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Manufacturer suggested retail prices, loss aversion and competition ☆

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ABSTRACT

We study a model of vertical relations with imperfect retail competition in which a fraction of the consumers display reference-dependent demand with respect to the manufacturer's suggested retail price. We demonstrate that in equilibrium the suggestion will either be undercut or complied with by the retailers, but never surpassed: undercutting occurs if competition is fierce, the impact from consumers affected by reference-dependent preferences is significant, and high price suggestions are credible; compliance occurs otherwise. We provide comparisons, and discuss implications, for consumer surplus for the scenarios with suggested retail prices, without vertical restraints and with resale price maintenance.

1. Introduction

Kahneman and Tversky (1979, 1991) posit the idea that, in many contexts, economic agents assess alternatives relative to reference points. Changes in value, as opposed to utility, are defined in terms of gains and losses, based on deviations from a reference point. Reference points can reflect past experiences with similar choices, or be induced by the ways in which choice situations are framed. Kahneman's and Tversky's *prospect theory*, with its insights, originating from research in

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psychology, has inspired many studies within the disciplines of behavioral and experimental economics, as well as behavioral finance validating the existence of non-stable and context dependent consumers' preferences.[1]

While the existence of non-stable and context dependent preferences is well accepted, it is less well understood how consumer and firm behavior is affected by these preferences. To advance our understanding of market scenarios and conditions affecting consumer purchasing and firm pricing behavior in the presence of consumers subject to reference-dependent preferences, we study a model of market competition with vertical restraints between upstream manufacturers and downstream retailers. Vertical restraints are a natural starting point for proposing a behavioral approach to industrial economics for two reasons. First, manufacturers involved in vertical structures with retailers are well placed to affect (frame) the consumers' reference points by making retail price suggestions.[2] Second, competition authorities throughout the world scrutinize vertical restraints because they may lead to consumer welfare losses.[3] Thus, it seems pertinent to analyze whether suggested retail prices could also reduce consumer welfare and, if so, how their current treatment under competition laws and policies should be adapted to constrain their negative impact on consumers.

Our goal is to first analyze how manufacturers and retailers can exploit the presence of (a fraction of) consumers with reference-dependent preferences in a vertical chain and, then, to explore the implications for retail prices and quantities; hence, for consumer welfare. By doing so, we provide novel insights into some of the issues surrounding the existence of reference points for market behavior in a competitive setting.[4] Examples are:

> <u>Question</u>: '*Would upstream manufacturers in a vertical chain with downstream retailers have an incentive to manipulate the consumers' purchasing decisions by altering their reference points, for example, by suggesting non-binding retail prices?*'
> <u>Answer</u>: Not necessarily. Under some conditions, upstream manufacturers would prefer to resort to other forms of vertical restraints and pricing strategies to the exploiting of consumers' reference-dependent behavior.

> <u>Question</u>: '*Would any such manipulation, whether chosen or not, systematically lead to an overall loss of consumer surplus?*'
> <u>Answer</u>: Not necessarily. Under some conditions, manufacturers choose not to suggest a retail price in equilibrium, but consumer surplus would increase if they made such suggestions (that is, manipulative price suggestions would have been beneficial also to those consumers not affected by reference-dependent preferences, yet they are not chosen).

Thereby, with our study, we contribute to and combine two recent and growing bodies of literature, one on the adoption of suggested retail prices as a vertical restraint and another on reference-dependent preferences. In particular, we add to the recent literature that explains the widespread use of non-binding manufacturer suggested retail prices. Lubensky (2011) studies how manufacturer suggested retail prices can help communication between manufacturers and consumers in a consumer search environment; and Olczak (2011) shows that a manufacturer can use suggested retail prices in its bargaining with retailers to its advantage. Our setup adds downstream competition and the presence of (a fraction of) consumers with reference-dependent preferences; it thereby also extends the literature that deals with the consequences and implications of such consumer preferences in industrial economics. A number of recent studies analyze the ways in which the findings of behavioral economics, and of reference-dependent preferences in particular, affect standard models of industrial economics and imperfect competition. See, for example, Heidhues and Kőszegi (2008, 2014) and Zhou (2011).[5] Though, these studies do not explore, as we explicitly do, situations involving consumers with reference-dependent preferences in vertical chain models.

Relating the explanation for suggested retail prices to reference-dependent preferences, Puppe and Rosenkranz (2011) proposes a model in which consumers adopt the suggested retail price as their point of reference and experience a loss when purchasing at a higher price.[6] We follow their modelling of the consumer's decision in that we assume that the reference point is one-dimensional (monetary value) and exogenously given by the suggested price determined by the manufacturer. We add imperfect downstream competition and bargain-loving consumers to that setup. By allowing for a (n arbitrarily small) fraction of consumers to adopt the manufacturer's suggestion as an (exogenous) reference point, we assume that some consumers have a cognitive bias and that their preferences are affected by psychological effects arising purely from framing as described by Tversky and Kahneman (1981). In that sense, our approach is in the spirit of Ok, Ortoleva, and Riella (2014). This paper considers the conditions under which a monopolist choosing price-quality bundles to offer to consumers whose quality valuation is private information can use the attraction effect to overcome incentive-compatibility constraints by, essentially, introducing a, for some consumers, dominated quality-price pair.[7] In their approach, they make use of a notion of reference-dependent

[1] See, among many others, Thaler and Johnson (1990), Thaler, Tversky, Kahneman, and Schwartz (1997), Camerer (2000), Rabin and Thaler (2001), Schmidt and Traub (2002), Kőszegi and Rabin (2006), Kőszegi and Rabin (2007), Kőszegi and Rabin (2009), Einiö, Kaustia, and Puttonen (2008), Munro (2009), Azar (2011, 2013), Attema and Brouwer (2013), and Bayer and Ke (2013).

[2] See Biswas and Blair (1991) and Mazumdar, Raj, and Sinha (2005) for an overview of reference price research in the marketing literature.

[3] See Rey and Tirole (1986), Rey and Stiglitz (1988), Motta (2004), Jullien and Rey (2007), and Rey and Vergé (2008).

[4] Sibly (2002) studies profit-maximizing monopoly behavior in the presence of an exogenously given reference price but does not focus on the strategic manipulation of reference prices.

[5] See also Spiegler (2011), which examines bounded rational consumers in industrial economics more generally.

[6] The idea of explaining the presence of manufacturer suggested retail prices through reference-dependent preferences was first formulated by Rosenkranz (2003).

[7] Similarly, Carbajal and Ely (in press) allows for the consumers' purchasing decisions to be determined by comparisons between the level of a firm's offered quality and a reference quality, in addition to their intrinsic taste for product quality. By doing so, they are able to derive novel effects for product line design due to the interaction between loss aversion and incomplete information, proving that a unique preferred self-confirming contract menu exists in which the quality levels offered by the firm coincide with consumers' preferred (self-confirming menu of) reference quality levels.

preferences introduced in Ok, Ortoleva, and Riella (2015). Similarly, in one of the extensions of Buehler and Gärtner (2013), retail price recommendations serve as a communication device between a privately informed manufacturer and a retailer in a repeated bilateral monopoly in order to maximize joint surplus, in which a reference price is assumed to directly affect demand. As in our model, a reference point is determined by the seller's framing of the consumer decision and not calculated endogenously by consumers. Their (and our) notion, hence, differs from the approach by Kőszegi and Rabin (2006) and Heidhues and Kőszegi (2008, 2014) in which the reference point is assumed to be endogenously determined by the consumer's expectation in a stochastic environment, and in which a suggested price could have, at best, informational value to the consumer, but where (strategic) framing of consumers by manufacturers is not possible.[8]

The assumption that consumers derive gain from purchasing below the manufacturer suggested retail price is particularly realistic in markets for relatively infrequently purchased goods, for which an internal, and current, reference price may not exist, but rather is formed by adopting the publicly available price suggestion, if any. Using a similar assumption, Armstrong and Chen (2013) analyzes discount pricing in a model with bargain-loving consumers who have an intrinsic preference for paying a below-average price.[9] Our assumption that the suggested price may influence preferences and thus serve as a reference point is also empirically relevant. See, e.g., Ariely, Loewenstein, and Prelec (2003). More recently, Bruttel (2014) provides experimental evidence that at any given sale price, demand is larger for higher price suggestions, while it drastically drops for prices above the suggestion.

