

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 centre of a fierce international row with the US authorities. A number of parties have claimed this theory has no economic foundations.

We show in this paper that the acquisition of a comprehensive portfolio of brands is likely to lead to full-line forcing with a view to deter entry in the long-term. However, due to buyer power on the retail market, this will happen only if entry would not increase the collusive profit.

The effects on consumer welfare are however ambiguous, but we can show that there exists situations for which “portfolio effects” harm the consumers.

Keywords: full-line forcing, entry deterrence, predatory pricing

JEL Classification: L13, L42

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1 Introduction

The European Commission's decision in July 2001 to prohibit the proposed merger between *General Electric* and *Honeywell*¹ has been the starting point of the fierce debate between the European and the U.S. competition authorities on the theory of "portfolio power" or "range effects" in conglomerate mergers.

This "portfolio power" approach has first been introduced in 1996-97 by the European Commission in three major merger cases.² 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*) 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 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.

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 it 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,*

¹See Giotakos et al. (2001) for a detailed presentation of the *GE / Honeywell* decision.

²*Coca-Cola / Amalgamated Beverages* (case IV/M.796), *Coca-Cola / Carlsberg* (case IV/M.833) and *Guinness / Grand Metropolitan* (case IV/M.938).

³We will discuss in greater details the *GMG* case in the last section of the paper. 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.

⁴See OECD (2002).

efficiency-enhancing mergers.” In its competition memo on the *GMG* case, Lexecon (1998) show the same scepticism: *“In its current form, the portfolio power approach is made up of a number of disparate ideas which are not supported by a unifying economic theory.”*

It has to be acknowledged, that although there exists a thorough literature on the effects of tying and bundling of complementary products, the economic theory of “portfolio power” in the case of portfolio of substitutable products (such as in *GMG*) is fairly limited. Rabassa (1999) is to our knowledge the first and only attempt: she shows that when quality is a short run decision variable and therefore producers are able to modify the quality of their products after a merger, mergers increase the breath of the portfolio may have anti-competitive effects. 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, her analysis is limited to the case of producers directly selling their products to final consumers, whereas the “portfolio theory” has usually be applied to situations in which manufacturers sell their ranges of products through retailers rather than to final consumers who might be interested to buy one of the products only.

This paper does not try to provide a unifying economic theory of “portfolio effects” but attempts to offer a new insight (and wants to “add a stone to the creation” of this unified theory). The objective of this paper is to show that a firm may acquire a comprehensive range of products (even if the addition to the original portfolio does not seem interesting in the short-term) with the view to impose to the retailer to buy its complete range of products in order to deter entry. The idea is that a firm that enjoys monopoly power on one market may want to “invade” the retailer’s shelves in order to ensure that entry on the monopolized market cannot occur because consumers never have any opportunity to discover new brands. As we will show this strategy is best implemented when the firm can offer the full range of product and impose vertical restraints (full-line forcing in our case).

This paper relates more or less closely to three strands of literature. Firstly, the model we propose is closely inspired by Shaffer (1991) and Vergé (2001). Shaffer (1991) provides a first attempt to analyze full-line forcing in a vertical relationship between a multi-product monopolist and a unique retailer. He shows that the upstream monopolist will have incentives to sell the two products under a unique contract (full-line forcing) in order to eliminate the rent that the retailer can obtain due to its ability to select the products it carries. Vergé (2001) shows that in Shaffer’s setting full-line forcing has also a positive impact on consumer surplus because it reduces price distortions. In this model, we will introduce perfect competition on the tied market. This ensures that the retailer’s rent is now fixed and we therefero eliminate any incentives to for the tying -market monopolist to produce both goods. There would therefore be no incentives in our setting to hold a comprehensive

portfolio of brand and to tie their sales if there was no threat of entry. We will then show how these incentives can be modified if an entrant can threatened the incumbent's monopoly power.

Our analysis is also related to the dynamic leverage theory. Following a long (and still ongoing) debate on the credibility of the leverage theory of tying,⁵ a strand of literature mostly inspired by the Microsoft case has developed on the dynamic effects of tying (dynamic leveraging). The idea is that a firm which has monopoly power on one market may want to reduce competition on a 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.⁶ 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 in 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 prevent entry in the "tied" market in order to maintain its monopoly position. Our model however departs from the standard literature on tying / bundling in that we consider imperfectly substitutable goods that can be consumed in variable proportions.

Finally, this paper could also be related to the literature on entry deterrence. The idea is that the holder of a comprehensive portfolio of brands will use that portfolio to impose *barriers to entry* through full-line forcing. By "flooding" the retailer's shelves, the incumbent will make it impossible for the entrant to have to the consumers.⁷ Although the idea is that established brand owner have a substantial advantage on the producer of a new brand who needs to acquire a reputation, our model is however different from the advertising models such as Schmalensee (1982) or from limit pricing models such as Milgrom and Roberts (1982)

⁵See Whinston (1990) for an extensive presentation of the debate.

⁶Using a similar framework, Choi and Stefanidis (2001) shows that tying reduces the incentives for innovation thereby protecting the monopolist position. The main idea is that if the incumbent ties the sales of the two complementary goods, a new comer now need to successfully enter both market.

⁷Our model differs from Schmalensee (1978) in that the incumbent "floods" the market by increasing the quantity rather than the number of brands it sells.

in the sense that everybody (including the firms) is uncertain about the chances of success of a new comer and there is no room for signalling.⁸ Entry deterrence in our model will be achieved through the contract offered by the incumbent to the retailer. Although it is similar to what happens in Aghion and Bolton (1987), it does not occur because of the uncertainty but because full-line forcing makes entry more costly. However, the intuition is similar in that entry cannot always be deterred because the incumbent needs to compensate the retailer because it would benefit from entry.

The paper is organized as follows: in section 2, we present the features of our dynamic model with threat of entry. Once we have analyzed the possible second period equilibria (section 3), we analyze the rationale for full-line forcing and the role of a comprehensive portfolio of products (section 4). In particular we show that this portfolio of products can be used to deter entry (through the use of vertical restraints) and this may happen to the detriment of the consumers. We then discuss the robustness of the analysis suggesting how our modelling assumptions could be relaxed (section 5). Finally, section 6 presents some implications of the model for competition authorities and concludes.

