Salience in Retailing: Vertical Restraints on Internet Sales

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Abstract: We provide an explanation for a frequently observed vertical restraint in e-commerce, namely that brand manufacturers partially or completely prohibit that retailers distribute their high-quality products over the internet. Our analysis is based on the assumption that a consumer's purchasing decision is distorted by salient thinking, i.e. by the fact that he overvalues a product attribute – quality or price – that stands out in the choice set. A brand manufacturer of a high-quality good prefers that its relative advantage, i.e. quality, is salient. If online competition determines the margin a retailer can charge at his brick-and-mortar store, he has no incentive to create a quality-salient environment. If, however, the branded product is not available online, a retailer can charge a significant markup on the high-quality good. As the markup is higher if quality rather than price is salient, this aligns the retailer's incentives with the brand manufacturer's interest to make quality the salient attribute and allows the manufacturer to charge a higher wholesale price. Consumer welfare and total welfare, however, are higher if distribution systems that prohibit internet sales are forbidden.

Keywords: Decoy good, Internet competition, Relative thinking, Retailing, Salience, Selective distribution

JEL classification: D43, K21, L42

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1. Introduction

Internet sales are becoming more and more important in retailing. In the European Union, the share of enterprises that made e-sales increased from 13% in 2008 to 20% in 2015.[1] Nowadays, retailers often engage in "click & brick", i.e. they offer goods not only at a brick-and-mortar store but also on the internet – either via an own online shop or an internet platform like *ebay* or *Amazon Marketplace*. Manufacturers, however – in particular brand producers of status and luxury products –, very often feel uneasy when retailers who distribute their goods engage in e-commerce. Correspondingly, brand manufacturers' distribution agreements frequently include provisions that partially or completely ban online sales activities.[2]

In the European Union, antitrust authorities take a tough stance on vertical restraints that limit online sales. E-commerce is not only believed to have pro-competitive effects, but is also in line with the political goal of the Internal Market. "An outright ban of on-line sales [...] is considered a hard-core restriction which amounts to an infringement by object of Article 101(1) TFEU, unless it is justified by 'objective reasons'."(OECD, 2013, p. 26).

A landmark case regarding restrictions on online sales is the ruling of the European Court of Justice (ECJ) against *Pierre Fabre Dermo-Cosmétique* in 2009.[3] *Pierre Fabre* produces cosmetics and personal care products and sells these via a selective distribution network.[4] It required from its retailers that a pharmacist has to assist the sales of its products. The ECJ considered this requirement as a de facto ban on online sales and thus an infringement of Article 101 (1) TFEU. Not only at the European, but also at the national level, courts and competition authorities have ruled against manufacturers that tried to impose a ban on sales over the internet.[5] More recently, a number of cases which

[1] The e-sales turnover increased from 12% in 2008 to 16% in 2015 (share of e-sales to total sales). There is a lot of heterogeneity in the EU. The share of enterprises that makes e-sales ranges from 7% (Romania) to 30% (Ireland). The numbers are for the EU-28. Source: Eurostat, December 2016.

[2] In the "E-commerce Sector Inquiry" conducted by the European Commission, 50% of the responding retailers reported that they are affected by at least one contractual restriction to sell or advertise online (European Commission, 2017). For a discussion regarding vertical restraints in e-commerce see also Buccirossi (2015).

[3] ECJ, 13th October 2011, C-439/09, Pierre Fabre Dermo-Cosmétique.

[4] For a formal definition of a selective distribution system, see the Vertical Block Exemption Regulation (European Commission Regulation (EU) No. 330/2010 of April 2010, Article 1, 1 (e)).

[5] See for instance the ruling of French authorities in the Hi-Fi and home cinema products case, in particular the decision regarding the strategies of *Bang & Olufsen, France* (Conseil de la concurrence, 5th October 2006, Decision n°06-D-28, Bose et al.; Autorité de la concurrence, 12th December 2012, Decision n°12-D-23, Bang et Olufsen), or the fine levied on CIBA Vision, a wholesaler of contact lenses, by the *Bundeskartellamt* (Bundeskartellamt, 25th September 2009, B3-123/08).

attracted significant attention dealt with distribution agreements that prohibited retailers from selling via online marketplaces and using price comparison search engines.[6] As such platforms represent an important sales channel in particular for small and medium-sized retailers, to preclude their use can be a major obstacle to participating in e-commerce and might result in a reduction of competition in the online market as well. Recently, in the case of *Coty*[7], a supplier of luxury cosmetics, the ECJ decided that it is compatible with Art. 101 (1) TFEU to prohibit retailers in a selective distribution system for luxury goods to sell via third-party online platforms.[8] The Court emphasized that in this case, retailers were allowed to advertise on price-comparison websites and to use online search engines, so that their offers could be found by consumers.

Why do manufacturers want to restrict the distribution channels of their retailers? E-sales enhance intra-brand competition leading to lower retail prices, and thus increase the amount sold. A manufacturer is interested in the wholesale and not in the retail price and thus, all else equal, benefits from enhanced intra-brand competition. According to standard Industrial Organization theory, there is, however, a reason for the manufacturer to limit intra-brand competition if it has negative effects on the amount sold: A low markup may lead to under-investments by retailers in inventories (Krishnan and Winter, 2007), service qualities, or reduced efforts to advise consumers (Telser, 1960). Next to hold-up problems, also free-riding issues – consumers physically inspect goods at brick-and-mortar stores but then purchase online (so-called "showrooming") – can reduce retailers' investment incentives. In such cases, a restraint that limits intra-brand competition is not only in a manufacturer's but also in consumers' interest. This positive effect of vertical restraints is (partly) acknowledged by antitrust authorities and courts. If a manufacturer's product requires certain methods of sale, then restrictions on online sales aiming to ensure that the necessary standards of distribution are met are legal.[9] For instance, in 2002, the

