WORKING PAPERS

N° 17-835

August 2017

"Negative consumer value and loss leading"

Stéphane Caprice and Shiva Shekhar

Toulouse School of Economics

Negative consumer value and loss leading*

Stéphane Caprice† and Shiva Shekhar‡

09 August 2017

Abstract

Large retailers competing with smaller stores that carry a narrower range can exercise market power by pricing below cost for some of their products. Below-cost pricing arises as an exploitative device rather than a predatory device (e.g., Chen and Rey, 2012). Unlike standard textbook models, we show that positive consumer value is not required in these frameworks. Large retailers can sell products offering consumers a negative value. We use this insight to revisit some classic issues in vertical relations.

JEL Classification: L13, L81.

Keywords: Multi-product retailers, loss-leading, negative consumer value.

*We are grateful to Patrick Rey, Yassine Lefouilli and Markus Reisinger for their helpful discussions.

†Toulouse School of Economics, INRA, University of Toulouse Capitole, Toulouse, France; email: stephane.caprice@inra.fr.

‡DICE (University of Düsseldorf); email: shekhar@dice.hhu.de.

1 Introduction

One line of research in industrial organization examines the phenomenon of loss-leading when retailers are multi-product firms (i.e., Chen and Rey, 2012; Chen and Rey, 2016; and Johnson, 2017). Large retailers competing with smaller stores that carry a narrower range can exercise market power by pricing below cost for some products also offered by smaller rivals. Loss-leading does not appear for predatory reasons: rather pro-competitive justifications are invoked. For example, in Chen and Rey (2012) below-cost pricing arises as an exploitative device to discriminate between multi-stop shoppers and one-stop shoppers. The result is shown in a standard model where the goods offer consumers a positive value as in textbook models. In this article, we demonstrate that positive value is not required for the goods which are priced below cost. Large retailers can sell products offering consumers negative values. Our result emerges from a recalculation of Chen and Rey's original model in allowing for a negative consumer value for the good which is priced below-cost.[1]

We organize the paper as follows. Section 2 presents Chen and Rey's (2012) model and we then show our result. In Section 3, we provide some applications of our result in vertical relations, and we conclude in Section 4.

2 The model and results

In order to make our results as clear as possible and directly comparable, we first start in Subsection 2.1 with the simple example used by Chen and Rey (2012).[2] Then, we extend this setting in Subsection 2.2.

2.1 A simple example

Suppose two goods A and B, consumers value A at $u_A = 10$ and B at $u_B = 6$. There are two firms: L and S. While L is a multi-product firm which can supply A and B, S only supplies B. L supplies A at no cost and supplies B at unit cost c_L. Let $v_L = u_B - c_L$ denote the consumer value of the good B at L. Chen and Rey assume in this example that $c_L = 4$ which results in $v_L = u_B - c_L = 2$: the good B offers consumers a positive

[1] We also extend our results to Chen and Rey (2016) and Johnson (2017) in the Appendices.

[2] See p. 3466.

value at L. We do not restrict attention to $c_L = 4$; instead we say that the good B offers consumers a positive value if $v_L > 0$, that is, $c_L < u_B = 6$ and a negative value if $v_L \leq 0$, that is $c_L \geq u_B = 6$. B is also offered by S which is a competitive fringe, at a price $\widehat{p} = 2$. Let $v_S = u_B - \widehat{p}$ denote the consumer value of the good B at S; we obtain $v_S = 4$. We assume that $v_S > v_L$, which translates into $v_L < 4$, that is $c_L > 2$.

Consumers face a shopping cost s for visiting a store, reflecting the opportunity cost of the time spent in traffic, selecting products and so on.[3] We suppose further that half of the consumers face a high shopping cost $\overline{s} = 4$, whereas the others can shop at no cost, that is $\underline{s} = 0$.

If L were a monopolist, implying that S were not present in the market, it is easy to show that B would be sold only if $v_L > 0$. Thus, if L were alone, it would supply A and B to all consumers at a total price $p^m_{AB} = u_A + u_B - \overline{s} = 12$, and would obtain a profit $\pi^m_{AB} = p^m_{AB} - c_L = 12 - c_L$.[4] It could also supply A only to all consumers at a price $p^m_A = u_A - \overline{s} = 6$, which results in a profit of $\pi^m_A = 6$.[5] L would supply A and B if $c_L < 6$ and would supply A only if $c_L \geq 6$ which corresponds to $u_B = 6$. L would thus supply A and B if $v_L > 0$ and A only if $v_L \leq 0$. The result is not surprising as firms only supply goods offering consumers values which are positive. This suggests the idea as found in textbook models that "only goods which deliver consumers a positive value are sold by a multi-product firm".

Suppose now, instead, that L is not a monopolist and good B is also offered by S, which offers consumers a value of $v_S = 4$. S cannot attract high-cost consumers, who would obtain $v_S - \overline{s} = 0$; L can therefore still charge them a total price p^m_{AB}. As shown by Chen and Rey (2012), due to the presence of S, L can now screen consumers according to their shopping costs by selling B below cost (i.e., $p_B < c_L$): keeping the total price equal to $p^m_{AB} = 12$ it can lower the price for B down to $p_B = 2$, and increasing the price for A to $p_A = 10$. This does not affect the shopping behavior of high-cost consumers, who still face a total price of p^m_{AB}, but increases the margin earned on low-cost consumers, who now become multi-stop shoppers and buy B from S. This loss-leading strategy allows

[3] It may also account for consumers' enjoyment or dislike of shopping.

[4] Selling to low-cost consumers only at a total price $p_{AB} = u_A + u_B = 16$ leads to a lower profit $\pi_{AB} = (16 - c_L)\frac{1}{2} = 8 - \frac{c_L}{2} < 12 - c_L$ for any $c_L < 8$, which is satisfied for $v_L > 0$.

[5] Selling A to low-cost consumers only at a price $p_A = u_A = 10$ leads to a lower profit $\pi_A = 10\frac{1}{2} = 5 < 6$.