2 The Model

2.1 Goods and Consumers

We consider an economy in which two imperfectly substitutable varieties of a good are available. We further assume that the two varieties are vertically differentiated and we will hereafter denote them H and L and refer to them as the high-value and low-value varieties respectively.⁹ The inverse demand functions are denoted $P_H(q_H, q_L)$ and $P_L(q_H, q_L)$, and given that the two varieties are imperfect substitutes, these functions are decreasing in both q_H and q_L .

Let us denote by $\pi(q_H, q_L; w_H, w_L)$ the profit that a monopolist producing the two varieties at constant marginal costs w_H and w_L would realize if it sells quantities q_H and q_L , that is:

$$\pi(q_H, q_L; w_H, w_L) = (P_H(q_H, q_L) - w_H)q_H + (P_L(q_H, q_L) - w_L)q_L.$$

We assume that, for any value of w_H and w_L , this profit function is strictly concave in (q_H, q_L) and reaches its maximum for a unique pair of quantities, $q_H^M(w_H, w_L)$ and $q_L^M(w_H, w_L)$. We

⁸See Vickers (1985) for a comprehensive presentation of the different theories of entry deterrence under uncertainty and asymmetric information.

⁹Vertically differentiation is assumed for exposition purposes only. The value of a product can for example be related to its intrinsic or perceived quality.

also denote by $p_H^M(w_H, w_L)$ and $p_L^M(w_H, w_L)$ the corresponding prices, and by $\pi^M(w_H, w_L)$ the profit made by that hypothetical monopolist. Due to the concavity assumption, q_i^M ($i = H, L$) is decreasing in w_i and increasing in w_j ($j \neq i$), whereas the profit $\pi^M(w_H, w_L)$ is a decreasing function of w_H and w_L .

If the production cost of one variety (let say w_L) is too high, or if the producer cannot propose it, it maximizes

$$\pi(q_H, 0; w_H, w_L) = (P_H(q_H, 0) - w_H)q_H.$$

Under our assumption, this is a concave function of q_H and we continue to assume that it reaches its maximum for a unique value of q_H . We will denote by $q_H^M(w_H, \emptyset)$ this optimal quantity, by $p_H^M(w_H, \emptyset)$ the price at which it is sold and by $\pi_H^M(w_H, \emptyset)$ the corresponding profit. $q_L^M(\emptyset, w_L)$, $p_L^M(\emptyset, w_L)$ and $\pi_L^M(\emptyset, w_L)$ are defined in a similar way.¹⁰

We moreover assume that the inverse demand functions are such that the prices $p_H^M(w_H, w_L)$ and $p_L^M(w_H, w_L)$ are increasing function of w_H and w_L .¹¹

2.2 Firms

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

- **Competitive Producers (“Fringe”)**

Perfectly substitutable manufacturers produce the low-quality variety (L) at marginal cost c .

- **Incumbent (I)**

The incumbent manufacturer I produces a high-quality variety (H) at marginal $c_I > c$. It is assumed that it is more costly to produce quality H because it involves either more sophisticated ingredients or more costly packaging or advertising.

The incumbent manufacturer can also acquire the technology to produce the low-value variety (L) at zero cost. One such possibility is to merge with a competitive manufacturer. We thus assume that the incumbent then produces that variety at marginal cost c .

- **Entrant (E)**

Manufacturer E produces a “new” brand at marginal cost $c \leq c_E \leq c_I$. We describe the entrant product’s type and the entry process in the next subsection.

¹⁰Notice that in these cases we have: $q_L^M(w_H, \emptyset) = q_H^M(\emptyset, w_L) = 0$ and the prices $p_H^M(w_H, \emptyset)$ and $p_L^M(\emptyset, w_L)$ are irrelevant.

¹¹The 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).

The producers do not have direct access to the final consumers and have to sell their products through a monopolist retailer.¹² Marginal distribution costs are assumed to be constant and we will, without loss of generality, normalize them to 0. In addition, we consider that shelf space is a scarce resource and assume that the retailer can carry at most two different products.¹³ The manufacturer thus have to compete in order to gain access to this essential facility. There seem to be some evidence that access to retailers' shelves is a crucial issue for most manufacturers who usually have to pay large slotting allowances to ensure that retailers will consider selling their products.¹⁴ We can see several justifications for this specific constraint on the number of products proposed by a retailer: firstly, if there is a fixed cost to carry a product in the shelves, the number of products that a retailer chooses to carry will necessarily be limited. This will for example be the case if proposing a product in the shelves is associated with some "marketing" activities that are independent of the number of units actually sold.¹⁵ A similar interpretation in terms of opportunity costs was suggested in Shaffer (1991). We could also imagine that a product will be attractive to consumers only if it is put in evidence in the shelves. This means that a product would be "visible" (or catch the consumers eyes) only if a sufficiently large quantity of the product is presented in the shelves. This in turn implies that the number of products that a retailer can carry is limited.¹⁶

2.3 Timing

We analyze a two-period game in which the sequence of events is identical for both periods. The two periods however differ with respect to the existing competition on the market for each variety of the good. We will first present the sequence of offers common to both periods

¹²The assumption that there exists only one retailer might seem restrictive. It is however commonly observed that the food retailing sector is fairly concentrated in Europe (see Dobson Consulting (1999)). It would thus be interesting to extend the model to an oligopolistic retail sector, but this would significantly complicate the analysis given that different retailers would then be able to offer different lines of products (see for example Champsaur and Rochet (1989) or Gilbert and Matutes (1993) for such issues in models without the threat of entry). Considering a monopolized sector is therefore a way to keep the analysis simple while allowing for buyer power.

¹³In what follows, we will call *product* a combination of a *quality* (H or L) and a *brand name* (manufacturer). From the point of view of the consumers two products of the same quality (therefore produced by two different manufacturers) are perfectly substitutable.

¹⁴See Dobson Consulting (1999) for a comprehensive analysis of the food retailing industry in the European Union.

¹⁵We can for example think of advertising or in-store promotional activities to increase the visibility of the product.