In line with Puppe and Rosenkranz (2011), in this study the presence of loss-averse consumers allows the non-binding suggested retail price to function as a proxy for a resale price maintenance mechanism and to (incompletely) solve the double marginalization problem. In a similar environment (bilateral monopoly), Buehler and Gärtner (2013) shows that price suggestions will always be undercut if they affect demand directly. However, contrary to these studies, which rationalize only either retail price compliance or undercutting, in the presence of reference-dependent preferences, we show that whether retailers undercut a manufacturer's price suggestion or comply with it depends on the degree of retail competition as well as on how strongly the price suggestion affects demand. If downstream competition is sufficiently strong and consumers with reference-dependent preferences are sufficiently bargain-loving as compared to their loss aversion, then the manufacturer suggests a retail price that retailers undercut. Otherwise, the manufacturer will suggest a retail price that retailers comply with in equilibrium.[10]

Next, we compare consumer welfare under the two alternative equilibria involving manufacturer suggested retail prices (with compliance and with undercutting), against two vertical pricing arrangements not involving retail price suggestions, namely simple linear pricing without vertical restraints and linear pricing with resale price maintenance in the form of a ceiling. Doing so, we find that, in the equilibrium of our model, all consumers (with and without reference-dependent preferences) are better off with a manufacturer suggested retail price than with simple linear wholesale pricing without any vertical restraints. We show, however, that consumers are better off with resale price maintenance than with a manufacturer suggested retail price unless retailers undercut the manufacturer's suggestion and the highest credible retail price suggestion is sufficiently small. We find that the manufacturer's incentives to implement retail price maintenance over a retail price suggestion need not coincide with the impact on consumers: For intermediate degrees of retail competition, they choose resale price maintenance where all consumers (with and without reference-dependent preferences) would have been better off with a manufacturer suggested retail price.

The remainder of the paper is organized as follows. Section 2 introduces a simple model of vertical relations with a manufacturer, two competing retailers, and two types of consumers. Section 3 analyzes the players' optimal decisions in three scenarios: linear wholesale pricing without vertical restraints, linear wholesale pricing with a non-binding retail price suggestion by the manufacturer, and resale price maintenance. Section 4 compares the retail prices across the three scenarios. Section 5 concludes.

2. Model

Consider the following modification of Singh and Vives (1984).[11] There is an economy consisting of a market for a good produced by an upstream manufacturer at cost c, distributed by two differentiated downstream retailers, and a competitive *numeraire* sector. The manufacturer charges a wholesale price, p_w, per unit to the retailers, who resell the good without additional costs. In addition, the manufacturer can publicly suggest a non-binding retail price, p_s, or impose a binding price ceiling, $\overline{p}$.

There is a continuum of consumers of two types with a total mass of 1. Each type's utility function is separable and linear in the *numeraire* good. A share $1-\psi$ of the consumers, indexed A, has standard preferences. The representative consumer of type A maximizes

[8] For example, in the automobile market consumers have come to expect prices below the manufacturer suggested retail price. In practice consumers anchor their price expectations at an (internal) reference point based on the historic prices and announcements made by car manufacturers over time, across different models and different locations, rather than at the manufacturer's price suggestion. We are grateful to Yongmin Chen for this comment.

[9] Similarly, Thaler (2008) analyzes prospect theory value functions that include a 'mental accounting' of potential gains and losses by consumers when choosing among alternatives. In his model, consumers derive 'transaction utility' from purchasing a good at a price below the reference price.

[10] Indeed, in our model, neither the existence of bargain-lovers without sufficiently strong retail competition nor the existence of retail competition without bargain-lovers induces retail prices suggestions that are undercut in equilibrium.

[11] See also Martin (2009).

$$U_A(q_{1,A},q_{2,A}) - p_1 q_{1,A} - p_2 q_{2,A}, \tag{1}$$

where $q_{i,A}$ stands for the quantity of goods purchased from outlet i by the representative consumers of type A and p_i stands for the retail price charged by outlet i. U is assumed to be quadratic and strictly concave: $U_A(q_{1,A},q_{2,A}) = \alpha(q_{1,A}+q_{2,A}) - \frac{1}{2}\left(q_{1,A}^2+q_{2,A}^2\right) - \gamma q_{1,A}q_{2,A}$. We assume $\alpha > c$ and $\gamma \in [0,1[$.

A share ψ of the consumers, indexed B, is affected by reference points, which impact their perceived cost of purchasing the goods. While for A-type consumers the perceived cost is the same as the expenditure necessary to obtain the good, we assume that, for B-type consumers, the perceived cost is above or below the expenditure necessary to obtain the goods, depending on whether the price they pay for them is above or below a price suggestion, if such a suggestion was made. The representative consumer of type B maximizes

$$U_B(q_{1,B},q_{2,B}) - p_1 q_{1,B} - p_2 q_{2,B} + \mu_1(p_s - p_1)q_{1,B} + \mu_2(p_s - p_2)q_{2,B}, \tag{2}$$

where $q_{i,B}$ stands for the quantity of goods purchased from outlet i by the share of consumers indexed B, $U_B(q_{1,B},q_{2,B}) = \alpha(q_{1,B}+q_{2,B}) - \frac{1}{2}\left(q_{1,B}^2+q_{2,B}^2\right) - \gamma q_{1,B}q_{2,B}$, [12] and, denoting the highest credible manufacturer suggested retail price by $\overline{p}_s$, the parameter $\mu_i, i \in \{1,2\}$, scales the B-type consumers' perceived gains and losses according to

$$\mu_i = \begin{cases} \underline{\mu} & \text{if } \overline{p}_s \geqslant p_s > p_i \\ \overline{\mu} & \text{if } \overline{p}_s \geqslant p_i > p_s \\ 0 & \text{if } p_i = p_s \text{ or } p_s > \overline{p}_s \text{ or } \nexists p \text{ or in the absence of a suggestion.} \end{cases} \tag{3}$$

Expressions (2) and (3) imply the following. If a B-type consumer buys from an outlet, which charges a price above the manufacturer's suggested retail price, he perceives a loss from the unpleasant surprise. This loss is larger if the retail price diverges from the suggested price to a greater extent and if the quantity bought is larger. An increase in the parameter $\overline{\mu}$ signifies increased perceived losses per unit purchased at a given retail price above the suggested price. Similarly, if a B-type consumer buys from an outlet, which charges a price below the manufacturer's suggested retail price, he perceives a gain from the pleasant surprise associated with finding the good at a bargain. This gain is larger if the retail price diverges from the suggested price to a greater extent and if the quantity bought is larger. A larger parameter $\underline{\mu}$ signifies that B-type consumers are more bargain-loving: they perceive larger gains per unit purchased at a given retail price below the suggested price.

In line with the asymmetric value function assumed in prospect theory, we impose $0 < \underline{\mu} < \overline{\mu}$: B-type individuals perceive losses more strongly than gains. We also assume $\overline{\mu} < 1$: the standard impact of a price change on consumer surplus is stronger than any non-standard impact due to perceived bargains or losses.

Furthermore, we assume that the highest retail price a manufacturer can credibly suggest, that is one that type B consumers adopt as a reference point, is $\overline{p}_s \leqslant \alpha$: even type B consumers ignore moon price suggestions. Further, denoting by p^{LP} the equilibrium retail price that would prevail with linear wholesale pricing in the absence of vertical restraints and price suggestions, we assume that the highest retail price a manufacturer can credibly suggest is at least as large as p^{LP}.