L to charge the monopoly price to one-stop shoppers and, here, extracts the full value of A from multi-stop shoppers.

To make our point, we first start with the case $v_L = 0$, that is $u_B = c_L$. While in the monopoly case, where L would be indifferent between supplying A and B and supplying A only, L is now better off by supplying A and B. Focusing on high-cost consumers who are one-stop shoppers, L is indifferent between supplying A and B and supplying A only. The two strategies lead to the same monopoly margin from these consumers: $p^m_{AB} - c_L = p^m_A = 6$. However, in the presence of S, L can now charge a higher price p_A to low-cost consumers who are multi-stop shoppers and buy B from S. By keeping the total price equal to p^m_{AB}, in selling B below cost, and in increasing the price for A, it can obtain to a higher margin on low-cost consumers. While the margin on these consumers were $p^m_{AB} - c_L = p^m_A = 6$ without S, the margin is now $p_A = 10$ which leads to a total profit of $\frac{1}{2}p_A + \frac{1}{2}(p^m_{AB} - c_L) = 8$ instead of $p^m_{AB} - c_L = 6$ without S. The presence of S thus allows L to screen consumers according to their shopping costs, which makes supplying null-valued good by L profitable.

The result still holds in the case where $v_L < 0$, that is $u_B < c_L$, as long as the gains of screening (i.e., $p_A - p^m_A = 4$) are larger than the losses of supplying A and B (i.e., $(p^m_{AB} - c_L) - p^m_A$) instead of supplying A only. With half of the consumers facing a high shopping cost while the others can shop at a lower cost, L makes losses on one-stop shoppers (high-cost consumers) by supplying A and B instead of B only, that is $\frac{1}{2}[(p^m_{AB} - c_L) - p^m_A] = \frac{1}{2}(6 - c_L)$. However, L makes gains on multi-stop shoppers (low-cost consumers), that are $\frac{1}{2}(p_A - p^m_A) = \frac{1}{2}4$. Comparing losses and gains, L supplies A and B instead of supplying A only if $c_L < 10$, that is $v_L > -4$. Thus, as shown by Chen and Rey (2012), the presence of small rivals allows L to screen consumers according to their shopping costs, but this strategy of selling B below cost opens a door to a new insight. Indeed, L can now supply goods that are competitive, for which consumer values are negative; here, the good B is sold for any $v_L > -4$.

2.2 A more general setting

We now extend the previous setting in a simple way, and, in particular, we allow for any proportion of low and high shopping costs. Let α and $1 - \alpha$ denote the proportion of low- and high-cost consumers (i.e., $\underline{s} = 0$ and $\overline{s} = 4$) respectively.

We denote by v_A, v_L the consumer values offered by L and by v_S the consumer value offered by S ($v_A > v_S > v_L$). As previously, we assume $v_A - \overline{s} > 0$ and $v_S - \overline{s} \leq 0$ such that S cannot attract high-cost consumers. This leads to high-cost consumers either buying at L or not buying at all. In the previous numerical example, $v_A = u_A - c_A = 10$, $v_S = u_B - \widehat{p} = 4$, and these assumptions were satisfied: $v_A - \overline{s} = 6 > 0$ and $v_S - \overline{s} = 0$. As we focus on negative consumer value offered by L on the competitive segment, we assume $v_L < 0$, that is $v_L = u_L - c_L < 0$.

We denote by $r = p_A - c_A + p_B - c_L$, $r_A = p_A - c_A$ and by $r_L = p_B - c_L$ L's total margin, the margin for A and for B respectively, with $r = r_A + r_L$.

As we did above, we first assume that L is a monopolist, implying that S is not present in the market; it is easy to show that the good B is not sold when $v_L < 0$. Two cases should be distinguished but in any case, B is not sold; L can supply A either to all consumers (as above) or to low-cost consumers only. Let $\underline{r}_A = v_A - \overline{s} = v_A - 4$ denote L's margin for A in the former case and $\overline{r}_A = v_A - \underline{s} = v_A$ L's margin for A in the latter case. When it supplies the good A to all consumers, it obtains $\underline{r}_A = v_A - 4$, and when it supplies A to low-cost consumers only it gets $\overline{r}_A \alpha = v_A \alpha$. Comparing the profits, the result is that it supplies A to all consumers if $\alpha < \frac{v_A - \overline{s}}{v_A - \underline{s}} = \frac{v_A - 4}{v_A}$ and A to low-cost consumers only if $\alpha \geq \frac{v_A - 4}{v_A}$.[6] Then, it can also supply A and B, however, B is not sold (in any case) because $v_L < 0$.

Suppose now, instead, that L is not a monopolist and the good B is also offered by S. As previously, we assume that S is a competitive fringe; S offers consumers a value v_S. We show that while in the monopoly case L would be better off in supplying A only, either to all consumers or to low-cost consumers only, L is now better off in supplying A and B to all consumers for $v_L < 0$, whatever the proportion of high and low shopping costs are.

When the proportion of low-cost consumers is small, that is, $\alpha < \frac{v_A - \overline{s}}{v_A - \underline{s}} = \frac{v_A - 4}{v_A}$, L supplies A only to all consumers at $\underline{r}_A$ if it were alone. The presence of the competitive fringe allows L to screen consumers according to their shopping cost. Keeping the total margin unchanged on high-cost consumers such that $v_A + v_L - r - \overline{s} = v_A - \underline{r}_A - \overline{s} = 0$ (i.e., $r = \underline{r}_A + v_L$), lowering the margin for B down to $r_L = -(\overline{s} - \underline{s}) + v_L$ (i.e.,

[6] In above numerical example, with $v_A = 10$ and $v_L < 0$, the good A was sold to all consumers because $\alpha = \frac{1}{2} < \frac{v_A - \overline{s}}{v_A} = \frac{3}{5}$.