[6] See, for example, the following judgments by courts and the national competition authority in Germany: the ruling in favor of *Scout* a producer of school bags, Oberlandesgericht Karlsruhe, 25th November 2009, 6 U 47/08 Kart, Scout; the ruling against *Coty* a manufacturer of luxury cosmetics, Landgericht Frankfurt a.M., 31st July 2014, 2-03 O 128/13, Coty; the ruling in favor of *Deuter*, a producer of high-quality hiking backpacks, Oberlandesgericht Frankfurt a.M., 22th December 2015, U 84/14, Deuter; the rulings against *Adidas* and *Asics*, producers of sportswear, Bundeskartellamt, 27th June 2014, B3-137/12, Adidas; Bundeskartellamt, 26th August 2015, B2-98/11, Asics. While the Bundeskartellamt considered a ban on marketplaces and price comparison tools as illegal, the judgments of courts differed considerably.

[7] ECJ, 6th December 2017, C-230/16, Coty Germany GmbH vs Parfümerie Akzente GmbH

[8] The ECJ did not regard such a prohibition as disproportionate for the objective of preserving a luxury image of the goods. Whether the same should apply for other high-quality, but not necessarily luxury products was not explicitly stated.

[9] See for example European Commission (2010), paragraphs 52 (c) and (d), 56.

Liège Cour d'appel considered even the complete internet ban of *Makro* in the market for luxury perfumes and cosmetics as legal.[10] The court considered the internet ban as justified because it protected demand enhancing investments by retailers.

From these considerations, two questions arise: (i) Absent any hold-up and free-riding problems, why do manufacturers want to impose bans on internet sales, and (ii) why do European courts worry that such a restraint is detrimental for competition and thus ultimately for consumers? We provide an answer to these questions based on the presumption that consumers' decisions are distorted by salient thinking (Bordalo, Gennaioli, and Shleifer, 2013).

In our model, a brand manufacturer that produces a good of high quality competes against a competitive fringe that produces low quality. The goods are sold to consumers via retailers that stock both the high-quality and the low-quality product. Retailers can engage in click-and-brick, i.e offer the goods next to at the brick-and-mortar store also online, where there is perfect competition. In each local market, there is only one brick-and-mortar store. A consumer can either purchase a good at his local store or from an online shop but he has a (mild) preference for purchasing at his local store. Consumers have context dependent preferences and may overvalue the attribute quality or price. Following Bordalo, Gennaioli, and Shleifer (2013), we assume that quality (price) is salient if the ratio of the high to the low quality is larger (smaller) than the ratio of the respective average prices. The brand manufacturer's relative advantage is the high quality and thus it prefers that quality rather than price is salient. This allows it to charge a higher markup relative to the fringe product. If both products are available online, online competition highly restricts the prices a retailer can charge at his physical store. The best alternative to purchasing the branded product from the local store is to purchase it from an online shop. Thus, a retailer cannot benefit from a quality-salient environment. If the brand manufacturer bans online sales, only the fringe product is available online. The markup a retailer can demand for the branded product is now not limited by the prices for the branded product online and, importantly, it is higher if quality is salient than if price is salient. Thus, a retailer now has an incentive to create a quality-salient environment, which is also in the brand manufacturer's interest. In other words, a ban on internet sales aligns a retailer's interests with the brand manufacturer's. Moreover, as a ban of internet sales increases the retail price of the branded product, it is harmful to consumer welfare.

[10] Cour de cassation Belgique, 10th October 2002, N° C.01.0300.F, Makro v Beauté Prestige International AO.

How does a retailer create a quality-salient environment? He uses the fringe product as a decoy good: A retailer can increase the price charged for the fringe product at the local store, which increases the average price for the fringe product, and thus makes quality salient. Now the retailer can demand a high markup for the branded product because consumers focus more on quality than on price. The fringe product at the store, however, is now too expensive and a consumer who prefers to buy the low-quality fringe product does so online despite his preference for the local store. This strategy is optimal for the retailer only if the profits from the sales of the branded product compensate for the foregone sales of the fringe product at the local store. If consumers have only a mild preference for purchasing at the local store, the potential profits from selling the fringe product are low and thus it is not too costly for the brand manufacturer to compensate the retailer. In these cases, the brand manufacturer has a strict incentive to ban online sales of its retailers, thereby incentivizing the retailers to create a quality-salient environment which distorts consumers' preferences in favor of the brand manufacturer.

It is important to point out that restrictions on online sales are typically imposed within a selective distribution system. Selective distribution systems are considered as effective distribution agreements for products whose sales depend on the creation of a certain brand image. Within selective distribution systems, retailers must guarantee to fulfill various requirements intended to create a shopping experience consistent with the brand image (Buccirossi, 2015).

The shopping experience is also affected by the available choices. It is well-known in retailing that the assortment of a retailer can shape consumer preferences and affect what they purchase (Simonson, 1999). In particular, adding a so-called decoy good to a consumer's choice set can affect the consumer's purchasing decision even though the decoy good is never purchased – it represents an irrelevant alternative. The literature has investigated three kinds of decoy effects: (i) the *asymmetrically dominated effect* – adding a decoy which is dominated by the target but not by the competing product (Huber, Payne, and Puto, 1982), (ii) the *attraction effect* – adding a nearly asymmetrically dominated option (Huber and Puto, 1983), and (iii) the *compromise effect* – adding a decoy so that the target appears to be a good compromise (Tversky and Simonson, 1993). Numerous empirical studies have documented the robustness of decoy effects among various products. In their meta-study, Heath and Chatterjee (1995) report that decoy goods are more effective in promoting sales of high-quality goods. More recent studies on decoy effects document the robustness and importance of these effects for online purchasing decisions

(Hsu and Liu, 2011; Lichters, Bengart, Sarstedt, and Vogt, 2017). For instance, in the experiments conducted by Lichters, Bengart, Sarstedt, and Vogt (2017), the choice options were presented in a similar fashion as on *Google Shopping*.