Assumption 1. $p^{LP} \leqslant \overline{p}_s \leqslant \alpha$. [13]

Finally, we assume that consumers ignore price suggestions if there is a retail price maintenance agreement in place, for example, because they can observe these agreements.

Our assumptions yield inverse demand functions of A-type and B-type consumers of $p_i = \alpha - q_{i,A} - \gamma q_{-i,A}$ and $p_i = \alpha - q_{i,B} - \gamma q_{-i,B} + \mu_i(p_s - p_i)$ with $i \neq -i$, and $i, -i \in \{1,2\}$. Solving for the direct demand functions, we obtain

$$q_{i,A}(p_i,p_{-i}) = \frac{(1-\gamma)\alpha - p_i + \gamma p_{-i}}{1-\gamma^2}, \tag{4}$$

and

$$q_{i,B}(p_i,p_{-i},p_s) = \frac{\alpha(1-\gamma) - (1+\mu_i)p_i + (1+\mu_{-i})\gamma p_{-i} + (\mu_i - \mu_{-i}\gamma)p_s}{1-\gamma^2}, \tag{5}$$

again with $i \neq -i$, and $i, -i \in \{1,2\}$.

3. Analysis

In this section, we first derive the optimal prices and quantities in the vertical chain if the manufacturer charges a simple linear wholesale price without any further vertical restraints, as a benchmark for the subsequent analysis. We then allow the manufacturer to publicly announce a non-binding retail price suggestion and compare the wholesale and retail prices as well

[12] This formulation parallels Azar (2014), where such gains and losses due to deviations from a reference price are assumed to be additively separable from the utility derived from consuming the goods.

[13] The $p^{LP} \leqslant \overline{p}_s$ part of Assumption 1 reduces the number of cases we need to deal with in the text. Appendix B relaxes it and suggests that the main insights of our model continue to hold.

as quantities, profits, and consumer surplus in this scenario with those obtained without the suggestion. We finally allow the manufacturer to impose resale price maintenance and we compare the resulting prices, quantities, profits and consumer surplus with those obtained with the non-binding retail price suggestion.

For simplicity, we study symmetric subgame-perfect equilibria, in which retailers choose the same price level. We refer to this common retail price as "the" retail price.

3.1. Linear wholesale pricing with no vertical restraint

Standard analysis of the vertical chain if the manufacturer charges a linear wholesale price without vertical restraints yields equilibrium quantities of $q_i^{LP} = \frac{\alpha-c}{2(2-\gamma)(1+\gamma)}$, equilibrium retail prices of $p^{LP} = \alpha - \frac{\alpha-c}{2(2-\gamma)}$ and an equilibrium wholesale price of $p_w^{LP} = \frac{\alpha+c}{2}$. These imply a profit for the manufacturer and each downstream retailer of $\Pi_U^{LP} = \frac{(\alpha-c)^2}{2(2-\gamma)(1+\gamma)}$ and $\Pi_D^{LP} = \frac{(1-\gamma)(\alpha-c)^2}{4(2-\gamma)^2(1+\gamma)}$ and a consumer surplus of $CS^{LP} = \frac{(\alpha-c)^2}{4(1+\gamma)(2-\gamma)^2}$. See Appendix A.1 for the derivations.

3.2. Linear wholesale pricing with suggested retail prices

Assume now the manufacturer charges a linear wholesale price, suggests a retail price, and does not impose a retail price ceiling. In this case, retailer i's aggregate demand is $q_i(p_i, p_{-i}, p_s) = (1-\psi)q_{i,A}(p_i, p_{-i}) + \psi q_{i,B}(p_i, p_{-i}, p_s)$.

3.2.1. The retailers' problem

Retailer i solves

$$\max_{p_i}(p_i - p_w)q_i(p_i, p_{-i}, p_s).$$

Let $p_i(p_w, p_s)$ denote the symmetric equilibrium solution to this problem, i.e., $p_i(p_w, p_s)$ is the best response of the retailers $i = 1, 2$ to the manufacturer setting p_w and p_s. To understand the equilibrium in the retailers' subgame, start with a (p_w, p_s) such that $p_i(p_w, p_s) < p_s$ and, holding p_s fixed, increase p_w. In Appendix A.2, we show that, for fixed p_s the optimal retail price is strictly increasing in p_w at a constant rate as it approaches p_s from below. We denote by $\underline{p_w}(p_s)$ the smallest value of the wholesale price for which the optimal retail price equals the suggestion. An increase of the retail price beyond p_s would trigger loss aversion (keeping p_s fixed). Therefore, a marginal increase in the wholesale price beyond $\underline{p_w}(p_s)$, would not induce retailers to increase their price above the suggestion, implying a "flat" part of the optimal retail price. It is only once the wholesale price, which constitutes the retailers' per-unit cost, exceeds a certain threshold, that the retailers start finding it profitable again to increase their prices, despite the demand reduction due to loss aversion. We denote this threshold by $\overline{p_w}(p_s)$. The following proposition formalizes these arguments.

Proposition 1. *For every p_s, there exist $\underline{p_w}(p_s) < \overline{p_w}(p_s)$ such that*

$$p_i(p_w, p_s) = \begin{cases} \frac{(1-\gamma)(\alpha+\psi\underline{\mu}p_s)+(1+\psi\underline{\mu})p_w}{(2-\gamma)(1+\psi\underline{\mu})} & \text{if } p_w < \underline{p_w}(p_s), \\ p_s & \text{if } \underline{p_w}(p_s) \leqslant p_w < \overline{p_w}(p_s), \\ \frac{(1-\gamma)(\alpha+\psi\overline{\mu}p_s)+(1+\psi\overline{\mu})p_w}{(2-\gamma)(1+\psi\overline{\mu})} & \text{if } \overline{p_w}(p_s) \leqslant p_w. \end{cases}$$

Proof. See Appendix A.2. □

Fig. 1 illustrates the retail price setting equilibrium. The equilibrium retail price increases in p_w until it reaches the manufacturer's suggestion, p_s. At that point, a further increase of p_i would induce loss aversion and retailers are reluctant to pass on further increases in the wholesale price to consumers. Once the wholesale price reaches the threshold $\overline{p_w}$, the equilibrium retail price jumps to a higher level.

3.2.2. The manufacturer's problem

While the logic of the retailers' problem analyzed in the previous subsection follows closely that of Proposition 1 in Puppe and Rosenkranz (2011), the manufacturer's problem is quite different due to the presence of competition and bargain-loving consumers.[14] In particular, there can now be equilibria in which the retailers undercut the manufacturer's suggestion.

In principle, there could be three types of symmetric equilibria, one in which the manufacturer sets p_s and p_w such that the retailers set a price above the manufacturer's suggestion, one in which the retailers comply with the suggestion, and one in which they undercut the manufacturer's suggestion by setting a retail price below p_s. We first show that the manufacturer's profit is monotonically increasing in the price suggestion if retail prices are not equal to that suggestion in equilibrium. This implies that, in equilibrium, a manufacturer would never choose a suggestion which would induce

[14] Rosenkranz (2003) models bargain-loving consumers, but no downstream competition.

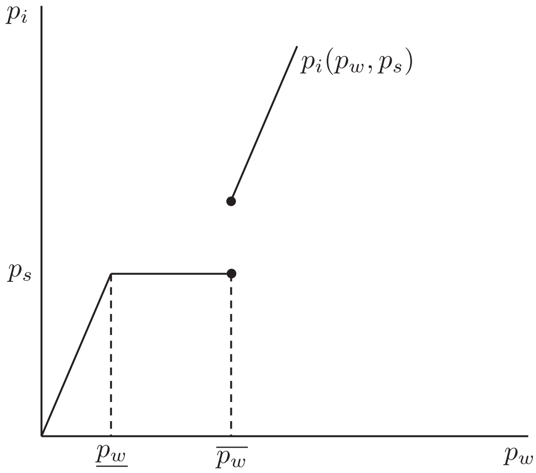

Fig. 1. Equilibrium retail prices, $p_i(p_w, p_s)$, as a function of the wholesale price, p_w, and the manufacturer's suggested retail price, p_s. $\underline{p_w}$ is the smallest value of the wholesale price for which the optimal retail price, $p_i(p_w, p_s)$, equals the suggestion, p_s. $\overline{p_w}$ is the threshold for p_w beyond which the retailers start finding it profitable again to increase their prices, despite the demand reduction due to loss aversion.

retailers to set prices above that level.[15] Furthermore, it also implies that, in an equilibrium in which the retailers undercut the suggestion, the manufacturer always suggests the highest credible level. We then derive the conditions on the degree of loss aversion and bargain-loving, the share of consumers with reference-dependent preferences, and the degree of competition, for which the manufacturer sets p_w and p_s such that retailers either price at or below the manufacturer's suggestion.