$r_L = -(\overline{r}_A - \underline{r}_A) + v_L = -(\overline{s} - \underline{s}) + v_L$ with $r_A + r_L = r$ and $r_A = \overline{r}_A$) and increasing the margin for A to $r_A = \overline{r}_A = v_A - \underline{s}$ does not affect the shopping behavior of high-cost consumers (who still face the same margin) but increases the margin earned on low-cost consumers (who now become multi-stop shoppers). L earns a total profit $\overline{r}_A\alpha + (\underline{r}_A + v_L)(1-\alpha) = (v_A - \underline{s})\alpha + (v_A - \overline{s} + v_L)(1-\alpha)$ with $r_A = \overline{r}_A$ and $r = \underline{r}_A + v_L$, which can be greater than $\underline{r}_A = v_A - \overline{s}$, that is the profit it would obtain in selling A only to all consumers. Comparing the gains and losses of screening, this is true as long as the gains on low-cost consumers, which are $(\overline{r}_A - \underline{r}_A)\alpha = (\overline{s} - \underline{s})\alpha$, are larger than the losses on high-cost consumers, that are $((\underline{r}_A + v_L) - \underline{r}_A)(1-\alpha) = v_L(1-\alpha)$. The result is that L earns a higher total profit if $\alpha(\overline{s} - \underline{s}) > -(1-\alpha)v_L$ with $v_L < 0$, that is $v_L > -\frac{\alpha(\overline{s}-\underline{s})}{(1-\alpha)}$ which gives $v_L > -\frac{4\alpha}{(1-\alpha)}$. This case corresponds to the situation we developed in the numerical example above.[7]

When the proportion of low-cost consumers is high (i.e., $\alpha \geq \frac{v_A - \overline{s}}{v_A - \underline{s}} = \frac{v_A - 4}{v_A}$), the situation is different, but the same logic applies. If L were alone, it would supply A to low-cost consumers only at $\overline{r}_A = v_A - \underline{s}$. The presence of the competitive fringe allows L to screen consumers according to their shopping costs, by pricing the good B below cost. Without changing the margin for A, which is still equal to $r_A = \overline{r}_A$, L can now attract high-cost consumers by charging $r_L = -(\overline{s} - \underline{s}) + v_L$ on the good B. With L's total margin, which is equal to $r = \underline{r}_A + v_L = (v_A - \overline{s}) + v_L$, high-cost consumers buy A and B from L. Low-cost consumers still buy A only from L because they are multi-stop shoppers, and high-cost consumers now become shoppers because they are interested in buying the basket (i.e., the good A and the good B). L earns a total profit $\overline{r}_A\alpha + (\underline{r}_A + v_L)(1-\alpha) = (v_A - \underline{s})\alpha + (v_A - \overline{s} + v_L)(1-\alpha)$ with $r_A = \overline{r}_A$ and $r = \underline{r}_A + v_L$, which can be greater than $\overline{r}_A\alpha = (v_A - \underline{s})\alpha$, that is the profits it gets in selling A only to low-cost consumers. While profits on low-cost consumers are unchanged, L can now earn $(v_A - \overline{s} + v_L)(1-\alpha)$ on high-cost consumers, which were not possible without the competitive fringe. Assume $v_L = 0$, L benefits of the presence of S because this allows it to screen consumers according to their shopping costs: L charges $r_A = \overline{r}_A$ and $r_L = -(\overline{r}_A - \underline{r}_A)$ which leads to a total margin of $r = \underline{r}_A$ (high-cost consumers become shoppers instead of not buying at all and low-cost consumers are multi-stop shoppers and buy B from S instead of buying A only). The benefits for L are thus given by $\underline{r}_A(1-\alpha) = (v_A - \overline{s})(1-\alpha)$ for $v_L = 0$. At the end, this strategy

[7] With $\alpha = \frac{1}{2}$, v_L should be larger than -4.

is profitable for $v_L < 0$, as long as the benefits on high-cost consumers are positive, that is, $v_L > -\underline{r}_A = -(v_A - \overline{s})$.

We summarize our results in Proposition 1.

Proposition 1 *Suppose L faces a competitive fringe of small retailers, L supplies A and B to all consumers whatever the proportion of high and low shopping costs even if* $v_L < 0$*; in particular, L supplies A and B to all consumers if* $v_L > -\frac{\alpha(\overline{s}-\underline{s})}{(1-\alpha)} = -\frac{4\alpha}{(1-\alpha)}$ *for* $\alpha < \frac{v_A-\overline{s}}{v_A-\underline{s}} = \frac{v_A-4}{v_A}$ *and if* $v_L > -(v_A - \overline{s}) = -(v_A - 4)$ *for* $\alpha \geq \frac{v_A-4}{v_A}$.

Proof. See the text above. ■

Figure 1 summarizes results in Proposition 1 for numerical values used above ($v_A = 10$, $v_S = 4$, $\underline{s} = 0$ and $\overline{s} = 4$) according to the proportion of low shopping costs.

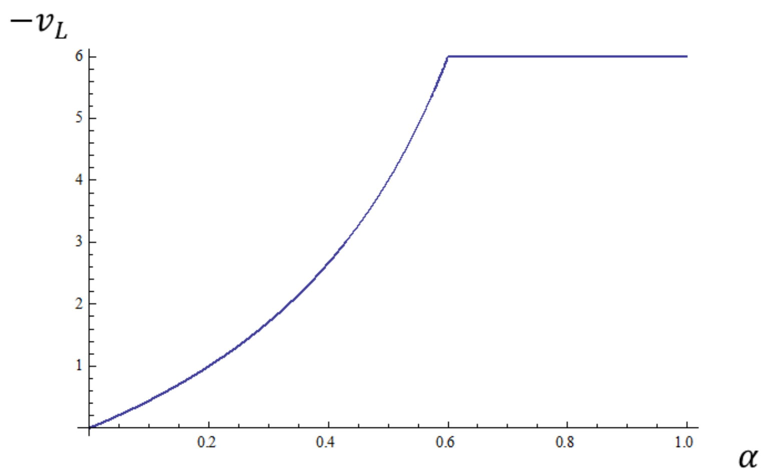

Figure 1

This insight which may seem quite surprising is due to the presence of small retailers which allows the large retailer to screen consumers according to their shopping costs. While a multi-product monopolist has no incentive to profitably introduce a good with a negative value, a multi-product firm which competes with small retailers on some segments has an incentive to profitably introduce products on these segments even if its products offer consumers negative values. By selling these products below cost, the multi-product firm can discriminate between the low-cost consumers (who are multi-stop shoppers and buy some products from the multi-product firm and these products from the small retailers) from the high-cost consumers (who are one-stop shoppers and buy all goods, i.e., the basket of goods from the multi-product firm). Our insight provides a rationale for why multi-product firms are able to offer a larger product line at no benefit (i.e., $v_L = 0$) or at a loss (i.e., $v_L < 0$).[8]

