equations (1) and (2) are increasing functions of w_{I}. The two conditions are therefore satisfied if and only if:

$$\pi^{\mathsf{M}}(\emptyset, c_{\mathsf{E}}) + \pi^{\mathsf{M}}(c_{\mathsf{E}}, c) \leq 2\pi^{\mathsf{M}}(\emptyset, c),$$

and this would contradict the assumption (H_2).

B Proof of Proposition 4

The fixed fees F_{I} and F_{E} have to satisfy the following constraints:

$$\begin{aligned} \pi^{\mathsf{M}}(c_{\mathsf{I}}, c_{\mathsf{E}}) - F_{\mathsf{I}} - F_{\mathsf{E}} + \pi^2_{\mathsf{D}}(E) &\geq \pi^{\mathsf{M}}(\emptyset, c) + \pi^2_{\mathsf{D}}(F) \quad (3) \\ ... &\geq \pi^{\mathsf{M}}(c_{\mathsf{I}}, c) - F_{\mathsf{I}} + \pi^2_{\mathsf{D}}(F) \quad (4) \\ ... &\geq \pi^{\mathsf{M}}(\emptyset, c_{\mathsf{E}}) - F_{\mathsf{E}} + \pi^2_{\mathsf{D}}(E) \quad (5) \end{aligned}$$

Conditions (4) and (5) determine the maximum franchises the producers can charge. We thus have:

$$F_{\mathsf{I}} \leq \pi^{\mathsf{M}}(c_{\mathsf{I}}, c_{\mathsf{E}}) - \pi^{\mathsf{M}}(\emptyset, c_{\mathsf{E}}) \text{ and } F_{\mathsf{E}} \leq \pi^{\mathsf{M}}(c_{\mathsf{I}}, c_{\mathsf{E}}) - \pi^{\mathsf{M}}(\emptyset, c).$$

In both cases, the maximum fee is equal to the additional surplus (cumulated over the two periods) generated by the product. If these two constraints are satisfied, the third condition (3) is satisfied if and only if:

$$\pi^{\mathsf{M}}(c_{\mathsf{I}}, c_{\mathsf{E}}) - \pi^{\mathsf{M}}(\emptyset, c_{\mathsf{E}}) \leq \pi^{\mathsf{M}}(c_{\mathsf{I}}, c) - \pi^{\mathsf{M}}(\emptyset, c). \quad (6)$$

However, using the envelop theorem, we have (for any w_{H} including $w_{\mathsf{H}} = \emptyset$) :

$$\frac{\partial \pi^{\mathsf{M}}(w_{\mathsf{H}}, w_{\mathsf{L}})}{\partial w_{\mathsf{L}}} = -q^{\mathsf{M}}_{\mathsf{L}}(w_{\mathsf{H}}, w_{\mathsf{L}}).$$

Since c_{E} is larger than c, (6) cannot be satisfied and (3) is therefore binding.The franchise fees must then satisfy the following three conditions:

$$\begin{aligned} F_{\mathsf{I}} + F_{\mathsf{E}} &= \pi^{\mathsf{M}}(c_{\mathsf{I}}, c_{\mathsf{E}}) + \pi^{\mathsf{M}}(c_{\mathsf{I}}, c) - 2\pi^{\mathsf{M}}(\emptyset, c) \quad (7) \\ F_{\mathsf{I}} &\leq \pi^{\mathsf{M}}(c_{\mathsf{I}}, c_{\mathsf{E}}) - \pi^{\mathsf{M}}(\emptyset, c_{\mathsf{E}}) \quad (8) \\ F_{\mathsf{E}} &\leq \pi^{\mathsf{M}}(c_{\mathsf{I}}, c_{\mathsf{E}}) - \pi^{\mathsf{M}}(\emptyset, c) \quad (9) \end{aligned}$$

The incumbent makes the first offer and can therefore set its franchise fee such that the constraint (8) is binding. The entrant then sets its fee in order to satisfy the condition (7).