Lemma 1. *For all $\overline{p}_s \geqslant p^{LP}$, there is no symmetric subgame-perfect equilibrium in which the retailers price above the manufacturer's suggestion.*

Proof. Using Proposition 1 and plugging the optimal price into the demand function, one derives the quantities in the symmetric equilibrium for retail prices not equal to the suggestion as

$$q_i(p_w, p_s) = \frac{\alpha + \psi\mu p_s - (1+\psi\mu)p_w}{(2-\gamma)(1+\gamma)}.$$

For any given wholesale price, this quantity is increasing in p_s and therefore the manufacturer's profit is strictly increasing in p_s.

Next, note that for any suggested retail price p_s, given the downstream equilibrium described in Proposition 1, the manufacturer sets $p_w = \frac{\alpha+\psi\mu p_s+(1+\psi\mu)c}{2(1+\psi\mu)}$. Plugging this back into the symmetric downstream equilibrium prices described in Proposition 1, we find $p_i = \alpha - \frac{\alpha-c}{2(2-\gamma)} - \frac{\psi\mu(3-2\gamma)(\alpha-p_s)}{2(2-\gamma)(1+\psi\mu)} < \alpha - \frac{\alpha-c}{2(2-\gamma)} = p^{LP}$.

Now, suppose there is an equilibrium in which the manufacturer suggests a price that retailers find optimal to exceed. Then, the manufacturer could increase its profit by raising the price suggestion up to the retailers' price. Because $p_s < p_i < p^{LP} \leqslant \overline{p}_s$, such an increase is feasible for the manufacturer, implying that a manufacturer's suggestion of a price that retailers find optimal to exceed cannot be an equilibrium. □

This leaves us with two equilibrium candidates: one in which the retailers price at (equal to, denoted by superscript "=") the suggestion, $p_i(p_w, p_s) = p_s$ and one in which they undercut (set it lower than, denoted by superscript "$<$") the suggestion, $p_i(p_w, p_s) < p_s$.

Suppose there is an equilibrium in which $p_i(p_w, p_s) = p_s$. Clearly, the manufacturer sets $p_w = \overline{p_w}(p_s)$. In Appendix A.2, we show that $\overline{p_w}(p_s) = p_s - \frac{(1-\gamma)(\alpha-p_s)}{1+\psi\overline{\mu}}$. Given $p_w = \overline{p_w}(p_s)$ and using the demand function (4), in the symmetric equilibrium in which $p_i = p_{-i} = p_s$ the manufacturer sets p_s to solve

$$\max_{p_s} 2(\overline{p_w}(p_s) - c)\frac{\alpha - p_s}{1+\gamma},$$

yielding $p_s^{=} = \alpha - \frac{(1+\psi\overline{\mu})(\alpha-c)}{2((1+\psi\overline{\mu})+(1-\gamma))}$, $q_i^{=} = \frac{(1+\psi\overline{\mu})(\alpha-c)}{2(1+\gamma)(2-\gamma+\psi\overline{\mu})}$, and $\Pi_U^{=} = \frac{(1+\psi\overline{\mu})(\alpha-c)^2}{2(1+\gamma)(2-\gamma+\psi\overline{\mu})}$. See Appendix A.3 for the derivations.

[15] Provided that $\overline{p}_s$ is sufficiently large. A sufficient condition is $p^{LP} \leqslant \overline{p}_s$.

Because the manufacturer's profit is strictly increasing in the price suggestion if the optimal retail prices are not equal to that suggestion, in an equilibrium, in which $p_i(p_w, p_s) < p_s$, the manufacturer sets $p_s = \overline{p}_s$. Using this, we find $p_w^< = \frac{\alpha+\psi\underline{\mu}\overline{p}_s+(1+\psi\underline{\mu})c}{2(1+\psi\underline{\mu})}$ and, plugging the wholesale price back into the downstream equilibrium prices, we find downstream prices of $p_i^< = \alpha - \frac{\alpha-c}{2(2-\gamma)} - \frac{\psi\underline{\mu}(3-2\gamma)(\alpha-\overline{p}_s)}{2(2-\gamma)(1+\psi\underline{\mu})}$ and quantities of $q_i^< = \frac{\alpha+\psi\underline{\mu}\overline{p}_s-(1+\psi\underline{\mu})c}{2(2-\gamma)(1+\gamma)}$. With a retail price suggestion that retailers undercut, the manufacturer receives a profit of $\Pi_U^< = \frac{(\alpha+\psi\underline{\mu}\overline{p}_s-(1+\psi\underline{\mu})c)^2}{2(2-\gamma)(1+\gamma)(1+\psi\underline{\mu})}$. See Appendix A.4 for the derivations.

Using the manufacturer's profit we have derived for the two equilibrium candidates, we characterize the parameter constellations in which one or the other equilibrium prevails as follows:

Proposition 2. *Suppose that the manufacturer makes a price suggestion. Then, there exists an equilibrium in which the manufacturer implements a suggested price that retailers comply with if and only if*

$$\Pi_U^< = \frac{(\alpha+\psi\underline{\mu}\overline{p}_s-(1+\psi\underline{\mu})c)^2}{2(2-\gamma)(1+\gamma)(1+\psi\underline{\mu})} \leqslant \frac{(1+\psi\overline{\mu})(\alpha-c)^2}{2(1+\gamma)(2-\gamma+\psi\overline{\mu})} = \Pi_U^=.$$

Otherwise, there exists an equilibrium in which the manufacturer implements a suggestion that retailers undercut if and only if $\Pi_U^< \geqslant \Pi_U^=$.

Whether the suggested retail price is complied with by the retailers therefore depends on the level of the highest credible price suggestion, the degree of competition, the share of consumers with reference-dependent preferences, and the extent of their loss aversion and love for bargains.

Assume $\overline{p}_s = \alpha$. Then the manufacturer implements a suggestion that retailers comply with if $1+\psi\underline{\mu} \leqslant (1+\psi\overline{\mu})(2-\gamma)/(2-\gamma+\psi\overline{\mu})$ or, equivalently, if $0 < \psi\underline{\mu} < \frac{1}{3}$ and $\frac{2\psi\underline{\mu}}{1-\psi\underline{\mu}} < \psi\overline{\mu} < 1$ and $0 < \gamma \leqslant \frac{\psi\overline{\mu}-2\psi\underline{\mu}-\psi^2\overline{\mu}\underline{\mu}}{\psi\overline{\mu}-\psi\underline{\mu}}$. Hence, our model predicts that we should observe retailers comply with suggested prices if consumers with reference-dependent preferences perceive losses sufficiently strongly as compared to bargains and if retail competition is not too strong.

If $\overline{p}_s < \alpha$, then the profit of the manufacturer that implements a suggestion that retailers undercut is lower than that in case $\overline{p}_s = \alpha$. Therefore, if the highest credible suggested retail price is lower than α, we observe retailers comply with the manufacturer's suggestion for higher degrees of retail competition.