¹⁶Notice that if the contracts signed with the manufacturers include buy-back guarantee this assumption simply limits the number of products proposed in the shelves but does not require to actually pay for a minimum number of units.

and then describe the market structure (i.e. the entry process) in each period.

For the sake of simplicity, we will assume that the two periods carry equal weight, that is, there is no discounting.

2.3.1 Sequence of Offers

The sequence of the events is the same for both periods:

- (a) The incumbent producer I makes take-it-or-leave-it offers to the retailer.
- (b) The entrant E and the competitive producers make take-it-or-leave-it offers to the retailer.¹⁷
- (c) The retailer accepts or rejects each offer. For each product it has accepted to carry, it then decides the quantity to be sold on the retail market and relevant contracts are enforced.

Each offer made by the entrant or by a competitive producer 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 .¹⁸

The incumbent can decide to sell the high-value variety only or to sell both varieties (if its technology allows it to do so). If it offers the variety H only, the offer is then a two-part tariff (w_H, F_H) . If it sells both varieties, the incumbent can either sell the two products separately and thus offers two variety-specific two-part tariffs $((w_L, F_L)$ and $(w_H, F_H))$, or sell them under a unique contract (w_H, w_L, F_{HL}) consisting of a unique fixed fee and a per unit wholesale price for each product (full-line forcing).

All offers are publicly observable.

2.3.2 Entry Process

The good we consider is an experience, in the sense the consumer do not know the value of a product if they have not tested in some way. Consumers are assumed to be extremely risk-averse when they try a new product and to have a strong bias against new comers. One justification for this bias can be the following: a large number of firms can acquire the technology to produce a low-value brand, but only the incumbent firm has yet managed to acquire a good reputation on the market. Consumers will then be extremely cautious when a

¹⁷Assuming that offers are made simultaneously would lead to multiple equilibria, and our equilibrium would then correspond to the most favourable equilibrium for the incumbent. Selecting any other equilibrium would simply reinforce the “portfolio effect” presented in the next sections.

¹⁸We allow for negative franchise fees in which case the producer pays to have its product in the retailer’s shelves (“slotting allowance”).

new firm enters the market. The actual “type” (or variety) of the product can be discovered through consumption but can also be spread around by word of mouth or by consumer associations (as long as people “spreading the news” - word of mouth or associations - have tested the product).

When the entrant’s product is introduced nobody is able to tell whether it is likely to be a success or not. However, the firms (all manufacturers and the retailer) know with which probability this product will be success. Nobody knows the “actual” variety of the entrant’s product before the end of the first period (when uncertainty is resolved). It is therefore impossible for the firms to signal the type to consumers who can only discover it through consumption or word of mouth. The “entry process” will thus be the following:

- In the first period, consumers are extremely cautious and, if the entrant’s product is present on the retailer’s shelves, they consider it as a perfect substitute for the low-value variety (type L).
- If the product is not present in the shelves during the first period, or if nobody has bought it during this period, nobody has any chance to discover the “actual” type and the entrant’s product will continue to be seen as a low-value product in the second period.
- If the product has been sold in the first period, then consumers who have bought the product “learn” its type. Moreover these consumers can spread the news to all other consumers so that all consumers are now informed. We are assuming here that information can be transmitted through consumers reviews or tests very quickly. This might seem an extreme case, but it can be reasonable to assume that with the rapid expansion of the internet, access to information is now relatively easy. We assume that consumers will like the product with probability p . If consumers like it, entry is said to have been successful and, in the second period, the entrant’s product is a perfect substitute for the incumbent’s high-value variety. Otherwise, entry has failed and the second period is identical to the first period.

We furthermore assume that consumers are myopic.¹⁹

3 Second Period Equilibrium

The second period corresponds to a static situation in which producers are selling their products through a common agent. Competition is nevertheless affected by the type (quality)

¹⁹Some of the assumptions presented in this section might seem very strong. Rather than discussing them at this stage, we made the choice to present the results and the intuitions with this framework and only then discuss the robustness of the results.

of the different products, that is, it depends on whether entry has been successful or not in the first period. We can summarize the situation as follows.

- **If entry has been successful:** the entrant and the incumbent's high-value variety are perfect substitutes. There is then some degree of competition on both markets (low- and high-value).
- **If entry has failed or did not occur:** the incumbent is a monopoly on the high-value market whereas the low-value market is competitive.

In what follows we will assume that the marginal costs and the demand functions satisfy the following conditions:

(H_1) : $\forall c_E \in [c, c_I]$, the quantities $q_H^M(c_E, c)$, $q_L^M(c_E, c)$, $q_H^M(c_I, c_E)$, $q_L^M(c_I, c_E)$ are strictly positive.

These conditions imply that $q_H^M(c_E, \emptyset)$ and $q_L^M(\emptyset, c_E)$ are positive. The first two conditions are relatively natural since they ensure that the varieties are viable whichever manufacturer is producing them. The last two are made for sake of simplicity but are not essential and do not affect the results.

3.1 Entry failed

Assume first that entry has failed or did not even occur (i.e. the entrant's product was not available on the retailer's shelves). The incumbent thus maintains its monopoly position on the market for high-quality and, since the entrant is less efficient than the producers of the fringe for the low-value product ($c_E \geq c$), it will leave the market. This situation is thus very similar to Shaffer (1991) except that the low-value is perfectly competitive.

Everything thus happens as if the retailer were able to produce the low-value variety itself at cost c . It can then decide to reject the wholesale contract offered by the incumbent, sell the low-value product only and secure a profit equal to $\pi^M(\emptyset, c)$.

The incumbent makes a take-it-or-leave-it offer to the retailer to sell its high-value variety and possibly its low-value variety. 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 $\pi^M(\emptyset, c)$. 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:²⁰

²⁰In what follows, the subscripts I , E and R refer to the incumbent, the entrant and the retailer respectively.

Lemma 1 *If entry did not occur or failed, the second period equilibrium is such that the incumbent manufacturer I charges wholesale price(s) equal to the marginal production cost(s) and sets a fixed fee such that the second period profits are:*

$$\pi_I^2(F) = \pi^M(c_I, c) - \pi^M(\emptyset, c), \quad \pi_E^2(F) = 0 \quad \text{and} \quad \pi_R^2(F) = \pi^M(\emptyset, c).$$

Because the low-quality market is perfectly competitive it is pointless for the incumbent to produce such this variety.²¹ Without the threat of entry, the acquisition of a low-quality producer would have no impact on prices and profits.