While we demonstrate our results in a simple example, similar insights can be provided by using the general model of Chen and Rey (2012). Interestingly, similar insights also apply in Chen and Rey (2016), in which multi-product firms with different comparative advantages compete for consumers with heterogenous shopping patterns. In their setting, competition for one-stop shoppers drives total prices down to cost, but firms subsidize weak products with the profit made on their strong products. Negative consumer values for weak products thus arise because multi-product firms price these products below cost.[9] Recently, Johnson (2017) considers a setting in which one-stop shoppers may underestimate their needs, and shows that below-cost pricing may emerge when consumers have different biases across products. In particular, loss-leader products tend to be products that consumers purchase regularly. Our insight that negative consumer values for these loss-leader products is feasible, once again applies to these products.[10]

Using the simple example above, we now provide some applications of our insights on vertical relations in the following section.

3 Applications in vertical relations

We provide two applications. First, we discuss access to the retail market (using the large retailer) for a supplier for which the good offers a negative consumer value, providing an example in which below-cost pricing is good for the supplier. Second, we demonstrate

[8] For example, assuming that L faces a fixed cost to introduce the product L, that is F; our analysis shows (for $v_L = 0$) that there exists a positive F such that L has incentive to introduce B whatever the proportion of low-cost and high-cost consumers are. Using calculations above, threshold values in F are given by $(\overline{s} - \underline{s})\,\alpha$ for $\alpha < \frac{v_A - \overline{s}}{v_A - \underline{s}}$ and by $(v_A - \overline{s})\,(1 - \alpha)$ for $\alpha \geq \frac{v_A - \overline{s}}{v_A - \underline{s}}$.

[9] We provide an example in Appendix A.

[10] See Appendix B for an example.

that a large retailer that benefits from an alternative source of supply which provides a negative consumer value for this good may have buyer power vis-à-vis an efficient supplier of this good. This latter application helps us to show that the assortment strategy of a large retailer may interact with the buyer power of this retailer when it competes with smaller retailers.

3.1 Access to the retail market

L is a multi-product retailer which provides two goods, A and B. In this subsection, we consider a scenario where the good B at L is being supplied by a supplier. The supplier can produce B at a constant marginal cost $c \geq 0$ and offers a take-it-or-leave-it two-part tariff contract (w_L, F_L), where w_L and F_L, respectively, are the wholesale price and the fixed fee paid to the supplier by the large retailer. The timing of the game is as follows: first, the supplier offers contracts to the large retailer, which decides whether to accept or reject the contract, and then the large retailer sets retail prices.

For notational simplicity, we denote the market value of the good B as $v_L = u_B - c_L - c$, where c_L represents the retailing cost of the large retailer. Furthermore, we assume that the market value of good B is negative, that is, $v_L < 0$ (to focus on our point) Then, there is a competitive fringe S of small retailers that sells the good B at a price $\widehat{p}$, providing consumers a utility of $v_S = u_B - \widehat{p}$. As previously, we assume that consumers face shopping costs $\underline{s}$ and $\overline{s}$, and that $v_A > v_S$ and $v_S \leq \overline{s}$.

Using previous results, we can write the retail margins of the large retailer and its gross profits. We denote by $v_L(w_L) = u_B - c_L - w_L$ the consumer value of the good B at L for a wholesale price w_L. Retail margins are thus given by $r_A = \overline{r}_A$ and $r_L = -(\overline{s} - \underline{s}) + v_L(w_L)$ which leads to:

$$\begin{aligned}\pi_{AL} &= (v_A - \underline{s})\,\alpha + (v_A - \overline{s} + v_L(w_L))\,(1-\alpha) \\ &= \pi_A^m + \left[(\overline{s} - \underline{s})\,\alpha + v_L(w_L)\,((1-\alpha))\right] \qquad \text{for } \alpha < \frac{v_A - \overline{s}}{v_A - \underline{s}},\end{aligned}$$

and:

$$\begin{aligned}\pi_{AL} &= (v_A - \underline{s})\,\alpha + (v_A + v_L(w_L) - \overline{s})\,(1-\alpha) \\ &= \pi_A^m + (v_A + v_L(w_L) - \overline{s})\,(1-\alpha) \qquad \text{for } \alpha \geq \frac{v_A - \overline{s}}{v_A - \underline{s}},\end{aligned}$$

as gross profits for the large retailer.[11]

Then, the supplier sets its contract to maximize the following:

$$\max_{w_L, F_L} (w_L - c)(1-\alpha) + F_L$$
$$s.t. \qquad \pi_{AL} - F_L \geq \pi_A^m,$$

and the fixed fee is set so as to just satisfy the participation constraint of the large retailer. Since the retailer is the residual claimant of the total profits, the supplier sets its wholesale price to maximize the multi-product retailer's profit and hence $w_L = c$. The supplier's profits are thus given as:

$$\begin{aligned} \left[(\overline{s} - \underline{s})\,\alpha + v_L\left((1-\alpha)\right)\right] \text{ for } \alpha &< \frac{v_A - \overline{s}}{v_A - \underline{s}}, \\ \text{and } (v_A + v_L - \overline{s})(1-\alpha) \text{ for } \alpha &\geq \frac{v_A - \overline{s}}{v_A - \underline{s}}. \end{aligned}$$

The above implies that the supplier of good B can supply its good for $v_L < 0$, that is $v_L > -\frac{\alpha(\overline{s} - \underline{s})}{(1-\alpha)}$ for $\alpha < \frac{v_A - \overline{s}}{v_A - \underline{s}}$ and $v_L > -(v_A - \overline{s})$ for $\alpha \geq \frac{v_A - \overline{s}}{v_A - \underline{s}}$ (see our previous analysis).[12] The supplier is thus able to profitably supply the good B at L even if its good has a negative market value. Our application provides a clear example whereby below cost pricing is good for the supplier, echoing the findings of von Schlippenbach (2015). However, we go further in this application and say that the supplier has the incentive to introduce a good for which the market value is negative.