Hence, for an identical product sold in multiple outlets and carrying some manufacturer's price suggestion, our results suggest that (1) if that product's retail pricing strongly affects consumers' selection whether to buy from one outlet or another, then we are in world with high potential for business stealing and would expect the manufacturer to have set a price suggestion at a level which triggers undercutting; and (2) if that product's retail pricing only weakly affects the consumers' selection whether to buy from one outlet or another, then we are in a world with low potential for business stealing and would expect a manufacturer to have set a price suggestion at a level which retailers comply with.

3.3. Resale price maintenance

Assume now the manufacturer charges a linear wholesale price, but imposes a retail price ceiling, $\overline{p}$, thereby foregoing the option to recommend a retail price. We concentrate on the case in which the manufacturer can extract all rents from the downstream retailers, by imposing a wholesale price equal to the price ceiling, and by setting the level of the wholesale price ceiling equal to the retail price which would have maximized the joint profits of the industry, as if the upstream manufacturer and the downstream retailers were fully integrated.[16] Adopting resale price maintenance, hence, leads to $p_w^{RPM} = p_i^{RPM} = p_{-i}^{RPM} = \frac{\alpha+c}{2} = \alpha - \frac{\alpha-c}{2}$, yielding the quantities $q_i^{RPM} = q_{-i}^{RPM} = \frac{\alpha-c}{2(1+\gamma)}$, and a profit for the upstream manufacturer of $\Pi_U^{RPM} = \frac{(\alpha-c)^2}{2(1+\gamma)}$.

3.4. Equilibrium vertical restraint

Comparing the manufacturer's profit with linear wholesale pricing, suggested retail prices and resale price maintenance, we find the following result:

[16] This conduct is equivalent to an effectively 'enforced' retail price recommendation. Competition authorities typically view this behavior with suspicion because they consider it to be potentially harmful to consumers: it has the power to reduce/soften competition downstream. In the presence of bilateral monopolies, one upstream and one downstream, such a pricing strategy would have the virtue of eliminating double marginalization. However, in the presence of downstream competition, combining price ceiling and a downstream wholesale price equal to the ceiling, is a way to enforce price fixing, to a level other than the one which would have prevailed in the market otherwise. Whether this is detrimental overall, depends on the degree of elimination of the downstream competition (which is bad) as opposed to the elimination of double marginalization (which is good). Typically, suggested retail prices are considered legal as long as they are not enforced by the manufacturer, for example, by threatening to refuse to supply retailers in cases of non-compliance. For additional information, see "*Minimum retail price accords allowed, U.S. Supreme Court rules*," The New York Times, June 28, 2007, http://www.nytimes.com/2007/06/28/business/worldbusiness/28iht-price.4.6394812.html.

Proposition 3. *The manufacturer is better off*

1. *suggesting a retail price than with simple linear wholesale pricing;*
2. *with resale price maintenance than with a suggested retail price that retailers comply with; and*
3. *with resale price maintenance than with a suggested retail price that retailers undercut whenever* $\gamma < 1 - \psi\underline{\mu}$.

Proof. Part 1. It is easy to check that $\Pi_U^{LP} < \Pi_U^{=}$ always holds. Furthermore, the manufacturer will only implement a suggested retail price-wholesale price combination that retailers undercut if $\Pi_U^{<} > \Pi_U^{=}$, implying Part 1.

Part 2. It is easy to check that $\Pi_U^{=} < \Pi_U^{RPM}$ always holds.

Part 3. The manufacturer's profit from suggesting a retail price that retailers undercut, $\Pi_U^{<}$, is increasing in the highest credible SRP, $\overline{p}_s$. Hence, the condition for $\Pi_U^{RPM} > \Pi_U^{<}$ if $\overline{p}_s = \alpha$ is a sufficient condition for $\Pi_U^{RPM} > \Pi_U^{<}$ in general. This condition is $\gamma < 1 - \psi\underline{\mu}$. □

Part 1 of Proposition 3 implies that, if there are consumers that use the manufacturer suggested retail price as a reference point and resale price maintenance is not an option, then the manufacturer should always suggest one.[17] Parts 2 and 3 say, if resale price maintenance is an option, the manufacturer prefers it unless competition is sufficiently tough and there are many, very bargain-loving consumers. In that case, it prefers to suggest a retail price that retailers undercut.

4. Impact of suggested retail prices on consumers

What is the impact of introducing manufacturer suggested retail prices on consumer welfare in our framework? To assess this question, we compare equilibrium retail prices with a manufacturer's suggestion with equilibrium prices that would have prevailed in the absence of such a suggestion as well as with equilibrium prices that would have prevailed with retail price maintenance.

If retail prices with a manufacturer's suggestion are *lower* than those without a suggestion or those with retail price maintenance, then both types of consumers are better off, irrespective of whether the retailers *comply with* the manufacturer's suggestion *or undercut* it. If retail prices with a manufacturer's suggestion that retailers *comply with* are *higher* than those without a suggestion or than those with retail price maintenance, then both types of consumers are worse off due to the suggestion. Finally, if retail prices with a manufacturer's suggestion that retailers *undercut* are *higher* than those without, then *A*-type consumers are worse off. Whether *B*-type consumers are also worse off depends on how bargain-loving *B*-type consumers are and whether we include the gains they derive purely from receiving a bargain in our consumer welfare measure.

4.1. Consumer surplus gross of behavioral gains and losses

We start our discussion not counting the gains from perceived bargains in the consumer surplus. A comparison of retail prices yields:

Proposition 4.

1. $p^{RPM} < p^{=} \leqslant p^{LP}$.
2. $p^{<} \leqslant p^{LP}$ *and* $p^{RPM} < p^{<} \iff \overline{p}_s > \frac{(2-\gamma)\psi\underline{\mu}\alpha-(1-\gamma)\alpha+(1-\gamma)(1+\psi\underline{\mu})c}{(3-2\gamma)\psi\underline{\mu}}$.

Therefore, both *A*- and *B*-type consumers are better off with a suggestion that retailers comply with than without the suggestion if the comparison is a situation in which there is simple linear wholesale pricing; and they are both better off with resale price maintenance than with a suggestion that retailers comply with. Given the problem of double marginalization, the manufacturer benefits from lower retail prices, which also benefits consumers. The manufacturer's influence on the retail price is greater with suggested retail pricing with compliance than with linear pricing; and greater with resale price maintenance than with suggested retail pricing with compliance. This implies that double marginalization is smaller with suggested retail pricing with compliance than with linear pricing; and smaller with resale price maintenance than with suggested retail pricing with compliance. Hence, it is intuitive to find that consumer welfare is greater with suggested retail pricing with compliance than with linear pricing; and greater with resale price maintenance than with suggested retail pricing with compliance.

Both *A*- and *B*-type consumers are better off with a suggestion that retailer undercut than without it if the comparison is a situation in which there is simple linear wholesale pricing; and they are better off with resale price maintenance if the highest credible suggested retail price is sufficiently large. To see this, note first that $p^{<}$ is increasing in the highest credible retail price suggestion, $\overline{p}_s$. If that equals the highest willingness to pay, that is if $\overline{p}_s = \alpha$, then the retail price with such an suggested

[17] Proposition 2 tells us which version the manufacturer implements – either a suggestion that retailers comply with or one that they undercut in equilibrium.

retail price is strictly larger than with resale price maintenance, $p^{<} > p^{RPM}$. Once the highest credible suggested retail price is sufficiently low, retail prices with a suggested retail price that retailers undercut are smaller than those with retail price maintenance.

The difference $p^{LP} - p^{=}$ is decreasing in γ. The more competitive the retailers, the lower is the problem of double marginalization to begin with, and the lower is the potential gain from the retail price suggestion. Further, the difference between p^{LP} and $p^{=}$ is increasing in $\overline{\mu}$ and ψ. If B-type consumers are more numerous and/or they are more loss-averse, they will have a stronger impact on the retailer's loss from increasing their retail price beyond the manufacturer's suggestion, which allows the manufacturer (i) to charge a higher wholesale price for any given suggestion and therefore (ii) to suggest a lower retail price in the first place. The difference $p^{RPM} - p^{=}$ is decreasing in γ, ψ, and $\overline{\mu}$. Stronger competition reduces the disadvantage of only being able to approximate resale price maintenance imperfectly with a suggested retail price that retailers comply with. Furthermore, if there are more B-type consumers and if these are more loss-averse, then, for any γ, this approximation is closer to resale price maintenance.