3.2 Entry was successful

Suppose now entry has occurred and was successful, that is, it was revealed that the entrant's product is of high quality (or value). This product is now a perfect substitute for the incumbent's high-value variety. Moreover, the entrant is more efficient than the incumbent at producing the high-quality and will thus be the only active firm on that market. However 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. The retailer is therefore able to secure a profit equal to $\pi^M(c_I, c)$.²²

The entrant will therefore ensure that the retailer charges the industry maximizing prices (by selling its product at marginal cost) and charge the highest fee such that its product is carried by the retailer. These results are summarized in the following lemma:

Lemma 2 *If entry has been successful, the second period equilibrium is such that the entrant charges a wholesale price equal to its marginal product cost and sets a fixed fee such that the second period profits are:*

$$\pi_I^2(S) = 0, \quad \pi_E^2(S) = \pi^M(c_E, c) - \pi^M(c_I, c) \quad \text{and} \quad \pi_R^2(S) = \pi^M(c_I, c).$$

²¹This allows us to focus on the potential anti-competitive effects in isolation and get rid of the possible welfare improving effects of full-line forcing when used to limit the retailer's ability to select the products it carries (see Vergé (2001)).

²²To be selected by the retailer, the entrant has to make an offer which is attractive even if the incumbent is ready to sell its high-value variety at cost. Notice here that we consider only "cautious equilibria" in which the offer made by the incumbent is such that it would lead to non-negative profit if it was accepted.

4 Portfolio Power and Entry-Deterrence

4.1 Incentives to Deter Entry

Let us first look at the impact of active entry (the entrant's product is actually sold during the first period: $q_E^1 > 0$) on the firms' expected profits. We thus have for any $i = I, E, R$:

$$\Delta\pi_i^2 = p\pi_i^2(S) + (1-p)\pi_i^2(F) - \pi_i^2(F) = p(\pi_i^2(S) - \pi_i^2(F)),$$

that is:

$$\begin{aligned}\Delta\pi_I^2 &= -p(\pi^M(c_I, c) - \pi^M(\emptyset, c)) < 0; \\ \Delta\pi_E^2 &= p(\pi^M(c_E, c) - \pi^M(c_I, c)) > 0; \\ \text{and } \Delta\pi_R^2 &= p(\pi^M(c_I, c) - \pi^M(\emptyset, c)) > 0.\end{aligned}$$

This shows that as long as the cost differential $c_I - c_E$ is not too high, the incumbent I has more to lose than the entrant has to gain.²³ This could create incentives for the incumbent to deter entry. However as we will see, the existence of a monopolist retailer makes it more difficult to achieve (at least profitably) because the retailer also benefits from entry.

4.2 First Period Equilibrium

4.2.1 Equilibrium without Portfolio Power

Let us first assume that the incumbent produces only the high-value variety (H). Because, successful entry introduces competition on the high-value segment and thus increases its second period profit, the retailer has strong incentives to favor entry. The retailer might be tempted to carry the entrant's product rather than one of the competitively produced low-value brands even if this decreases its first period profit. Options for the incumbent are therefore limited:

(i) Either it decides to "accommodate entry" and maximizes its short term profit hoping that entry will not be successful;

(ii) or it distorts its first period profits in order to deter entry and maintain its monopoly position for sure.

In what follows we make the following assumption:

(H_2): $p(\pi^M(c_E, c) - \pi^M(\emptyset, c)) \geq \pi^M(\emptyset, c) - \pi^M(\emptyset, c_E)$. This imposes that either the entrant's cost advantage (relative to the incumbent) is large enough (the right-hand term goes to 0 when c_E goes to c) or that the probability that entry succeeds is high enough.

²³This will always be the case if c_I and c are such that $2\pi^M(c_I, c) > \pi^M(\emptyset, c) + \pi^M(0, c)$.

The following lemma shows that under assumption (H_2) , it will never be possible for the incumbent to deter entry (without portfolio power). This assumption is not essential for the result, but it allows us to focus on the anti-competitive motives for the acquisition of the low-quality variety.

Lemma 3 *If it produces the high-value variety only, the incumbent can never deter entry.*

Proof. See Appendix A. ■

The intuition behind this result is straightforward. Although the entrant is less efficient than the competitive producers (on the low-value segment), the expected increase of joints profits of the pair entrant - retailer compensates any possible first period loss thereby making entry deterrence impossible.

Because the incumbent cannot deter entry, 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. Wholesale prices are therefore set to marginal costs ($w_H = c_I$ and $w_L = c_E$) in order to maximize industry profits, and each retailer sets its franchise fee in order to ensure that the retailer will accept its contract in addition to the competitor's contract. This leads to the following proposition:

Proposition 1 *If the incumbent produces only the high-value variety, the incumbent and the entrant charge wholesale prices equal to their respective marginal production costs (c_I and c_E) and the franchise fees are*

$$F_I = \pi^M(c_I, c_E) - \pi^M(\emptyset, c_E) \text{ and } F_E = \Delta\pi_R^2 - (\pi^M(\emptyset, c) - \pi^M(\emptyset, c_E)).$$

The incumbent's total profit is therefore:

$$\pi_I(L) = \pi^M(c_I, c_E) - \pi^M(\emptyset, c_E) + (1 - p) (\pi^M(c_I, c) - \pi^M(\emptyset, c)).$$

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-value segment) 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, whereas the entrant has to compensate the retailer for the loss incurred in the first period.