C Product-specific Two-part Tariffs

In this section, we show that the incumbent cannot replicate the profit $\pi_{\mathsf{I}}(FLF)$ (proposition 5) if it cannot tie the sales of the two products.[16] In order to get $\pi_{\mathsf{I}}(FLF)$ with

[16]Notice that this section is relevant only if full-line forcing occurs, that is if $c_{\mathsf{E}} > c^{\mathsf{M}}_{\mathsf{E}}$.

two product-specific two-part tariffs, the incumbent has set wholesale prices equal to its marginal production costs ($w_{\mathsf{H}} = c_{\mathsf{I}}$ and $w_{\mathsf{L}} = c$) in order to ensure that the retailer will then maximize the industry profit, and set franchise fees such that:

$$F_{\mathsf{H}} + F_{\mathsf{L}} = F_{\mathsf{HL}}(FLF) = \pi^{\mathsf{M}}(c_{\mathsf{I}}, c) + \pi^{\mathsf{M}}(\emptyset, c) - \pi^{\mathsf{M}}(\emptyset, c_{\mathsf{E}}) - \pi^{\mathsf{M}}(c_{\mathsf{E}}, c).$$

Moreover, the franchise fees must be set in order to ensure that the retailer accepts both offers, even though the entrant is willing to give up its technology (or makes the offer $w_{\mathsf{E}} = c_{\mathsf{E}}$ and $F_{\mathsf{E}} = -\pi^2_{\mathsf{E}}(E)$). The following three constraints must therefore be satisfied:

$$\begin{aligned} \pi^{\mathsf{M}}(c_{\mathsf{I}}, c) - F_{\mathsf{H}} - F_{\mathsf{L}} + \pi^{\mathsf{M}}(\emptyset, c) &= \pi^{\mathsf{M}}(\emptyset, c_{\mathsf{E}}) + \pi^{\mathsf{M}}(c_{\mathsf{E}}, c) & (10) \\ &\geq \pi^{\mathsf{M}}(c_{\mathsf{I}}, c_{\mathsf{E}}) - F_{\mathsf{H}} + \pi^{\mathsf{M}}(c_{\mathsf{E}}, c) & (11) \\ &\geq \pi^{\mathsf{M}}(\emptyset, c) - F_{\mathsf{L}} + \pi^{\mathsf{M}}(\emptyset, c) & (12) \end{aligned}$$

Condition (10) guarantees that the retailer accepts both offers rather than only the entrant's offer. Constraint (12) ensures that the retailer prefers to resell both the incumbent's products rather than just the incumbent's low-demand product, whilst condition (11) ensures that it does not prefer to only resell the high-demand product. Conditions (10), (11) and (12) define constraints on the franchise fees:

$$\begin{aligned} F_{\mathsf{H}} &\leq \pi^{\mathsf{M}}(c_{\mathsf{I}}, c) - \pi^{\mathsf{M}}(\emptyset, c); \\ F_{\mathsf{L}} &\leq \pi^{\mathsf{M}}(c_{\mathsf{I}}, c) + \pi^{\mathsf{M}}(\emptyset, c) - \pi^{\mathsf{M}}(c_{\mathsf{I}}, c_{\mathsf{E}}) - \pi^{\mathsf{M}}(c_{\mathsf{E}}, c); \\ F_{\mathsf{H}} + F_{\mathsf{L}} &= \pi^{\mathsf{M}}(c_{\mathsf{I}}, c) + \pi^{\mathsf{M}}(\emptyset, c) - \pi^{\mathsf{M}}(\emptyset, c_{\mathsf{E}}) - \pi^{\mathsf{M}}(c_{\mathsf{E}}, c). \end{aligned}$$

which imply:

$$\begin{aligned} F_{\mathsf{H}} + F_{\mathsf{L}} &\leq 2\pi^{\mathsf{M}}(c_{\mathsf{I}}, c) - \pi^{\mathsf{M}}(c_{\mathsf{I}}, c_{\mathsf{E}}) - \pi^{\mathsf{M}}(c_{\mathsf{E}}, c); \\ \text{and } F_{\mathsf{H}} + F_{\mathsf{L}} &= \pi^{\mathsf{M}}(c_{\mathsf{I}}, c) + \pi^{\mathsf{M}}(\emptyset, c) - \pi^{\mathsf{M}}(\emptyset, c_{\mathsf{E}}) - \pi^{\mathsf{M}}(c_{\mathsf{E}}, c). \end{aligned}$$

These two conditions are simultaneously satisfied only if:

$$\pi^{\mathsf{M}}(c_{\mathsf{I}}, c) - \pi^{\mathsf{M}}(\emptyset, c) \geq \pi^{\mathsf{M}}(c_{\mathsf{I}}, c_{\mathsf{E}}) - \pi^{\mathsf{M}}(\emptyset, c_{\mathsf{E}}) \Leftrightarrow c_{\mathsf{E}} \leq c.$$

This shows that, with product-specific two-part tariffs, the incumbent can never obtain the same profit as it can with full-line forcing.