The difference $p^{LP} - p^{<}$ is decreasing in $\overline{p}_s$ and γ and increasing in $\underline{\mu}$ and ψ. Note that the demand with undercutting is expanded, but that it is also less steep. This implies that an increase in the degree of downstream competition leads to a narrowing of the gap between simple linear wholesale pricing and pricing with a suggested retail price that is undercut. Further note that, for the highest degree of competition, $\gamma \to 1, p^{<} < p^{LP}$ as long as $\psi\underline{\mu} \neq 0$ and $\overline{p}_s \neq \alpha$. Finally, an increase in the share of B-type consumers or their degree of bargain-lovingness, lowers the retail price with a suggestion that is undercut, whereas the retail price with simple linear wholesale pricing is unaffected.

The difference $p^{<} - p^{RPM}$ is decreasing in γ, ψ, and $\underline{\mu}$, and increasing in $\overline{p}_s$. If there were almost no B-type consumers ($\psi \to 0$) or if the B-type consumers were not very bargain-loving ($\underline{\mu} \to 0$), the price that retailers charge, which undercuts a manufacturer's suggestion, $p^{<}$, would approach the retail price with plain linear wholesale pricing, p^{LP}. Because of the double marginalization problem, this price is greater than that with resale price maintenance. Once the share of bargain-loving consumers and their degree of bargain-lovingness increases, the retailers are able to benefit from these customers' demand expansion by undercutting the manufacturer's suggestion.

An increase of the degree of retail competition decreases the retail price with the manufacturer's suggestion, $p^{<}$, but does not impact that with resale price maintenance, p^{RPM}. Hence, the stronger the competition the more likely are all consumers better off with a manufacturer's suggestion that retailers undercut than with resale price maintenance.

Because the manufacturer sets the price suggestion at the highest level that B-type consumers adopt as their reference price, an increase in this highest level increases the retail price with such a suggestion.

The condition in Part 2 of Proposition 4 can be rewritten as $\psi\underline{\mu}((1-\gamma)(\alpha-c)+(\alpha-\overline{p}_s)-2(1-\gamma)(\overline{p}_s-c)) > (1-\gamma)(\alpha-c)$. Clearly, for high $\overline{p}_s$, this cannot hold as the left-hand side of this inequality would be negative, whereas the right-hand side is positive. For sufficiently low $\overline{p}_s$, we have $(1-\gamma)(\alpha-c)+(\alpha-\overline{p}_s)-2(1-\gamma)(\overline{p}_s-c) > 0$, and in this case, the condition can be written as $\psi\underline{\mu} > \frac{(1-\gamma)(\alpha-c)}{(1-\gamma)(\alpha-c)+(\alpha-\overline{p}_s)-2(1-\gamma)(\overline{p}_s-c)}$. Hence, the retail price with a manufacturer's suggestion that retailers undercut is lower than that with resale price maintenance if there are sufficiently many sufficiently bargain-loving consumers *and* the highest retail price suggestion that B-type consumers use as a reference price is sufficiently low. Furthermore, it is lower for any $\psi\underline{\mu}$ as long as γ is large, that is, for strong competition. Note further, Proposition 2 shows that for strong competition the set of the highest credible price suggestion for which the manufacturer suggests a retail price that retailers undercut in equilibrium instead of one that retailers comply with, is the largest. That means in this case it is most likely that the suggested price is indeed undercut. Hence, for sufficiently strong retail competition (high γ), the manufacturer chooses a manufacturer suggested retail price that retailers undercut for any arbitrarily small share of B-type consumers (ψ) with any arbitrarily small degree of bargain-loving ($\underline{\mu}$). Furthermore, the resulting retail price is lower than the retail prices that would result with both retail price maintenance and linear wholesale pricing in the absence of a suggestion.

Note that all of these effects are true even if the share of B-type consumers is very small and note that all consumers, including our A-type consumers, are affected by the manufacturer's retail price suggestion.

4.2. Welfare net of behavioral gains and losses

We now extend our discussion to account for the B-types' gains from perceived bargains and report additional insights from doing so, which makes assessing the B-type consumers' welfare less clear-cut. We need to compare the B-types' consumer surplus according to Eq. (2), where we use quantities according to Eq. (5), the retail price $p^{<}$ and the retail price suggestion $\overline{p}_s$, with the B-types' consumer surplus according to Eq. (2) without a manufacturer's retail price suggestion when retail prices are p^{RPM}.

We compute the consumer surplus with resale price maintenance as $CS_B^{RPM} = \frac{(\alpha-c)^2}{4(1+\gamma)}$ and that with a manufacturer suggested retail price that retailers undercut as $CS_B^{<} = \frac{\left((\alpha-c)(1+\underline{\mu})(1+\psi\underline{\mu})-(\alpha-\overline{p}_s)\underline{\mu}\left(4-2\gamma(1-\psi)-(3-\underline{\mu})\psi\right)\right)^2}{4(2-\gamma)^2(1+\gamma)(1+\psi\underline{\mu})^2}$.

It follows that for $\underline{\mu}+\gamma < 1, CS_B^{\ll} CS_B^{RPM}$ for all α, c, and $\overline{p}_s$. For $\underline{\mu}+\gamma > 1$, on the other hand, $CS_B^{<} < CS_B^{RPM}$ if and only if $\overline{p}_s < \frac{\alpha\left(1+3\underline{\mu}-\gamma\left(1+\underline{\mu}(2-\psi)\right)-2\psi\underline{\mu}\right)-c(1-\gamma-\underline{\mu})(1+\psi\underline{\mu})}{\underline{\mu}\left(4-2\gamma(1-\psi)-\psi(3-\underline{\mu})\right)}$.

Because the manufacturer would prefer resale price maintenance to suggesting a retail price that retailers undercut in equilibrium if and only if $\gamma < 1 - \psi\underline{\mu}$, for intermediate degrees of competition, the manufacturer would prefer resale price maintenance whereas a non-binding suggested retail price would make B-type consumers better off. If, in addition, the highest credible suggested retail price is not too large, then also the A-type consumers may be better off.

5. Conclusions

The purpose of this study is to analyze the potential for manufacturers and retailers to exploit the presence of (some) consumers with reference-dependent preferences in a vertical chain with imperfect downstream competition. Within this framework, we have derived implications for retail prices and quantities, and hence, for consumer welfare. In doing so, our findings contribute to the growing literature on the consequences and implications of reference-dependent consumer preferences in industrial economics.

Our results demonstrate that, in equilibrium, a manufacturer would set a wholesale price and a retail price suggestion that retailers either comply with or undercut. Retailers undercut the manufacturer's suggestion if retail competition is strong, there are many consumers with reference-dependent preferences and their preferences are such that their loss aversion is not too much stronger than their bargain-loving. Retailers comply with the suggestion otherwise. The manufacturer always benefits from introducing a retail price suggestion compared with simple linear wholesale pricing. A manufacturer can, however, do better with resale price maintenance if retailers comply in equilibrium or if retailer undercut in equilibrium and retail competition is not sufficiently fierce.

Equilibrium retail prices with a retail price suggestion are lower than without such a suggestion both when retailers comply with the manufacturer's suggestion and when they undercut it. They are higher than with resale price maintenance than with a suggestion whenever retailers were to comply with the suggestion in equilibrium or if retailers were to undercut the manufacturer's suggestion unless the highest credible retail price suggestion is sufficiently low, competition is sufficiently strong and there are many sufficiently bargain-loving consumers.