4.2.2 Portfolio Power and Full-line Forcing

Assume now that the incumbent produces both varieties. Given that the incumbent is not more efficient than any of the competitive producers on the low-value segment, the only interest of proposing this product is to sell it jointly with the high-value variety and fill the two slots available in the retailer's shelves. It is then straightforward to see that this is best done when the incumbent offers a unique tariff $(w_H, w_L, F_H + F_L)$.²⁴

If the incumbent makes a unique offer, it has to ensure that the retailer is willing to accept it even if the entrant is ready to give its technology to the distributor for free. In this case, under hypothesis (H_2) , the profit the retailer would be guaranteed if it rejects the incumbent's offer is:

$$\underline{\pi}_R = \pi^M(\emptyset, c_E) + \pi^M(\emptyset, c) + p(\pi^M(c_E, c) - \pi^M(\emptyset, c)).$$

Once again, the incumbent can recover the industry profit minus this secured profit $\underline{\pi}_R$ through the franchise fee. It will therefore set wholesale prices equal to its marginal costs, and charge a franchise fee such that

$$\pi^M(c_I, c) - F_{HL} + \pi^M(\emptyset, c) = \pi^M(\emptyset, c_E) + \pi^M(\emptyset, c) + p(\pi^M(c_E, c) - \pi^M(\emptyset, c)),$$

that is,

$$F_{HL} = \pi^M(c_I, c) - \pi^M(\emptyset, c_E) - p(\pi^M(c_E, c) - \pi^M(\emptyset, c)).$$

If the incumbent decides to produce both varieties in order to deter entry, its profit is:

$$\pi_I(H + L) = 2\pi^M(c_I, c) - \pi^M(\emptyset, c_E) - \pi^M(\emptyset, c) + p(\pi^M(c_E, c) - \pi^M(\emptyset, c)).$$

In order to decide whether to force the retailer to buy its complete line of products or to accommodate entry, the incumbent compares $\pi_I(H + L)$ with the profit $\pi_I(L)$ given by proposition 1. This leads to the following proposition:

Proposition 2 *The incumbent decides to produce both varieties in order to deter entry whenever entry would decrease total industry profits, that is, when $c_E \geq \widehat{c}_E$ where $c < \widehat{c}_E < c_I$ is the unique solution of:*

$$\pi^M(c_I, c) - \pi^M(c_I, \widehat{c}_E) = p(\pi^M(\widehat{c}_E, c) - \pi^M(c_I, c)).$$

²⁴The producer can indeed replicate the equilibrium generated with the two contracts (w_H, F_H) and (w_L, F_L) , by offering the unique tariff $(w_H, w_L, F_H + F_L)$. Moreover, as shown by Shaffer (1991), full-line forcing reduces the rent that a multi-product firm needs to leave to the retailer.

Proof. The two profits the incumbent compares are:

$$\begin{aligned}\pi_I(H + L) &= 2\pi^M(c_I, c) - \pi^M(\emptyset, c_E) - \pi^M(c_E, c) \\ \text{and } \pi_I(L) &= \pi^M(c_I, c_E) - \pi^M(\emptyset, c_E).\end{aligned}$$

We thus have:

$$\pi_I(H + L) \geq \pi_I(L) \Leftrightarrow \pi^M(c_I, c) - \pi^M(c_I, c_E) \geq p(\pi^M(c_E, c) - \pi^M(c_I, c)).$$

The left-hand term of the inequality is the short term benefit generated by entry deterrence (because the low-value variety is produced more efficiently by the incumbent than the entrant), and is an increasing function of c_E . The right-hand term is the expected increase in industry profit generated by entry and is a decreasing function of c_E . Moreover, this inequality is not satisfied for $c_E = c$ but is satisfied for $c_E = c_I$. ■

The ownership of a comprehensive portfolio of varieties creates incentives for full-line forcing and allows the holder of such portfolio to strategically deter entry to maintain its monopoly position on the high-quality market.

When it only produces the high-value variety, 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 expected profit. Full-line forcing reinforces the incumbent's bargaining position. In order to sell the entrant's product, the retailer has now to reject the incumbent joint offer. In this case, it forsakes the opportunity of proposing the high-quality variety on its shelves and thus forsakes the associated first period profits. However, if the entrant is sufficiently efficient, the gain from successful entry is large enough to compensate the reduction in short term profit. In that case, it would be too expensive for the incumbent to deter entry. But as the entrant's cost advantage decreases, entry deterrence (through full-line forcing) becomes a more attractive strategy.

This result is similar to Aghion and Bolton (1987) in the sense that the incumbent must make sure that the retailer is compensated for any potential loss created by entry deterrence. Here, the incumbent cannot set clauses in the contract to compensate the retailer in case they decide to breach the agreement (they only sign short-term contracts), and it will thus be able to impose full-line forcing only when compensation - through the fixed fee - is not too costly. However, as in Aghion and Bolton, entry will sometimes be deterred when the entrant is more efficient than the incumbent.

4.3 Welfare Analysis

Let us now the impact of the acquisition of a comprehensive portfolio of varieties on consumers surplus. Any discussion on which criterion competition policy should focus on is far

beyond the scope of this paper. Since critics of the “portfolio effect” theory often “*quote the Supreme Court in saying that competition law should protect competition, not competitors (i.e. the only goal of competition law is to ensure that competition benefits consumers)*” (Condomines, 2002), we made the choice to concentrate on consumer surplus rather than on total welfare. We have already seen that there exist situations in which portfolio of products can be used to deter entry, and we will now show that consumers (not only competitors) may well be harmed by this behavior.

If the incumbent produces both varieties and is thus able to deter entry, the outcome will be identical in both periods: consumers pay $p_H^M(c_I, c)$ for $q_H^M(c_I, c)$ units of the high-quality variety and $p_L^M(c_I, c)$ for $q_L^M(c_I, c)$ units of the low-quality variety.

If the incumbent cannot produce the low-value variety, it is impossible to deter entry in the first period and competition on the high-value segment is increased with probability p . We then have:

- **Entry fails with probability $1 - p$.** In this case, the second period is identical to the previous case (prices for high- and low-quality varieties are $p_H^M(c_I, c)$ and $p_L^M(c_I, c)$ respectively). However, in the first period the low-value variety is not efficiently produced (because $c_E > c$): prices are thus higher ($p_H^M(c_I, c_E)$ and $p_L^M(c_I, c_E)$ respectively) and consumer surplus is thus lower than when entry is deterred.
- **On the other hand, entry will be successful with probability p .** If entry is successful, the active high-quality producer is now more efficient ($c_E < c_I$) which decreases the prices at which both varieties are sold thereby increasing consumer surplus in the second period. The impact on the first period welfare is less straightforward: the consumers have bought $q_H^M(c_I, c_E)$ units of the incumbent’s high-quality variety at price $p_H^M(c_I, c_E)$ (which is less at a higher price than when entry is deterred) but have also acquired $q_L^M(c_I, c_E)$ units of the entrant’s product at price $p_L^M(c_I, c_E)$. However, because entry is successful they have realized that this was actually a high-quality product. Moreover they have been able to acquire it at a lower price ($p_L^M(c_I, c_E)$). The global effect is not clear, but it seems reasonable to think that it is more likely to be to the consumers benefit. Entry would then have globally been beneficial for the consumers.