There is also evidence, even though less direct, that there are cross-channel effects, i.e. that the online assortment affects offline purchasing decisions and vice versa. Bodur, Klein, and Arora (2015) report that prices observed on internet price comparison websites affect later purchasing behaviors when consumers shop offline at local stores.[11]

Before introducing our model in Section 2, we discuss the related literature in the following paragraphs. In Section 3, as a benchmark, we discuss the case of standard rational consumers. We show that the manufacturer has no incentive to restrict online sales. Thereafter, in Section 4, we analyze the model under the assumption that consumers are salient thinkers. First, in Section 4.1, we investigate equilibrium behavior for the case of no restriction on the distribution channel, while in Section 4.2, we analyze it for the case that online sales are prohibited. In Section 4.3, we show that the brand manufacturer strictly prefers to prohibit online sales if consumers have only a mild preference for purchasing at a physical store. We discuss the welfare implications of this business practice in Section 4.4. Alternative vertical restraints, like resale price maintenance and non-linear wholesale tariffs, are discussed in Section 5. Section 6 discusses possible extensions and robustness of our model. Section 7 summarizes our results and concludes. All proofs are relegated to the Appendix A. Additional technical material is relegated to Appendix B.

Related Literature

The paper contributes to two strands of literature: On the one hand to the standard literature in Industrial Organization that investigates the effects of vertical restraints on intra-brand competition, and, on the other hand, to the recent and growing literature in Behavioral Industrial Organization.

The former literature was initiated by Telser (1960) and Yamey (1954), who noted first that strong intra-brand competition can be detrimental to retailers' incentives to invest in (free-rideable) services.[12] How resale price maintenance or exclusive territories can be used to correct for service externalities is thoroughly analyzed by Mathewson and Winter

[11]That consumers' brand attitudes are influenced not only by brand beliefs from the respective channel but also by beliefs from the other channel is documented by Kwon and Lennon (2009).

[12]For a survey on the standard IO literature regarding vertical restraints, see Katz (1989) and Rey and Vergé (2008).

(1984) and Perry and Porter (1986).[13] While in the above mentioned papers the vertical restraint is used to enhance service investments and thus tends to be pro-competitive, Rey and Stiglitz (1988, 1995) point out that vertical restraints that eliminate intra-brand competition can also be used to mitigate inter-brand competition and then are anti-competitive.[14] More closely related to our paper is Hunold and Muthers (2017b), where retailers can also multi-channel, i.e. sell products at a physical store and via an online platform. They derive conditions under which price restraints (RPM and dual pricing) are more desirable to achieve chain coordination than non-price restraints (restrictions on online sales). In their model, in contrast to ours, retailers can provide services and consumers are fully rational.

Starting with DellaVigna and Malmendier (2004) and Gabaix and Laibson (2006), models of industrial organization have been extended by incorporating findings from behavioral economics.[15] Recently, there is a growing literature that investigates the implications of consumers who have context-dependent preferences for industrial organization. A prominent notion of context-dependent preferences is the theory of salient thinking developed by Bordalo, Gennaioli, and Shleifer (2013).[16] According to this theory, an attribute of a product, say quality, stands out if this product's quality-price ratio exceeds the quality-price ratio of the reference product. The attribute that stands out is salient and thus over-weighted by the consumer when making his purchasing decision. Bordalo, Gennaioli, and Shleifer (2013) show that their theory can explain demand shifts due to uniform price increases, and that it can capture the decoy effect discussed in the marketing literature.[17]

The theory of salient thinking is incorporated into a duopoly model of price and quality competition by Bordalo, Gennaioli, and Shleifer (2016). They show that, depending on the quality-cost ratio, either price or quality is salient in equilibrium. Moreover, they derive conditions so that there is over- or under-provision of quality in equilibrium. Herweg, Müller, and Weinschenk (2017) extend this model and allow one firm to offer more than one product but model the competitor as a non-strategic competitive fringe. They show

[13] For an analysis of various vertical restraints, see also Rey and Tirole (1986).

[14] For more recent contributions investigating the effects of vertical restraints that tend to reduce intra-brand competition, see Krishnan and Winter (2007); Jullien and Rey (2007); Asker and Bar-Isaac (2014); Hunold and Muthers (2017a).

[15] A textbook treatment of the most important contributions to Behavioral Industrial Organization is provided by Spiegler (2011).

[16] Alternative models of context-dependent preferences are Kőszegi and Szeidl (2013) and Bushong, Rabin, and Schwartzstein (2016).

[17] Empirical support for the model of salient thinking is provided by Dertwinkel-Kalt, Köhler, Lange, and Wenzel (2017). For a survey of the existing contributions of the salience model to industrial organization, see Herweg, Müller, and Weinschenk (2018).

that the strategic firm can always boost its sales and profits by offering an appropriate decoy good.[18] Further contributions with consumers that are salient thinkers are Adrian (2016) with a monopolistic screening model and Inderst and Obradovits (2017) with a model of sales.[19]