Our model does not address multi-product competition. To study to which extent the interplay of both intra-brand and inter-brand competition affects the adoption of price suggestions and consumer welfare a framework similar to Azar (2014) could be used. Azar (2014) looks at 'relative thinking' by consumers, which generates the opportunity for retailers selling two goods, one with a high and one with a low reference price, to maintain the prices of these goods further apart, in particular, by inflating the price of the high reference good. This discrepancy in the pricing of the two goods attracts consumers to the stores, when consumers value and purchase both goods. If, in addition to this, the reference prices were to be chosen by manufacturers, as in our model, it would be interesting to see whether this upward pressure in the pricing of one good would still prevail, and if so, whether it would lead to more or less retailer compliance with the suggestions. We leave this to future research.

Appendix A. Proofs

A.1. Linear wholesale pricing without vertical restraints

Assume the manufacturer charges a linear wholesale price and foregoes both the option to recommend a retail price as the one to impose a retail price ceiling. In this case, each downstream retailer i solves

$$\max_{p_i}(p_i - p_w)\frac{(1-\gamma)\alpha - p_i + \gamma p_{-i}}{1-\gamma^2},$$

leading to equilibrium downstream prices $p_1(p_w) = p_2(p_w) = (\alpha(1-\gamma) + p_w)/(2-\gamma)$ and quantities $q_1(p_w) = q_2(p_w) = (\alpha - p_w)/((2-\gamma)(1+\gamma))$. Taking this into account, the upstream manufacturer solves

$$\max_{p_w} 2(p_w - c)\frac{(1-\gamma)\alpha - \frac{\alpha(1-\gamma)+p_w}{2-\gamma} + \gamma\frac{\alpha(1-\gamma)+p_w}{2-\gamma}}{1-\gamma^2},$$

leading to $p_w^{LP} = (\alpha + c)/2$ and, plugging the wholesale price back into the downstream equilibrium prices, to final downstream prices and quantities of $p_1^{LP} = p_2^{LP} = \alpha - (\alpha - c)/(2(2-\gamma))$ and $q_1^{LP} = q_2^{LP} = (\alpha - c)/(2(2-\gamma)(1+\gamma))$. In this case, the upstream manufacturer receives an equilibrium profit of $\Pi_U^{LP} = ((\alpha - c)^2)/(2(2-\gamma)(1+\gamma))$, each downstream retailer receives a profit of $\Pi_D^{LP} = ((1-\gamma)(\alpha - c)^2)/(4(2-\gamma)^2(1+\gamma))$, and consumers receive a consumer surplus of $CS^{LP} = ((\alpha - c)^2)/(4(1+\gamma)(2-\gamma)^2)$.

A.2. Proof of Proposition 1

To find the optimal retail price below or above the manufacturer's suggested retail price for any given p_w, retailer i solves

$$\max_{p_i}(p_i - p_w)\left(\frac{(1-\gamma)\alpha - p_i + \gamma p_{-i}}{(1+\gamma)(1-\gamma)} + \psi\frac{\mu_i(p_s - p_i) + \mu_{-i}(p_{-i} - p_s)}{(1+\gamma)(1-\gamma)}\right)$$

The solutions to these problems yield a symmetric equilibrium candidate with a retail price of $p_i(p_w, p_s) = ((1-\gamma)(\alpha + \psi\mu_i p_s) + (1+\psi\mu_i)p_w)/((2-\gamma)(1+\psi\mu_i))$ and quantities of $q_i(p_w, p_s) = (\alpha + \psi\mu_i p_s - (1+\psi\mu_i)p_w)/((2-\gamma)(1+\gamma))$.

For $p_i(p_w, p_s) < p_s$, $\mu_i = \underline{\mu}$ and the retail price becomes $p_i(p_w, p_s) = ((1-\gamma)(\alpha + \psi\underline{\mu}p_s) + (1+\psi\underline{\mu})p_w)/((2-\gamma)(1+\psi\underline{\mu}))$.

For $p_i(p_w, p_s) > p_s$, $\mu_i = \overline{\mu}$ and the retail price becomes $p_i(p_w, p_s) = ((1-\gamma)(\alpha + \psi\overline{\mu}p_s) + (1+\psi\overline{\mu})p_w)/((2-\gamma)(1+\psi\overline{\mu}))$.

Note how $((1-\gamma)(\alpha + \psi\mu_i p_s) + (1+\psi\mu_i)p_w)/((2-\gamma)(1+\psi\mu_i))$ is an increasing function of p_w. Hence, for a given p_s, there exists a $p_w = \underline{p_w}(p_s)$ such that $((1-\gamma)(\alpha + \psi\mu_i p_s) + (1+\psi\mu_i)\underline{p_w}(p_s))/((2-\gamma)(1+\psi\mu_i)) = p_s$.

If both retailers set $p_i = p_{-i} = p_s$, the quantity each retailer sells is $q_i(p_s) = (\alpha - p_s)/(1+\gamma)$ and each retailer's profit is $\Pi_D(p_s, p_w) = (p_s - p_w)(\alpha - p_s)/(1+\gamma)$. We compute firm i's best deviation to $p_{-i} = p_s$ given p_w and p_s by solving

$$\max_{p_i}(p_i - p_w)\frac{\alpha(1-\gamma) - (1+\psi\mu_i)p_i + (1+\psi\mu_{-i})\gamma p_s + (\psi\mu_i - \psi\mu_{-i}\gamma)p_s}{(1-\gamma)(1+\gamma)},$$

yielding $\widehat{p}_i(p_s, p_w) = ((1-\gamma)\alpha + (\gamma + \psi\mu_i)p_s + (1+\psi\mu_i)p_w)/(2(1+\psi\mu_i))$ and $\widehat{q}_i(p_s, p_w) = ((1-\gamma)\alpha + (\gamma + \psi\mu_i)p_s - (1+\psi\mu_i)p_w)/(2(1-\gamma)(1+\gamma))$ and a profit for the deviating retailer of $\widehat{\Pi}_D(p_s, p_w) = (((1-\gamma)\alpha + (\gamma+\psi\mu_i)p_s - (1+\psi\mu_i)p_w)^2)/(4(1-\gamma)(1+\gamma)(1+\psi\mu_i))$.

Given a p_s, the highest p_w the manufacturer can charge without causing the retailers to increase their price beyond $p_i = p_{-i} = p_s$, that is, $\overline{p_w}(p_s)$, is found by solving

$$\Pi_D(p_s, p_w) = (p_s - p_w)\frac{\alpha - p_s}{1+\gamma} \geqslant \frac{((1-\gamma)\alpha + (\gamma+\psi\mu_i)p_s - (1+\psi\mu_i)p_w)^2}{4(1-\gamma)(1+\gamma)(1+\psi\mu_i)} = \widehat{\Pi}_D(p_s, p_w)$$

for p_w. Note that the retailer's best deviation is to a $\widehat{p}_i > p_s$, implying $\mu_i = \overline{\mu}$. This gives $p_w \leqslant \overline{p_w}(p_s) = p_s - ((1-\gamma)(\alpha - p_s))/(1+\psi\overline{\mu})$.

A.3. Retailers complying with the suggested retail price

In this scenario, the manufacturer exploits the kink introduced into its demand curve by the consumers with reference-dependent preferences. To do so, it sets the profit-maximizing pair (p_s, p_w) such that each retailer obtains the same profit adhering to $p_i = p_s$ as it would with its optimal deviation from p_s.

Given $\overline{p_w}(p_s)$, the manufacturer sets the p_s that solves

$$\max_{p_s} 2(\overline{p_w}(p_s) - c)\frac{\alpha - p_s}{1+\gamma},$$

yielding $p_s^{=} = (((1+\psi\overline{\mu}) + 2(1-\gamma))\alpha + (1+\psi\overline{\mu})c)/(2((1+\psi\overline{\mu}) + (1-\gamma)))$, $q_i^{=} = ((1+\psi\overline{\mu})(\alpha - c))/(2(1+\gamma)(2-\gamma+\psi\overline{\mu}))$, and $\Pi_U^{=} = ((1+\psi\overline{\mu})(\alpha - c)^2)/(2(1+\gamma)(2-\gamma+\psi\overline{\mu}))$.