The total impact of the entry deterrence is thus usually ambiguous. Entry deterrence increases the consumer surplus when it has prevented an unsuccessful entry (probability $1 - p$), but is very likely to have a negative impact if entry would have been successful (probability p). This naturally leads to the following lemma:

Corollary 1 *There exists a threshold $\bar{p} \in [0, 1]$ such that entry deterrence decreases consumer surplus if and only if $p \geq \bar{p}$.*

This is however not enough to conclude on the impact of the “portfolio of varieties” because entry deterrence does not occur for any value of p . From proposition 2, it indeed comes out that entry deterrence occurs only if entry is relatively unlikely to be successful:

$$p \leq \hat{p} \equiv \min \left[\frac{\pi^M(c_I, c) - \pi^M(c_I, c_E)}{\pi^M(c_E, c) - \pi^M(c_I, c)}, 1 \right].$$

To be able to say anything about the sign of the “portfolio effect” we would need to be able to compare the two thresholds \hat{p} and \bar{p} , with the result that allowing the incumbent to acquire the low-quality technology (for example through a merger) would decrease the consumer surplus whenever $\bar{p} \leq p \leq \hat{p}$.

The problem is that both thresholds are increasing with the entrant’s cost thus making any comparison virtually impossible in this general setting. We now propose a numerical example for which demand and cost functions are such that the two varieties are very likely to constitute two different markets. Let us assume that inverse demand functions are linear and given by:

$$P_H(q_H, q_L) = \frac{7}{4} - q_H - \frac{1}{4}q_L \text{ and } P_L(q_H, q_L) = 1 - q_L - \frac{1}{4}q_H,$$

while the marginal costs are $c = 0$ and $c_E = \frac{1}{8}$. Figure 1 shows that there exists a large range of values of the parameters (c_E, p) for which the holder of the portfolio of products is willing to deter entry thereby harming consumers. This example does not want to claim that “portfolio effects” always exists but that they might exist and be negative. We will discuss in a later section the implications of this result for merger analysis.

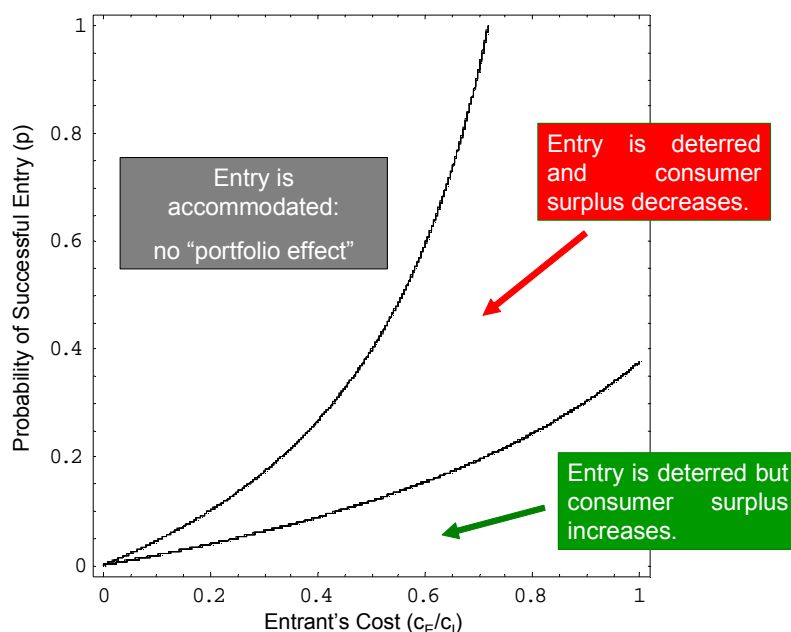


Figure 1: “Portfolio Effect” in a linear demand case

5 Alternative Frameworks

Some assumptions of the model might seem very strong and we would now like to discuss them and see how they could be (at least partially) relaxed.

Let us first focus on the assumption that the retailer can carry at most two different products. Although we believe that there exist some reasonable grounds to justify it, it is not a crucial assumption of the model and can be relatively easily relaxed without significantly affecting the results.

If the retailer can carry as many products as it wants, the incumbent will never be able to deter entry even it produces both varieties. This is because the retailer has incentives to sell the entrant's product even if only an infinitesimal quantity. Because it is not constrained this can be done together with the two incumbent's varieties. This would seem to suggest that our analysis collapses if shelf space is not scarce. This is however due to two important aspects of our initial model:

- (A₁) : there is no other cost of entry than the fact that the entrant first enters on the low-value segment on which it is less efficient than the existing firms (in particular, there is no fixed cost);
- (A₂) : it is enough to sell an infinitely small quantity in first period to obtain a chance to be a market leader (or high-value variety) in the second period.