3.2 Buyer power and alternative source of supply

There are a number of reasons to explain why large buyers obtain price discounts from sellers (e.g., Dobson and Waterson, 1999; Inderst and Mazzarotto, 2007). One of these is to assume that large buyers can turn to other sources of supply and can thus demand

[11] π_A^m which represents, here the outside option of the large retailer is given by: $\pi_A^m = (v_A - \overline{s})$ for $\alpha < \frac{v_A - \overline{s}}{v_A - \underline{s}}$ and $\pi_A^m = (v_A - \underline{s})\,\alpha$ for $\alpha \geq \frac{v_A - \overline{s}}{v_A - \underline{s}}$.

[12] While we provide an analysis in assuming that the supplier offers two-part tariff contracts to the large retailer, our analysis still holds in linear-contracting for values of v_L defined in the main text; however, equilibrium contracts would be different.

better terms from suppliers.[13] In these kinds of models, large retailers have access to other sources of supply and can turn to these other sources if they dislike the efficient suppliers' terms. Price discounts thus emerge when large retailers have *positive* outside options, which corresponds to the "textbook" view.[14]

In our present setting, the large retailer is a multi-product firm. While the previous view arises when the large retailer is a monopolist, that is, the large buyer has buyer power if it has a positive outside option, buyer power may also arise if the large retailer has a negative outside option when it competes with small retailers. It is the combination of both "access to an alternative supplier" and "seller power " (i.e., its ability to price these goods below cost) which allows the large retailer to have discounts even if it has a negative outside option.

In this application, we assume that L has a relationship with an efficient supplier for the good B. However, it has also access to an alternative supplier which is modeled as a competitive fringe. As previously, we assume that the efficient supplier makes take-it-or-leave-it offers to L in two-part tariffs. Let $v_L = u_B - c_L - c$ denote the consumer's value offered by the efficient supplier at L and $\widetilde{v}_L = v_L = u_B - c_L - \widetilde{c}$ the consumer's value offered by the alternative supplier at L with $v_L > \widetilde{v}_L$ (c and $\widetilde{c}$ denote, respectively, the constant marginal cost of the efficient supplier and of the alternative supplier). We assume that $\widetilde{v}_L < 0$ in order to focus on a negative outside option. The retail market and consumer behavior are unchanged.

L is a multi-product monopolist. There is no scope for L to exert buyer power vis-à-vis the efficient supplier of the good B because L has access to a negative outside option for this good (i.e., $\widetilde{v}_L < 0$). The profit of the large retailer is given by its monopoly profit on the good A, that is, π_A^m and the supplier extracts the monopoly profit for the good B. In this case, only a positive outside option for this good, that is, $\widetilde{v}_L > 0$ would allow L to obtain better terms for the efficient supplier.

L is in competition with S on the good B. The view changes drastically: while L had π_A^m as an outside option when it was a monopolist, it now has $\widetilde{\pi}_{AL}$ as an outside option, which can be greater than π_A^m even if $\widetilde{v}_L < 0$. This insight comes

[13] Integrating backward and producing the good themselves is an alternative solution, which is also mentioned.

[14] See Katz (1987), and more recently Caprice (2006) and Caprice and Rey (2015) for applications with this modeling of buyer power.

from our previous analysis: a multi-product firm which competes with small retailers on a specific segment has an incentive to profitably supply a product for which the consumer's value is negative on this segment. By selling this product below cost, the multi-product firm can discriminate between consumers according to their shopping costs, which allows products with a negative consumer value to be profitable. Using our previous simple example, we obtain $\widetilde{\pi}_{AL} = (v_A - \overline{s}) + [(\overline{s} - \underline{s})\, \alpha + \widetilde{v}_L\, ((1-\alpha))]$ which corresponds to $\pi_A^m + [(\overline{s} - \underline{s})\, \alpha + \widetilde{v}_L\, ((1-\alpha))]$ when $\alpha < \frac{v_A - \overline{s}}{v_A - \underline{s}}$ and $\widetilde{\pi}_{AL} = (v_A - \underline{s})\, \alpha + (v_A + \widetilde{v}_L - \overline{s})\, (1-\alpha)$, that is, $\pi_A^m + (v_A + \widetilde{v}_L - \overline{s})\, (1-\alpha)$ for $\alpha \geq \frac{v_A - \overline{s}}{v_A - \underline{s}}$. While L would have no buyer power when it were a monopolist, it has buyer power now as it can extract $\widetilde{\pi}_{AL} - \pi_A^m$ instead of π_A^m.

Figure 2 illustrates our insight, that is, $\widetilde{\pi}_{AL} - \pi_A^m$ for $\widetilde{v}_L = 0$ and numerical values used above ($v_A = 10$, $v_S = 4$, $\underline{s} = 0$ and $\overline{s} = 4$) according to the proportion of low shopping costs. Note that this buyer power arises whatever the proportion of high and low shopping costs are (for $\widetilde{v}_L = 0$). In particular, starting from a situation where all consumers have the same shopping costs, introducing an arbitrarily small number of consumers with different shopping costs suffices to give some buyer power to the large retailer, which was not the case for $\alpha = 0$ or $\alpha = 1$.