Our research question is directly addressed by Pruzhansky (2014) and Dertwinkel-Kalt and Köster (2018). Pruzhansky (2014) investigates the incentives of a monopolistic producer of a luxury good to also sell its product over the internet. In his model, a consumer's utility from the luxury good negatively depends on the number of consumers who buy it. He finds that, in most cases, the monopolist prefers to sell also over the internet but that this is detrimental for consumer welfare. More closely related to our work is the model by Dertwinkel-Kalt and Köster (2018). In their paper, a monopolistic manufacturer offers its goods via retailers to consumers who dislike if the good is offered at different prices.[20] Online consumers have a lower willingness to pay than offline consumers. Without a behavioral bias, price discrimination emerges and online prices are lower than offline prices. The biased consumers have a reduced willingness to pay if the good is sold at different prices on- and offline. The manufacturer can ensure that prices do not vary by banning online sales of its retailers. In Dertwinkel-Kalt and Köster (2018), such a ban also enhances total welfare, while it reduces welfare in our model. The reason is that in Dertwinkel-Kalt and Köster (2018), consumers' bias cannot be exploited; the willingness to pay of consumers is maximized when they make an unbiased decision. In our model, in contrast, the willingness to pay of consumers for the branded product is inflated in a quality-salient environment and thus, consumers can be exploited.

2. The Model

We consider a vertically related industry where, on the upstream market, a (female) brand manufacturer (M) competes against a competitive fringe. The brand manufacturer produces a branded product of high quality q_H at per-unit cost c_H. The remaining upstream firms, which form the competitive fringe, are identical and produce a good which is an imperfect substitute to the branded product. Each fringe firm operates with constant

[18] That retailers can benefit from offering decoy goods is also shown by Apffelstaedt and Mechtenberg (2016).

[19] A similar model where firms can impose hidden fees is analyzed by Inderst and Obradovits (2016).

[20] Dertwinkel-Kalt and Köster (2018) frame the applied bias as salience bias, i.e. price variation makes price salient. The model can also be interpreted as one where consumers have fairness concerns and react negative reciprocally to unfair – discriminatory – pricing.

marginal cost $c_L \leq c_H$ and produces a good of low quality q_L, with $0 < q_L < q_H$. In order to reduce the number of case distinctions, we assume that $q_H > 2q_L$.[21]

The products are distributed to consumers via (male) retailers. There are $r \geq 2$ independent and identical retail markets. In each market, there is only one retailer active, i.e. retailers are local monopolists. Each retailer stocks the products of two brands, i.e. the brand manufacturer's product next to the product of one fringe firm.

Next to selling the products in the brick-and-mortar store, retailers can also offer the products on the internet, where retailers are not differentiated (Bertrand competition).[22] We abstract from any retailing cost and assume that the wholesale prices paid to the manufacturers are the only costs of a retailer.

The products of the fringe firm are sold at a unit wholesale price $w_L = c_L$, due to perfect competition between these firms. Moreover, a fringe firm's product can be distributed by retailers without any restraints on the distribution channel. Hence, low-quality products are always available online.

The brand manufacturer, on the other hand, may impose restrictions on the distribution channels for her retailers. She makes a nondiscriminatory take-it-or-leave-it offer (w, D) to each retailer. The contract offer specifies, next to a unit wholesale price w, whether retailers are allowed to sell the branded good via the internet.[23] More precisely, $D \in \{F, R\}$: under distribution system F, retailers are free to offer the good online, whereas under the restricted distribution system R, they are allowed to sell the branded good only in the physical store.

In each local market, there are two consumers, a type H and a type L consumer who differ in their willingness to pay for quality: A consumer of type H has a high willingness to pay for quality; he cares about both quality and price and thus purchases either the high- or the low-quality product. For a type L consumer instead, the marginal willingness

[21] This assumption is needed only for the analysis of a distribution system where internet sales are forbidden. The case $q_H \leq 2q_L$ is analyzed in Appendix B, where we demonstrate the robustness of our main findings.

[22] We assume that online competition is more intense than offline competition. This assumption is in line with the empirical observation that online prices tend to be lower than offline prices. Brynjolfsson and Smith (2000) found that prices for books and CDs are 9 to 16 % lower online than offline. In a more recent investigation, Cavallo (2017) finds lower price differences (around 4% among the products with different prices on- and offline) but reports a significant heterogeneity across different product categories. Lieber and Syverson (2012) lists various articles that document that the introduction of online markets reduced prices.

[23] The manufacturer cannot specify different wholesale prices for online and offline sales. Next to being hard to monitor for the manufacturer, such a practice is also considered as illegal in the EU (European Commission (2010), paragraph 52 (d)).

to pay for a quality exceeding q_L is (close to) zero. He cares only about the price and thus, on the equilibrium path, always buys the low-quality product.[24] Each consumer always purchases one unit of the good, either at the local store or from an online shop. In other words, we assume that the fringe product is sufficiently valuable so that purchasing the fringe product online is always preferred to the outside option.

Consumers have a (slight) preference for purchasing in a physical store rather than online. This preference could reflect that (i) in the local store, the consumer obtains the good immediately, whereas when purchasing online, he has to wait till it is shipped, (ii) it is easier to complain about a product failure at a physical store, (iii) consumers prefer to interact with a human being rather than a computer, etc.[25] If neither of the product's attributes are particularly salient, a consumer of type $\theta \in \{L, H\}$'s utility when purchasing quality q at price p is

$$u_\theta^E(p, q) = v_\theta(q) - p + \delta \mathbb{I}. \tag{1}$$

The term $\delta \mathbb{I}$, with $\delta > 0$, captures a consumer's preference for purchasing in a brick-and-mortar store; $\mathbb{I} \in \{0, 1\}$ is an indicator function that equals one if the consumer buys in the physical store and zero otherwise. For simplicity, we set $v_H(q) = q$ and $v_L(q) = \min\{q, q_L\} = q_L$. The function u_θ^E reflects a consumer's unbiased preferences, i.e. his experienced utility.