The combination of these two hypotheses implies that the entrant and the retailer could substantially increase their joint profits at (almost) no cost. Relaxing one of them would already reintroduce a cost of selling the entrant's product in the first period:

- (B₁) : a first solution consists in relaxing (A₁) and assume that there is a fixed cost of F to be paid by the entrant if it decides to enter market in period one;
- (B₂) : another possibility would be to assume that the entrant's product must be sufficiently "visible" in the first period to have a chance to become a "market-leader" (and thus compete with the incumbent's high-value variety). By visible enough, we mean that entry would only stand a chance to be successful (with probability p) if a minimal quantity q^* has been sold in period 1.²⁵

Our results would then be qualitatively restored, if addition to the wholesale tariff, the incumbent can also add an *exclusivity clause* to the contract that requires the retailer to sell its product(s) only. In this case, it is important for the incumbent to produce both varieties because it makes the exclusivity clause more attractive for the retailer: the retailers profit

²⁵That is equivalent to assume that we have $p(q_E^1) = 0$ if $q_E^1 \leq q^*$ and $p(q_E^1) = p > 0$ otherwise. Our framework assumes $q^* = 0$.

if it accepts to pay a price F_I for the incumbent's product(s) under an exclusive purchasing contract would indeed be $\pi^M(c_I, \emptyset) - F_I + \pi^M(\emptyset, c)$ if the incumbent produces the high-value variety only, but $\pi^M(c_I, c) - F_I + \pi^M(\emptyset, c)$ if it produces both. We can again show that if the “entry cost” (fixed entry cost (F) or extra cost of producing and selling at least q^* units of the entrant's product in the first period (equal to at least $(c_E - c)q^*$) is large enough, or alternatively the probability of success (p) is low enough, a “portfolio of products” would help the incumbent to deter entry. It is easy to see that in this case, entry deterrence can only have a negative impact on consumer surplus: entry does not have any negative impact on the consumer surplus if it fails because the first period prices are not affected, but a successful entry would increase the consumer surplus in second period since the prices would then go down.²⁶

We would also get similar results adopting a framework inspired by Carlton and Waldman (2002). Suppose that entry in the high-value (or “primary”) market is possible only in the second period and only if the entrant has first entered the low-value (“secondary” market). The entry process is thus relatively similar to the one we have used until now assuming that $p = 1$ if the entrant has been active in period 1. In that case, even if the entrant has a cost advantage on the high-quality market (in period 2) and produces the low-quality at marginal cost c , the incumbent will still be able to deter entry and protect its monopoly power on the high-quality market using an *exclusivity clause* (at least when entry costs are large enough). It is again straightforward to check that the impact of entry deterrence on consumer surplus is again negative.

The common feature of these frameworks is that by “flooding” the retailer's shelves with its products the incumbent can prevent entry on the monopolized market in the long-term because consumers do not get an opportunity to try new products. This can only be profitable if the portfolio of brands offered by the incumbent is sufficiently wide or if the high-quality brand is very valuable, otherwise the retailer would prefer to take the risk of removing the incumbent's products of its shelves to favor entry.

Finally, 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 will limit the impact of “portfolio power” to situation in which the entrant is not too efficient. The results are likely to be 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

²⁶With linear demand functions, we could also imagine linear probabilities of success of the following type: $p(q_E^1) = \mu q_E^1$. Once again results would be qualitatively similar at the expense of a much “heavier” analysis.

efficient. If the incumbent could for example sell its low-value variety below cost in order to make entry more difficult. This would at the same time allow it to reduce the distortions that it has to impose on the price of the high-value variety to deter entry. Because it has now two tools (its two prices), the incumbent is likely to deter entry much more easily when it holds the two varieties.

6 Policy Implications and Concluding Remarks

In 1997, *Guinness Plc.* and *Grand Metropolitan Plc.* notified their intention to merge and form *GMG Brands* (now called *Diageo*). The case was investigated by the U.S. Federal Trade Commission and the European Commission (DG IV). The merger was allowed but the parties had agreed *inter alia* to terminate some distribution agreements and to divest some of their brands.

The merger brought together two complementary portfolios of brands: *Guinness* was at the time a producer and distributor of spirits worldwide that controlled renowned spirit brands. *Guinness* was strong on the gin market but relatively weak on the vodka market. *Grand Metropolitan* was involved in large number of business among which the distribution of wine and spirits. *GrandMet* was particularly strong on the vodka market but weak on the gin market, so that the two portfolios of brands were perfectly complementary.²⁷

The Commission determined that every single type of spirit constituted a separate product market, and that, because tastes differ from country to country and the distribution of spirit was organized at a national level, the relevant geographic markets were national. In this sense, the market share in most of the individual markets was not increased by the merger, one firm being strong where the other was weak. However, despite this lack of increase in market share, the Commission was concerned that the creation of a very large portfolio including an important number of leading brands could in itself create or strengthen a dominant position. The Commission was particularly concerned with this potential portfolio power because the products were usually sold to a common buyer (usually a large retail chain) who buys a range of products.

Among other issues raised by the Commission, two points seem to be relevant for the theory exposed in this paper:

1. There would be greater potential for tying product (full-line forcing).
2. The threat of a refusal to supply would be more potent.

The rationale behind this analysis is that the holder of a comprehensive portfolio of products could force the retailers (or the bar / pub chains for on-trade sales) to buy the

²⁷Note that production and distribution of wine and spirits is the main activity (in terms of revenues) of the new entity.

whole range of products thereby raising barriers to entry. In its detailed analysis of the case, Nalebuff (2003) identifies two ways in which such barriers could arise: firstly, “*a new entrant would need to develop a range of desirable products in order to counter the portfolio power of the merger company*”. Moreover, because brand name is an important feature of the spirits markets, there would be significant entry costs because a new comer would need to promote its brand heavily to encourage the retailers to carry it.

The results presented in this paper seem to be consistent with this approach of the “portfolio effects”. We indeed abstract from potential efficiency arguments²⁸ to focus on the potential entry deterrence aspects. We have shown in this paper that, even when the retailer has buyer power (which seems to be the case in the *GMG* case at least for off-trade sales made through large retail chains²⁹), a portfolio of brands can be used to reduce the space available in the retailer’s shelves which makes entry virtually impossible. As suggested by the Commission’s decision, this will be achieved through vertical restraints (e.g. full-line forcing or exclusive dealing). Even though the retailer would in general favor entry because it benefits from more competition between the brands, the holder of a large portfolio of products which includes a leading brand (the monopolized high-quality variety in our model) can prevent entry through full-line forcing because the retailer cannot afford not to propose the leading brand in its shelves. We have also shown that in this type of situation, the impact on consumer surplus might be negative even when the degree of substitutability between the products is relatively small. This suggests that the analysis of this type of 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).