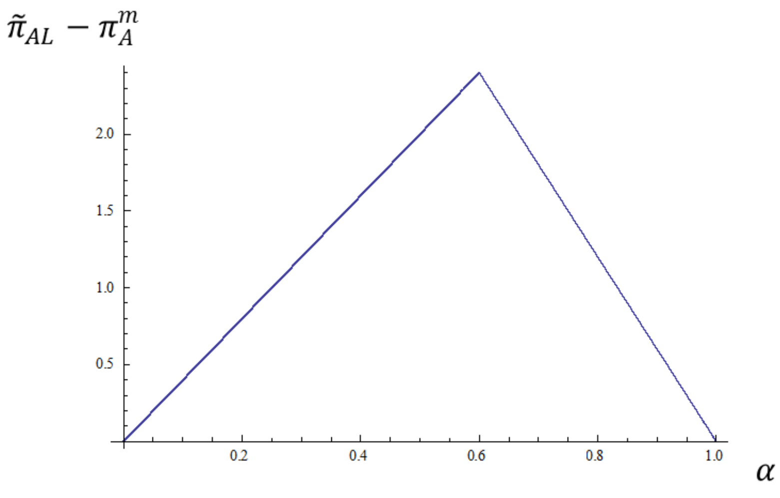

Figure 2

Our result contrasts with the standard textbook view about buyer power, in which $\widetilde{v}_L$ should be positive. While in the analysis of market power of large retailers buyer power and seller power are generally studied separately, our insight suggests that both can interact.[15] In particular, the assortment strategy of big-box retailers can help them to benefit from buyer power in product categories for which products are sold at below-cost prices.

4 Conclusion

Chen and Rey's (2012) model captures one of the key characteristics of the modern retail market: consumers face shopping costs and large retailers offering large product line benefit from seller power. The recalculation of Chen and Rey's (2012) paper provides new insights. Contrary to the conventional wisdom which requires positive consumer value for a multi-product firm, we show that goods with a negative consumer value can be provided by multi-product retailers as long as below-cost pricing on these goods is optimal.[16]

We provide two applications of our result on vertical relationships. First, we demonstrate that a supplier facing a negative consumer value can access the retail market when it negotiates with a large retailer. The supplier of the loss-leader product benefits from the large product line of the large retailer. The latter prices this product below cost and the supplier has access to the market, and thus the supplier can benefit from a large retailer's below-cost pricing strategy. Second, we demonstrate that a positive consumer value as demand-side substitution is not required in order for a large retailer to benefit from buyer power. When a large retailer prices some products below-cost, it does not need to have positive consumer values as a demand-side substitution for these products. Its seller power (i.e., here, its opportunity to price below cost) helps it to benefit from buyer power, even if it has a negative consumer value as a demand-side substitution.

While we focus here on vertical relations, interesting insights of our results in relation

[15] Note as an exception, Caprice and Shekhar (2017) which defines buyer power in the same way, but focuses on the impact of the countervailing power on consumers and total welfare. In particular, they show that countervailing power is detrimental to consumers and total welfare when the market power of the large retailer is defined by both seller power and buyer power; however, they do not deal, as here, with the introduction of negative market value products.

[16] We extend our insights to alternative modelings, such as, Chen and Rey (2016) and Johnson (2017).

to product line competition could also be provided. However, we leave this task for further investigation.

5 References

Caprice, S. (2006), "The Welfare Effects of a Ban on Price Discrimination", *Review of Industrial Organization*, 28(1): 63-80.

Caprice, S., and P. Rey (2015), "Buyer power from joint listing decision," *Economic Journal*, 125: 1677-1704.

Caprice, S., and S. Shekhar (2017), "On the countervailing power of large retailers when shopping costs matter", TSE Working Paper 17-771.

Chen, Z., and P. Rey (2012), "Loss leading as an exploitative practice", *American Economic Review*, 102(7): 3462-3482.

Chen, Z., and P. Rey (2016), "Competitive Cross-Subsidization", TSE Working Paper 13-450, revised version.

Dobson, P., and M. Waterson (1999), "Retailer power: recent developments and policy implications", *Economic Policy*, 14(28), 133-156.

Inderst, R., and N. Mazzarotto (2008), "Buyer Power in Distribution", in W.D. Collins (Ed.), ABA Antitrust Section Handbook, Issues in Competition Law, 1611-1637; ABA Book Publishing, Chicago.

Johnson, J. P. (2017), "Unplanned Purchases and Retail Competition", *American Economic Review*, 107(3): 931-65.

Katz, M. L. (1987), "The welfare effects of third-degree price discrimination in intermediate good markets," *American Economic Review*, 77(1): 154-167.

von Schlippenbach, V. (2015), "Sales at a loss: who benefits", *European Review of Agricultural Economics*, 42(2): 269-286.

Appendices

A Illustration from Chen and Rey's (2016) paper

We focus on the simple example (page 6) and transform it slightly in order to demonstrate our point more clearly within their setting.

Consumers wish to buy two goods, A and B, which can both be supplied by two firms, 1 and 2. Let v_1^A and v_1^B denote consumer values for A and B from firm 1, and v_2^A and v_2^B consumer values for A and B from firm 2. We assume that firms are symmetric such that $v_1^A + v_1^B = v_2^A + v_2^B$; however, firm 1 enjoys a larger consumer value for A ($v_1^A > v_2^A$) whereas firm 2 enjoys a larger consumer value for B ($v_2^B > v_1^B$): $v_1^A = v_2^B > v_2^A = v_1^B$.

Consumers face a shopping cost, reflecting the opportunity cost of the time spent in traffic, selecting products and so on. Some consumers face a "low" shopping cost, that is $\underline{s}$, such that they will adopt multi-stop shopping behavior, purchasing each product at the lowest available price. Let α denote the proportion of these consumers. While some consumers incur a low shopping cost, other consumers face a "high" shopping cost, that is $\overline{s}$, and $(1-\alpha)$ denotes the proportion of these consumers.