A consumer's purchasing decision, however, is affected – distorted – by the salience of either attribute quality or attribute price. When evaluating a product, a consumer inflates the weight of the attribute that he perceives to be salient, i.e. the attribute that has the highest relative variation in the choice set. According to the theory of salient thinking of Bordalo, Gennaioli, and Shleifer (2013), if a consumer can choose between two products with two attributes – quality and price –, quality is the salient attribute if the ratio of qualites is larger than the ratio of prices. Building on this result, we assume that in our

[24] Armstrong and Chen (2009) also build a model where a fraction of consumers shops on the basis of price alone without taking quality into account.

[25] Analyzing price and sales data for consumer electronics products in the EU, Duch-Brown, Grzybowski, Romahn, and Verboven (2017) find that indeed, for the average consumer, the disutility from shopping online outweighs the benefits. Similarly, Forman, Ghose, and Goldfarb (2009, p. 47) report that even for books "the disutility costs of purchasing online are substantial". A detailed investigation of consumers' preferences regarding traditional and online stores is conducted by Kacen, Hess, and Chiang (2013). They report in their Empirical Finding 1 that "unless prices are 8–22% lower online (depending on product category), consumers prefer to buy from traditional store." They also find that only a minority of consumers would pay extra to shop online instead of offline. Based on survey evidence, they list in their Empirical Finding 4 various reasons why consumers prefer traditional stores.

context, where a consumer can choose between two products that each might be offered via two distinct channels, that quality is salient if and only if the quality ratio is larger than the ratio of average prices. Formally, quality is salient if and only if

$$\frac{q_H}{q_L} \geq \frac{\bar{p}_H}{\bar{p}_L}, \tag{2}$$

with $\bar{p}_L = \frac{1}{2}(p_L^I + p_L^S)$ and $\bar{p}_H = \frac{1}{2}(p_H^I + p_H^S)$ if the branded product is available online, where p_L^I and p_H^I are the relevant online prices for the fringe and the branded product, and p_L^S and p_H^S the respective prices at the local store. If the branded product can be purchased only at local stores, $\bar{p}_H = p_H^S$. Note that the internet prices might not be unique and that a consumer observes the internet prices from all stores. If a consumer purchases a given quality online, he will do so at the lowest online price. Therefore, we assume that salience is affected only by the lowest online prices, i.e. dominated options are edited out of the consideration set by consumers.[26] Our formulation of salience captures the important empirical observation that increasing all prices by a constant amount makes it "more likely" that quality is salient (Dertwinkel-Kalt, Köhler, Lange, and Wenzel, 2017). It is important to note that with our approach, the same attribute is salient for all products, i.e. the environment either is a quality- or a price-salient one.[27]

The consumer's decision utility is given by

$$u_\theta(p,q) = \begin{cases} \frac{1}{\gamma} v_\theta(q) - p + \delta\mathbb{I} & \text{if quality is salient} \\ \gamma v_\theta(q) - p + \delta\mathbb{I} & \text{if price is salient,} \end{cases} \tag{3}$$

where $\gamma \in (0,1]$ captures the extent to which the consumer's perceived utility is distorted by salience. For $\gamma = 1$, the decision utility is not affected by salience.

We assume that

$$\gamma > \max\left\{\frac{c_H - c_L}{q_H - q_L}, \frac{c_L}{q_L}\right\} \geq 0. \tag{4}$$

The first part ensures that the brand manufacturer can always make a positive profit. The second part ensures that each consumer always purchases a product.

The sequence of events is as follows:

[26] This assumption is in line with the evidence provided by Bodur, Klein, and Arora (2015) on how prices on price comparison sites affect consumers' reference prices. They report that low prices – controlling for retailer ratings – have a higher impact on the reference price.

[27] This feature is shared by the model of *focusing* according to Kőszegi and Szeidl (2013), *relative thinking* according to Bushong, Rabin, and Schwartzstein (2016), and for binary choices by *salience theory* according to Bordalo, Gennaioli, and Shleifer (2013, 2016). With more than two options, salience can be good specific in the original approach of Bordalo, Gennaioli, and Shleifer (2013). Our simplified version reduces the number of case distinctions – it is more tractable – but preserves the main features of the model proposed by Bordalo, Gennaioli, and Shleifer (2013).

1. The manufacturer offers each retailer the same contract (w, D).
2. Each retailer decides whether or not to accept the manufacturer's offer. Retailers set prices for the goods they offer in the brick-and-mortar store and prices for the goods they offer in the online shop.
3. Each consumer observes the prices of his local store, (p_L^S, p_H^S), and the internet prices of all r retailers, in particular the lowest internet prices (p_L^I, p_H^I). These four prices determine whether a consumer focuses more on quality or on price. Based on his perceived utility (3), a consumer decides which product to buy and where, at the brick-and-mortar store or online.

The equilibrium concept employed is subgame perfect Nash equilibrium in pure and symmetric strategies. In order to obtain well-defined solutions, we impose the following tie-breaking rules: (i) When being indifferent whether or not to offer the high-quality branded product, a retailer offers the branded product. (ii) A consumer who is indifferent between purchasing in the brick-and-mortar store or from an online shop purchases in the brick-and-mortar store. (iii) A type H consumer who is indifferent between purchasing the high- or the low-quality product purchases the high-quality product.

3. Rational Benchmark

First, as a benchmark, we consider the case of rational consumers whose purchasing decisions are not affected by the salience of a particular product feature, i.e. $\gamma = 1$.