We do not want to claim that any merger that creates a large portfolio of products should be prohibited per se but simply that the Commission theory that “*the market power deriving from a portfolio of brands exceeds the sum of its parts*” has some rationale. As our analysis suggest, this type of more detailed analysis should be carried out even when the market shares on the identified product markets do not increase. Attention should be given to such mergers whenever the competition authority have identified brand names as being an important feature of the market.³⁰ As our analysis suggest full-line forcing is more likely to occur when the threat of refusal to supply is serious, that is, whenever a retailer cannot afford not to carry a brand. This will be the case when the merged entity owns

²⁸The merger could induce two types of efficiencies: firstly, economies of scale and scope would mean that a larger portfolio of brands is likely to reduce the costs. Moreover, if there are fixed negotiation costs, a retailer would save costs by dealing with only one producer rather than two.

²⁹According to Nalebuff (2003) there are also important barriers to entry created by the importance of on-trade sales: because “*the on-trade industry is more fragmented (...), direct distribution to the on-trade would be extremely costly for the new entrant.*”

³⁰This was for example the case in the *GMG* merger case. A relatively similar analysis was made by the French competition authorities in the *Coca-Cola / Orangina* case.

particularly strong brands. In these cases, the authorities should identify whether entry is particularly difficult for a new entrant in the sense that it has to convince both the retailer and the consumers about its product. Specific attention should be given if the retailers' shelves can be considered as an essential facility: if this is the case the holder of a large portfolio of products could easily try to prevent entry by blocking the access to these shelves by "flooding" with its secondary brands. Deep portfolios of brands can thus be seen as a threat to competition.

Although we do agree with Nalebuff (2003) that it is not the merger in itself that has anti-competitive effects, we do not believe that the appropriate solution is always to focus on behavioral (preventing bundling strategies) rather than structural remedies (divestiture of brands). The decision should rather be taken on a case by case basis and structural approaches should in our view be favored if the pro-competitive effects of the merger (cost efficiencies, ...) do not appear to be large. Once the merger has been agreed, it is very difficult and costly for competition authorities to monitor the behavior of the new entity.

Providing an exhaustive analysis of the unifying economic theory of "portfolio effects" 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.

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A Proof of Lemma 3

In order to deter entry, the incumbent has to ensure that the retailer is never willing to accept the entrant's offer and sell its product (even in infinitesimal quantity), and this 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 over the two periods).

This imply that the incumbent has to convince the retailer to distribute its high-value variety along with the competitive fringe's low-value variety. It would indeed be impossible to convince to sell only the high-value variety or a low-value variety from one of the competitive producers: the retailer would always be better off using its second shelf slot to store the entrant's product even if it ends up selling only infinitely small quantity of it. For this to happen, the incumbent needs to offer a wholesale contract such that the following constraint is met:

$$\pi^M(w_I, c) - F_I \geq \max[\pi^M(w_I, c_E), \pi^M(w_I, \emptyset)] - F_I + (\Delta\pi_R^2 + \Delta\pi_E^2), \quad (1)$$

This constraint rewrites as:

$$\min[\pi^M(w_I, c) - \pi^M(w_I, c_E), \pi^M(w_I, c) - \pi^M(w_I, \emptyset)] \geq p(\pi^M(c_E, c) - \pi^M(\emptyset, c)) \quad (2)$$

However, using the envelop theorem, we have:

$$\frac{\partial \pi^M(w_H, w_L)}{\partial w_L} = -q_L^M(w_H, w_L),$$

implying that the arguments of the min function the left-hand term of equation (2) are both increasing in w_I . This is equivalent to say that the (first period) benefit of selling the competitively produced low-value variety rather than the entrant's product is larger when the incumbent's high-value variety is more expensive. To deter entry, the incumbent will therefore over-price its high-value variety as much as possible (i.e. such that the retailer accepts the incumbent's offer but does not actually sell the product - or sells in infinitely small quantity). This is in some sense equivalent to say that the incumbent pays the retailer not to carry the entrant's product, although this means that its own product is not sold. Entry deterrence is thus possible if and only if:

$$\pi^M(\emptyset, c) - \pi^M(\emptyset, c_E) \geq p(\pi^M(c_E, c) - \pi^M(\emptyset, c)).$$

and this would contradict the assumption (H_2).

B Proof of Proposition 1

The fixed fees F_I and F_E set respectively by the incumbent and the entrant have to satisfy the following constraints:

$$\pi^M(c_I, c_E) - F_I - F_E + (\pi^M(\emptyset, c) + \Delta\pi_R^2) \geq \pi^M(c_I, c) - F_I + \pi^M(\emptyset, c) \quad (3)$$

$$\dots \geq \pi^M(\emptyset, c_E) - F_E + (\pi^M(\emptyset, c) + \Delta\pi_R^2) \quad (4)$$

$$\dots \geq \pi^M(\emptyset, c) + \pi^M(\emptyset, c) \quad (5)$$

Conditions (3) and (4) determine the maximum franchises the producers can charge, that is:

$$F_I \leq \pi^M(c_I, c_E) - \pi^M(\emptyset, c_E) \text{ and } F_E \leq \pi^M(c_I, c_E) - \pi^M(c_I, c) + \Delta\pi_R^2.$$

In both cases, the maximum fee is equal to the manufacturer's contribution to the retailer's profits. If these two constraints were to be binding, the third condition (5) would be satisfied if and only if:

$$\pi^M(c_I, c_E) - \pi^M(\emptyset, c_E) \leq \pi^M(c_I, c) - \pi^M(\emptyset, c). \quad (6)$$

However, using the envelop theorem, we have (for any w_H including $w_H = \emptyset$):

$$\frac{\partial \pi^M(w_H, w_L)}{\partial w_L} = -q_L^M(w_H, w_L).$$

Since c_E is larger than c , (6) cannot be satisfied and (5) is therefore binding. The franchise fees must then satisfy the following three conditions:

$$F_I + F_E = \pi^M(c_I, c_E) - \pi^M(\emptyset, c) + \Delta\pi_R^2 \quad (7)$$

$$F_I \leq \pi^M(c_I, c_E) - \pi^M(\emptyset, c_E) \quad (8)$$

$$F_E \leq \pi^M(c_I, c_E) - \pi^M(c_I, c) + \Delta\pi_R^2 \quad (9)$$

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).