Let r_1^A, r_1^B and r_1 denote firm 1's margins for A and B, and the total margin, such that $r_1 = r_1^A + r_1^B$ and r_2^A, r_2^B and r_2 firm 2's margins for A and B, and the total margin, that is $r_2 = r_2^A + r_2^B$.

Suppose first, as do Chen and Rey (2016), that consumers face a high shopping cost (smaller than $v_1^A + v_1^B = v_2^A + v_2^B$). In equilibrium, consumers behave as one-stop shoppers, that is, they buy both products from the same firm, and thus only the total margin, r_1 and r_2 matter. As the firms deliver the same consumer value, Bertrand-like competition drives the basket margin down to zero: $r_1 = r_2 = 0$.

Suppose instead that all consumers face a low shopping cost such that, in equilibrium, consumers behave as multi-stop shoppers and purchase each product at the lowest available price. Asymmetric Bertrand competition then leads firms to sell weak products at a zero margin, and strong products at a margin equal (or just below) the consumer value gain minus consumers' shopping costs: $r_1^A = v_1^A - v_2^A - \underline{s} = r_2^B = v_2^B - v_1^B - \underline{s}$ (i.e., $v_1^A - r_1^A - \underline{s} = v_2^A$ and $v_2^B - r_2^B - \underline{s} = v_1^B$). Note that $r_1^A = v_1^A - \underline{s}$ and $r_2^B = v_2^B - \underline{s}$ if $v_1^B = v_2^A < 0$.

Next, suppose that a fraction of consumers face a high shopping cost, that is, $\overline{s}$, whereas the others have a low shopping cost, that is, $\underline{s}$. As shown by Chen and Rey (2016), cross-subsidization naturally arises. As before, fierce price competition dissipates profits from one-stop shoppers, and drives basket margins down to zero: $r_1^A + r_1^B = r_2^A + r_2^B = 0$. Then, keeping the total margin constant for one-stop shoppers, it suffices to undercut the rival's weak product by the amount of $\underline{s}$ to attract multi-stop shoppers. It follows that equilibrium margins are given by:

$$\begin{aligned} v_1^A - r_1^A - \underline{s} &= v_2^A - r_2^A, \\ v_2^B - r_2^B - \underline{s} &= v_1^B - r_1^B. \end{aligned}$$

Replacing r_1^B and r_2^A by $-r_1^A$ and $-r_2^B$ (as $r_1^A + r_1^B = 0$ and $r_2^A + r_2^B = 0$), we obtain:

$$\begin{aligned} v_1^A - r_1^A - \underline{s} &= v_2^A + r_2^B, \\ v_2^B - r_2^B - \underline{s} &= v_1^B + r_1^A. \end{aligned}$$

By symmetry, $r_1^A = r_2^B$ and $r_1^A = \frac{v_1^A - v_2^A - \underline{s}}{2} = r_2^B = \frac{v_2^B - v_1^B - \underline{s}}{2}$, the result is $r_1^B = -\frac{v_1^A - v_2^A - \underline{s}}{2} = r_2^A = -\frac{v_2^B - v_1^B - \underline{s}}{2}$. This pricing strategy does not affect the shopping behavior of high-cost consumers (who still face a zero margin), but generates a positive profit from multi-stop shoppers, who buy A from firm 1 and B from firm 2, giving each firm a positive margin of $\frac{v_1^A - v_2^A - \underline{s}}{2} = \frac{v_2^B - v_1^B - \underline{s}}{2}$ on these consumers.

We now focus on our point and assume that $v_1^A = v_2^B > \overline{s}$ and $v_1^B = v_2^A < 0$.

Suppose first, that firm 1 were alone (by symmetry, the same analysis applies for firm 2 by replacing good A by good B and good B by good A), as $v_1^B < 0$, firm 1 would only supply good A. Two cases should be distinguished as long as all consumers are served or low-cost consumers only are served, but in any case firm 1 would only supply good A. We can define a threshold in α such that, for low α, firm 1 provides the good A to all consumers and, for high α, firm 1 provides the good A to low-cost consumers.

Next, we suppose that both firms compete (our previous analysis applies) and we can show that firm 1 supplies A and B and firm 2 supplies A and B even if $v_1^B = v_2^A < 0$.

Numerical example: $v_1^A = v_2^B = 26 > \overline{s} = 20$ and $v_1^B = v_2^A = -2 < 0$. We can define consumer utilities and costs as follows: $u_1^A = u_2^B = 36$, $u_1^B = u_2^A = 28$ and $c_1^A = c_2^B = 10$, and $c_1^B = c_2^A = 30$. We also assume for the numerical example that $\underline{s} = 2$.

When firms are monopolists, the threshold in α is given by $\alpha = \frac{1}{4}$, but in any case, each firm only provides its strong product as $v_1^B = v_2^A = -2$.

When the firms compete, firms supply both goods, which generates a profit of $\frac{v_1^A - v_2^A - s}{2}\alpha = \frac{v_2^B - v_1^B - s}{2}\alpha = 13\alpha$ for each firm, even if $v_1^B = v_2^A = -2$. Q.E.D.

B Illustration from Johnson's (2017) paper

Following Johnson's (2017) paper, we assume asymmetric competition, in which a large retailer L with a full product line competes against a small firm S with a limited product line.[17] We focus on the pricing behavior of the large retailer and we assume that the small firm is not a strategic player: the expected "in-store" utility of shopping at retailer S will be given by $\widehat{U}_S$.

L carries m products. For simplicity, we assume that $m = 3$. Let c_1, c_2 and c_3 denote the retailing costs of the large retailer for these products. Prices are perfectly observed by consumers, who then decide whether or not to go shopping.