Suppose the brand manufacturer charges unit wholesale price w and does not restrict her retailers' distribution channel. In this case, both products are available online. On the internet, retailers are not differentiated which means we have perfect Bertrand competition driving down prices to marginal costs. Thus, the internet prices for the high-quality branded and the low-quality fringe product are

$$p_H^I = w \quad \text{and} \quad p_L^I = c_L. \tag{5}$$

In each local (regional) market, there is only one retailer and each consumer has a willingness to pay of $\delta > 0$ for purchasing at a physical store. This gives the retailer some market power and allows him to charge prices above costs. This markup, however, is restricted to δ by online offers; i.e. if, for a given quality, a retailer charges a markup of more than δ, each consumer prefers to purchase this quality online instead of at the brick-and-mortar store. A markup of δ obviously is optimal for the fringe product, so that it costs $p_L^S = c_L + \delta$ at the local store. If the retailer charges a markup of δ also for the branded product, i.e. if $p_H^S = w + \delta$, a consumer of type H purchases the high-quality product if

$$w \leq (q_H - q_L) + c_L \equiv \hat{w}, \tag{6}$$

i.e. as long as the wholesale price is not too high. For wholesale prices larger than $\hat{w}$, a type H consumer's best alternative to purchasing the branded product at the local store is no longer to purchase it online, but to purchase the fringe product, either at the store or online. In this case, it is optimal for the retailer to sell the fringe product at a markup of δ also to the type H consumer and not to sell the branded product (to offer the branded product at an unattractively high price such as $p_H^S = w + \delta$). Irrespective of the wholesale price, the retailer makes a profit of $\pi = 2\delta$.

The manufacturer makes positive sales and thus a positive profit only if $w \leq \hat{w}$. Thus, the optimal wholesale price under a free distribution system is $w^F = (q_H - q_L) + c_L$ and the corresponding profit per retailer is $\Pi^F = (q_H - q_L) - (c_H - c_L)$.

Now suppose the manufacturer forbids her retailers to offer the product online so that on the internet, consumers can purchase only the fringe product, at $p_L^I = c_L$. By the same reasoning as above, a retailer charges $p_L^S = c_L + \delta$ in the physical store. A type H consumer prefers to buy the branded product instead of the fringe product if

$$p_H^S \leq (q_H - q_L) + c_L + \delta. \tag{7}$$

If the local store offers the branded product, it will charge the highest feasible price, i.e. $p_H^S = (q_H - q_L) + c_L + \delta$. The retailer offers the branded product only if he can earn a profit of at least δ from it. Otherwise, he prefers to sell the fringe product – for which he can always charge a markup of δ – to both consumer types. This means that a local retailer sells the branded product if and only if $w \leq \hat{w}$. He always makes a profit of $\pi = 2\delta$. Thus, under distribution system R, the manufacturer optimally charges $w^R = \hat{w}$ and makes a profit of $\Pi^R = (q_H - q_L) - (c_H - c_L)$ per retailer that she serves.

Proposition 1 (Rational Benchmark)**.** *The brand manufacturer is indifferent between the free and the restricted distribution system,* $\Pi^F = \Pi^R$.

According to Proposition 1, there is no rationale for the brand manufacturer to restrict the distribution channels of her retailers.[28] If anything, a distribution system under which

[28]This result does not only hold for our simple utility function but for all utility functions where the quality of the considered good and the numéraire good are (weak) substitutes, i.e. the indifference curves are weakly convex.

online sales are restricted allows the retailers to charge a higher markup for the branded product because the disciplining effect of the competitive online market is absent. Hence, in a model with elastic demand and thus a double markup problem (Spengler, 1950), the brand manufacturer would strictly prefer a free to a restricted distribution system. If, on the other hand, retailers can undertake demand enhancing investments, the manufacturer may prefer to restrict intra-brand competition by banning online sales.

4. Consumers are Salient Thinkers

Now, we posit that consumers are salient thinkers, i.e. $\gamma < 1$. A consumer's willingness to pay for a certain product depends on the prices and quality levels available to him at his local store and on online shops. We separately consider the optimal behavior of a retailer under a free and a restricted distribution system, respectively. Thereafter, we investigate the behavior of the manufacturer and show when it is optimal for her to restrict the distribution channel.

4.1. Free Distribution

Suppose the brand manufacturer does not impose restrictions on online sales. Thus, all retailers can offer, next to the fringe product, also the high-quality branded product on the internet. As the retailers are not differentiated there, they compete fiercely à la Bertrand. This drives down the internet prices to costs:[29]

$$p_L^I = c_L \quad \text{and} \quad p_H^I = w. \tag{8}$$

In his local market, each retailer has some market power, which allows him to charge prices above costs. The highest possible price a retailer can charge at the physical store is the online price plus δ; otherwise consumers prefer to purchase the respective product online. Thus, a retailer can make a profit of at most $\pi = 2\delta$. It is important to note that these considerations are independent of whether quality or price is salient.

Suppose a retailer charges $p_L^S = c_L + \delta$ and $p_H^S = w + \delta$ at his brick-and-mortar store. This is an optimal pricing strategy for the retailer as the store's offers weakly dominate the online offers, inducing both consumers to purchase in the store. The type L consumer

[29]That these prices are part of an equilibrium is formally established in the proof of Proposition 2. In Appendix B, we show that the outcome in any symmetric equilibrium is unique. The reason is that the usual undercutting logic also applies here when one takes into account that a retailer can reduce his store prices for the two products to a different extent. This allows him to avoid that salience flips if prices are reduced marginally.

purchases the low-quality product; the type H consumer purchases the branded product only if the wholesale price w is not too high. For too high a wholesale price, type H buys the fringe product in the store. In both cases, the retailer earns a markup δ from the H consumer.