In this notation, the superscript "=" signifies that, in equilibrium, the retailers comply with the manufacturers suggestion, setting a retail price that *equals* it. It is easy to verify that $p_s^{=} < p^{LP}$ and that, according to Assumption 1, the suggestion is credible.

A.4. Retailers undercutting the suggested retail price

In this scenario, the manufacturer exploits the bargain-loving nature of the consumers with reference-dependent preferences. To do so, it sets the profit-maximizing pair (p_s, p_w) such that retailers find it profitable to undercut the recommendation, that is, to set $p_i < p_s$, inducing demand expansion by bargain-lovers.

The manufacturer solves

$$\max_{p_s, p_w}(p_w - c)(q_1(p_w, p_s) + q_2(p_w, p_s)).$$

Note first that $q_1(p_w, p_s) + q_2(p_w, p_s)$ is increasing in p_s whenever $p_i \neq p_s$ and constant in p_s otherwise, implying the manufacturer will set as high a suggested retail price as possible. This leads to $p_s^{<} = \overline{p}_s$, where the superscript "<" signifies that, in equilibrium, the retailers undercut the manufacturer's suggestion, setting a retail price that is lower. To find the optimal wholesale price, the manufacturer solves

$$\max_{p_w} 2(p_w - c)\frac{\alpha + \psi\underline{\mu}\overline{p}_s - (1+\psi\underline{\mu})p_w}{(2-\gamma)(1+\gamma)},$$

leading to $p_w^{<} = (\alpha + \psi\underline{\mu}\overline{p}_s + (1+\psi\underline{\mu})c)/(2(1+\psi\underline{\mu}))$ and, plugging the wholesale price back into the downstream equilibrium prices, to final downstream prices of $p^{<} = \alpha - (\alpha - c)/(2(2-\gamma)) - (\psi\underline{\mu}(3-2\gamma)(\alpha - \overline{p}_s))/(2(2-\gamma)(1+\psi\underline{\mu}))$ and quantities of $q_i^{<} = (\alpha + \psi\underline{\mu}\overline{p}_s - (1+\psi\underline{\mu})c)/(2(2-\gamma)(1+\gamma))$.

With a retail price suggestion that retailers undercut, the manufacturer receives a profit of $\Pi_U^{<} = ((\alpha + \psi\underline{\mu}\overline{p}_s - (1+\psi\underline{\mu})c)^2)/(2(2-\gamma)(1+\gamma)(1+\psi\underline{\mu}))$ and each retailer receives a profit of $\Pi_D^{<} = ((1-\gamma)(\alpha + \psi\underline{\mu}\overline{p}_s - (1+\psi\underline{\mu})c)^2)/(4(2-\gamma)^2(1+\gamma)(1+\psi\underline{\mu}))$.

When we compare these profits to the manufacturer's and retailers' profits without the retail price suggestion, we see that suggesting a retail price is profitable, both for the manufacturer and the retailers, if and only if the highest credible suggested retail price is sufficiently high, that is if and only if $\overline{p}_s \geqslant (\alpha - c)/(\psi\underline{\mu})\left(\sqrt{(1+\psi\underline{\mu})} - 1\right) + c$.

Appendix B. Allowing for $\overline{p}_s < p^{LP}$

By Proposition 1, the downstream equilibrium price of retailers that price above a manufacturer's suggestion is given by $p_i(p_w, p_s) = ((1-\gamma)(\alpha + \psi\overline{\mu}p_s) + (1+\psi\overline{\mu})p_w)/((2-\gamma)(1+\gamma))$ and the associated quantity per retailer is $q_i(p_w, p_s) = (\alpha + \psi\overline{\mu}p_s - (1+\psi\overline{\mu})p_w)/((2-\gamma)(1+\gamma))$.

The manufacturer solves

$$\max_{p_w} 2(p_w - c)\frac{\alpha + \psi\overline{\mu}p_s - (1+\psi\overline{\mu})p_w}{(2-\gamma)(1+\gamma)},$$

leading to an optimal wholesale price of $p_w = (\alpha + \psi\overline{\mu}p_s + (1+\psi\overline{\mu})c)/(2(1+\psi\overline{\mu}))$. Its profit is increasing in p_s and hence, it sets $p_s = \overline{p}_s$. The manufacturer's profit is given by $\Pi_U^{>} = ((\alpha + \psi\overline{\mu}\overline{p}_s - (1+\psi\overline{\mu})c)^2)/(2(2-\gamma)(1+\gamma)(1+\psi\overline{\mu}))$, where, following our earlier notation, the superscript "$>$" signifies an equilibrium in which retailer choose a price above the manufacturer's suggestion.

B.1. Comparison with linear wholesale pricing

When we compare the manufacturer's profit with retailers pricing above the suggestion to its profit with linear wholesale pricing we find that $\Pi_U^{>} < \Pi_U^{LP}$ if and only if $\overline{p}_s < (\alpha - c)/(\psi\overline{\mu})\sqrt{1+\psi\overline{\mu}} - (\alpha - c)/(\psi\overline{\mu}) + c$. Hence, if the highest credible suggested retail price is close to c, the manufacturer is better off not suggesting a retail price.

If, for simplicity, we assume $c = 0$, then $\Pi_U^{>} < \Pi_U^{LP} \iff \overline{p}_s < \alpha/(\psi\overline{\mu})(\sqrt{1+\psi\overline{\mu}} - 1)$. For $\psi\overline{\mu} \to 1$ (everyone is very loss averse), this becomes $\overline{p}_s < (\sqrt{2} - 1)\alpha \approx 0.414\alpha$. For $\psi\overline{\mu} \to 0$ (either nobody is loss averse or the loss averse consumers are only marginally loss averse), this becomes $\overline{p}_s < +\infty$, which always holds.

B.2. Comparison with resale price maintenance

When we compare the manufacturer's profit with retailers pricing above the suggestion to its profit with resale price maintenance we find that $\Pi_U^{>} < \Pi_U^{RPM}$ if and only if either $\psi\overline{\mu} \leqslant 1 - \gamma$ or $\psi\overline{\mu} > 1 - \gamma$ and $\overline{p}_s < (\alpha - c)/(\psi\overline{\mu})\sqrt{(2-\gamma)(1+\psi\overline{\mu})} - (\alpha - c)/(\psi\overline{\mu}) + c$.

Assume, for simplicity, $c = 0$, then the latter condition simplifies to $\psi\overline{\mu} > 1 - \gamma$ and $\overline{p}_s < \alpha/(\psi\overline{\mu})(\sqrt{(2-\gamma)(1+\psi\overline{\mu})} - 1)$.

It turns out that the equilibrium retail price induced by the smallest $\overline{p}_s$ for which $\Pi_U^{>} > \Pi_U^{RPM}$ is smaller than the suggestion $\overline{p}_s$, contradicting that retailers exceed the suggestion. Hence, whenever retailers were to exceed a suggestion, the manufacturer is better off implementing resale price maintenance.

These results suggest that not much changes in the analysis if we do not assume $\overline{p}_s \geqslant p^{LP}$. For $\overline{p}_s$ smaller than but close to p^{LP}, the overpricing equilibrium does not exist as manufacturers will increase the price suggestion to induce compliance or undercutting. For small $\overline{p}_s$, the overpricing equilibrium could exist. In this case, the manufacturer prefers linear wholesale pricing without a suggestion (and resale price maintenance) for very small values of $\overline{p}_s$, and resale price maintenance for intermediate values of $\overline{p}_s$ or for any value of $\overline{p}_s$ if competition is too lax ($\gamma \leqslant 1 - \psi\overline{\mu}$). Overpricing is never the preferred equilibrium for the manufacturer.

Hence, Assumption 1 is a sufficient, but not a necessary, condition for our results.

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