A consumer who visits retailer L purchases quantities x_1, x_2 and x_3 to maximize:

$$\sum_i \zeta_i \left[u_i\left(x_i\right) - p_i x_i\right], \qquad i = 1, 2, 3,$$

where $\zeta_i \in (0, 1)$ is a binary random variable after the consumer chooses the large retailer but before final in-store purchasing decisions are made. Hence, for any i that is carried by L, a consumer has zero demand for it (so that $\zeta_i = 0$) and so buys zero units, or instead has a positive demand for it (so that $\zeta_i = 1$) and so buys quantity x_i to maximize $u_i\left(x_i\right) - p_i x_i$. Let $v_i\left(p_i\right)$ denote the indirect utility associated with product i: $v_i\left(p_i\right) = \max_{x_i} u_i\left(x_i\right) - p_i x_i$; we obtain $\frac{dv_i(p_i)}{dp_i} = -x_i$. The values $\{\zeta_i\}$ are realized independently of each other, and independently and identically across consumers. The true probability that a consumer has positive demand for i is given by θ_i. That is, for any given consumer, $\Pr\left[\zeta_i = 1\right] = \theta_i > 0$. While the true probability is θ_i, each consumer believes that he will have positive demand for product i with some probability $\widehat{\theta}_i$ with $\widehat{\theta}_i \neq \theta_i$. Consumers make unplanned purchases such that $\theta_i \geq \widehat{\theta}_i$. Let $\alpha_i = \frac{\widehat{\theta}_i}{\theta_i}$ denote the accuracy ratio with $\alpha_i \leq 1$.

[17] We use the version (2017), forthcoming in *AER*.

Because consumers believe that they will have a positive demand for i with probability $\widehat{\theta}_i$, each consumer forecasts his expected "in-store" utility of shopping at retailer L to be:

$$\widehat{U}_L = \sum_i \widehat{\theta}_i v_i(p_i).$$

As noticed previously, the expected "in-store" utility of shopping at retailer S is given by $\widehat{U}_S$.

Consumers choose whether to shop at retailer L or at retailer S by considering the values $\left\{\widehat{U}_L, \widehat{U}_S\right\}$. The number of consumers shopping at L is given by $Q\left(\widehat{U}_L, \widehat{U}_S\right)$. Let Q_1 denote the derivative with respect to the first argument; $Q_1 > 0$ so that Q is increasing in $\widehat{U}_L$. Properties of $Q\left(\widehat{U}_L, \widehat{U}_S\right)$ can be found in Johnson (2017, page 6).

The large retailer knows the true probabilities $\{\theta_i\}$ but also know that consumers forecast their utility values $\left\{\widehat{U}_L, \widehat{U}_S\right\}$ based on the values $\left\{\widehat{\theta}_i\right\}$. The result is L sets prices to maximize:

$$Q\left(\widehat{U}_L, \widehat{U}_S\right)\pi_L,$$

where $\pi_L = \sum_i \theta_i (p_i - c_i) x_i(p_i)$.

Define $L_i(p_i) = \frac{p_i - c_i}{p_i}\epsilon_i(p_i)$, where $\epsilon_i(p_i) = \frac{p_i x_i'(p_i)}{x_i(p_i)}$; $L_i(p_i)$ is the Lerner index of good i multiplied by its elasticity, so that if L were simply maximizing $(p_i - c_i) x_i(p_i)$, it would choose a price $\overline{p}_i$ such that $L_i(\overline{p}_i) = -1$ (by using the first-order condition: $(p_i - c_i) x_i'(p_i) + x_i(p_i) = 0$).

We assume in the following in order to make our point, that $x_i(p_i) = a - p_i$. Then, we assume that $c_1 = c_2 = c < a$; however we put no restriction on c_3. We will say that good 3 offers consumers a positive value if $c_3 < a$ and offers consumers a negative value if $c_3 \geq a$. So that, if L were simply maximizing $(p_3 - c_3) x_3(p_3)$, it would choose a price $\overline{p}_3$ such that $L_3(\overline{p}_3) = -1$ if the consumer value of the good 3 were positive and it would not sell the good in case of negative value, that is $c_3 \geq a$.

From the maximization problem of L which is given by $\max_{p_1,p_2,p_3} Q\left(\widehat{U}_L, \widehat{U}_S\right)\pi_L$, we derive first-order conditions ($i = 1, 2, 3$):

$$\frac{\partial \Pi_L}{\partial p_i} = Q\theta_i\left[x_i(p_i) + (p_i - c)\, x_i'(p_i)\right] + Q_1\left[\widehat{\theta}_i \frac{dv_i(p_i)}{dp_i}\right]\pi_L = 0.$$

Using $\frac{dv_i(p_i)}{dp_i} = -x_i(p_i)$ and $L_i(p_i) = \frac{p_i - c}{p_i}\epsilon_i(p_i)$ leads to:

$$\frac{\partial \Pi_L}{\partial p_i} = \frac{x_i(p_i)}{\widehat{\theta}_i}\left[Q\theta_i\left[1 + L_i(p_i)\right] - Q_1\pi_L\right] = 0.$$

Then, with $\alpha_i = \frac{\widehat{\theta}_i}{\theta_i}$, we obtain:

$$\frac{1}{\alpha_i}\left[1 + L_i(p_i)\right] = \frac{Q_1}{Q}\pi_L,$$

as it is derived in Johnson's (2017) paper (see page 9).

We assume that $\alpha_1 < \alpha_2 < \alpha_3$ and that $p_2 = c$ at equilibrium. We know from Proposition 1 (page 9) that good 3 is priced below-cost because $\alpha_2 < \alpha_3$. The result is that, assuming $c_3 = a$, good 3 is sold because it is priced below-cost at equilibrium: $p_3 < a$. By continuity, there exists a threshold in $c_3 > a$ such that good 3 is sold even if it provides consumers a negative value (i.e., $c_3 > a$). The result is obtained because good 3 generates traffic to the large retailer. As claimed by Johnson (2017), goods with few unplanned purchases behave in this way (we can think about bread, milk, and so on). While these goods may provide consumers negative values at L, they can be sold by L, which corresponds to the point we demonstrate in the present paper. Q.E.D.