How large the wholesale price can be, so that the type H consumer still prefers to buy the branded instead of the fringe product, depends on whether quality or price is salient. If quality is salient, the type H consumer purchases the branded product if and only if

$$\frac{1}{\gamma}q_H + \delta - (w+\delta) \geq \frac{1}{\gamma}q_L + \delta - (c_L + \delta) \tag{9}$$

$$\iff w \leq \frac{1}{\gamma}(q_H - q_L) + c_L \equiv \hat{w}_Q. \tag{10}$$

If, on the other hand, price is salient, a type H consumer purchases the branded product if and only if

$$\gamma q_H + \delta - (w+\delta) \geq \gamma q_L + \delta - (c_L + \delta) \tag{11}$$

$$\iff w \leq \gamma(q_H - q_L) + c_L \equiv \hat{w}_P. \tag{12}$$

Note that $\hat{w}_P < \hat{w}_Q$: The maximum wholesale price that can be charged is higher if quality is salient. Correspondingly, the brand manufacturer cares about the salience and prefers a quality-salient environment. The retailer, however, does not benefit from the consumer's higher willingness to pay for the branded product under quality salience. His markup is always restricted to δ. Therefore, the retailer has no interest to distort the prices in order to make quality salient.

If the retailer charges a markup of δ on both products, then quality is salient if and only if

$$\frac{q_H}{q_L} \geq \frac{2w+\delta}{2c_L+\delta} \tag{13}$$

$$\iff w \leq \frac{q_H}{q_L}c_L + \frac{q_H - q_L}{2q_L}\delta \equiv \widetilde{w}_F. \tag{14}$$

It is important to note that the salience constraint (13) is "more likely" to be satisfied for a given w (in the sense of set inclusion), the stronger consumers' preferences are for the local store, i.e. the higher δ is. The higher δ, the higher is the price level and thus – for a given absolute price difference between the high- and the low-quality product – the more likely it is that quality is salient. This is a core property of the model of salient thinking developed by Bordalo, Gennaioli, and Shleifer (2013).

The manufacturer wants to charge the highest feasible wholesale price so that her product is purchased by type H consumers. She knows that each retailer charges a markup of δ in his local store and thus that quality is salient only if $w \leq \widetilde{w}_F$. As long as this wholesale price critical for salience is at least as high as $\hat{w}_Q$, which is equivalent to

$$\delta \geq 2\left(\frac{1}{\gamma}q_L - c_L\right), \tag{15}$$

the manufacturer is not restricted in her price setting. She can charge the highest possible wholesale price, i.e. $w^F = \hat{w}_Q$, where compared to the fringe product, the branded good is marked up by the perceived (the inflated) quality difference under quality salience. For higher wholesale prices, a consumer never purchases the branded product. If, however, δ is lower, quality is salient only if the manufacturer chooses a wholesale price $w \leq \widetilde{w}_F < \hat{w}_Q$. There remain two potentially optimal strategies: (i) setting $w = \widetilde{w}_F$ so that quality is just salient, or (ii) setting $w = \hat{w}_P$, i.e. charging the highest feasible markup under price salience. The former strategy is optimal if and only if $\widetilde{w}_F \geq \hat{w}_P$, which is equivalent to

$$\delta \geq 2(\gamma q_L - c_L). \tag{16}$$

If consumers have only a weak preference for purchasing at a local store, $\delta < 2(\gamma q_L - c_L)$, a wholesale price $w^F = \hat{w}_P$ is optimal. In this case, price is salient.

The above observations are depicted in Figure 1 and summarized in the following proposition.

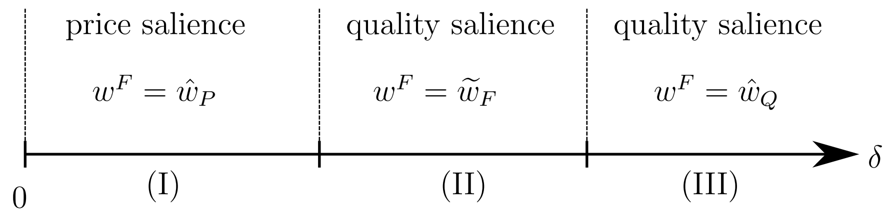

Figure 1: Free distribution.

Proposition 2 (Free Distribution)**.**

(I) For a weak preference of the consumers to purchase at a local store, $\delta < 2(\gamma q_L - c_L)$, the manufacturer charges $w^F = \hat{w}_P$. Price is salient and both consumer types purchase at the brick-and-mortar store.

(II) For an intermediate preference of the consumers to purchase at a local store, $2(\gamma q_L - c_L) \leq \delta < 2(q_L/\gamma - c_L)$, the manufacturer charges $w^F = \widetilde{w}_F$. Quality is salient and both consumer types purchase at the brick-and-mortar store.

(III) For a strong preference of the consumers to purchase at a local store, $\delta \geq 2(q_L/\gamma - c_L)$, the manufacturer charges $w^F = \hat{w}_Q$. Quality is salient and both consumer types purchase at the brick-and-mortar store.

The stronger are consumers' preferences for purchasing at a brick-and-mortar store instead of online, the higher is the market power of each retailer and, correspondingly, the higher is the markup he charges compared to the internet prices. A higher markup results in a higher overall price level which makes it more likely that quality is salient. For a high price level, case (III) of Proposition 2, quality is salient for all relevant wholesale prices and thus the manufacturer charges $w^F = \hat{w}_Q$ and makes a profit of $\Pi^F = \hat{w}_Q - c_H$ per retailer. The prices at the brick-and-mortar store are $p_H^S = (q_H - q_L)/\gamma + c_L + \delta$ and $p_L^S = c_L + \delta$. For an intermediate price level, case (II) of Proposition 2, the manufacturer charges a wholesale price that leaves quality just salient, i.e. $w = \widetilde{w}_F$. The per retailer profit is $\Pi^F = \widetilde{w}_F - c_H$. The retailer charges $p_H^S = (q_H/q_L)c_L + [(q_H + q_L)/2q_L]\delta$ and $p_L^S = c_L + \delta$ at his brick-and-mortar store. For a low price level, case (I) of Proposition 2, it is too costly for the manufacturer to charge a wholesale price that orchestrates quality salient. The optimal wholesale price is $w^F = \hat{w}_P$ leading to a per retailer profit of $\Pi^F = \hat{w}_P - c_H$. The retailer charges $p_H^S = \gamma(q_H - q_L) + c_L + \delta$ and $p_L^S = c_L + \delta$ at his brick-and-mortar store. In all cases, both consumer types purchase at a brick-and-mortar store. Type L purchases quality q_L and type H quality q_H.

4.2. Restricted Distribution

Under the free distribution system, a retailer has no preferences for quality salience or price salience because his markup is bounded by δ due to competition from the online platform. This changes dramatically if the manufacturer operates a distribution system under which online sales are forbidden. Now, the markup on the branded product can be higher than δ and depends on whether quality or price is salient.

First, note that due to perfect competition on the internet, we have $p_L^I = c_L$. The branded product is not sold online and only available in the brick-and-mortar stores. Thus, if a retailer wants to sell the fringe product at his local store, the optimal price is $p_L^S = c_L + \delta$. It is important to point out that a retailer can always ensure himself a profit of $\pi = 2\delta$ by charging $p_L^S = c_L + \delta$ and a prohibitively high price for the branded product. In this case, both consumer types purchase the fringe product at the local store. Hence, the brand manufacturer has to take into account that the wholesale price she charges from retailers allows them to earn a profit of at least δ on sales of the branded product.

Consider a retailer who wants to sell a positive amount of both products. The highest price he can charge for the branded product makes a type H consumer indifferent between purchasing high quality at the store and low quality at the store. This maximal price depends on whether quality or price is salient: If quality is salient, a type H consumer purchases the branded product if and only if

$$\begin{aligned} \frac{1}{\gamma}q_H + \delta - p_H &\geq \frac{1}{\gamma}q_L + \delta - c_L - \delta \\ \iff p_H &\leq \underbrace{\frac{1}{\gamma}(q_H - q_L) + c_L}_{=\hat{w}_Q} + \delta. \end{aligned} \tag{17}$$

If, on the other hand, price is salient, the price of the branded good is bounded by

$$p_H \leq \underbrace{\gamma(q_H - q_L) + c_L}_{=\hat{w}_P} + \delta. \tag{18}$$

Thus, for a given wholesale price, the retailer prefers a quality- to a price-salient environment because $\hat{w}_Q > \hat{w}_P$. For $p_H^S = \hat{w}_Q + \delta$ and $p_L^S = c_L + \delta$, quality is indeed salient if and only if

$$\begin{aligned} \frac{q_H}{q_L} &\geq \frac{\hat{w}_Q + \delta}{\frac{1}{2}(2c_L + \delta)} \\ \iff \quad \delta &\geq \frac{2(q_H - q_L)}{q_H - 2q_L}\left(\frac{1}{\gamma}q_L - c_L\right). \end{aligned} \tag{19}$$

If condition (19) holds and $w \leq \hat{w}_Q$ so that the profit he earns from selling the high-quality product is at least δ, then charging $p_H^S = \hat{w}_Q + \delta$ and $p_L^S = c_L + \delta$ is an optimal strategy for the retailer. This is also optimal for the brand manufacturer who can charge a wholesale price of $w = \hat{w}_Q$. For higher wholesale prices, the branded product is never sold.

If condition (19) is violated – i.e. if consumers do not have a strong preference for purchasing at a local store –, then a retailer who wants to sell the branded product at his local store cannot charge $p_H^S = \hat{w}_Q + \delta$ and $p_L^S = c_L + \delta$. He can choose between three potentially optimal alternative strategies:

Firstly, the retailer can set the branded product's price so that quality is just salient, i.e. $p_H^S = (2c_L + \delta)(q_H/2q_L)$. If the retailer selects this strategy, the brand manufacturer can charge a wholesale price of at most $w = \widetilde{w}_R$, with

$$\widetilde{w}_R \equiv \frac{q_H}{q_L}c_L + \frac{q_H - 2q_L}{2q_L}\delta. \tag{20}$$

For higher wholesale prices, the markup is less than δ so that the retailer prefers to sell only the fringe product.

Secondly, the retailer can acquiesce in price-salience and charge $p_H^S = \gamma(q_H - q_L) + c_L + \delta$. Under this strategy, the brand manufacturer can charge a wholesale price of at most $w = \hat{w}_P$.

Thirdly, and most interestingly, the retailer can decide to effectively sell only the branded product. He still offers the fringe product, which now he can use as a decoy good. The decoy good may allow the retailer to create a quality-salient purchasing environment. The salience constraint is less restrictive if the store price for the fringe product, p_L^S, is high. The fringe product, however, cannot be more expensive than the branded product at the store. If this was the case, the fringe product would be dominated by the branded product and no longer part of consumers' consideration set. It can be shown that this *no dominance constraint*, $p_L^S < p_H^S$, never imposes a binding restriction. Using the fringe product as a decoy and thereby making quality salient allows the retailer to charge a price of $p_H^S = \hat{w}_Q + \delta$ for the branded product. The fringe product is now too expensive at the local store and the type-L consumer prefers to buy it from an online shop. This implies that the retailer loses the type-L consumer who generates a profit of δ. Hence, this strategy can be optimal only if the markup the retailer can charge on the high-quality product is at least 2δ. This restricts the wholesale price the manufacturer can charge in this case to $w = \hat{w}_Q - \delta$.

For the retailer, the wholesale price is given and he chooses the strategy that allows him to make the highest profit. The optimal strategy depends on the exogenous parameters, in particular on how strong consumers' preferences for purchasing at a local store are. This is depicted in figure 2.

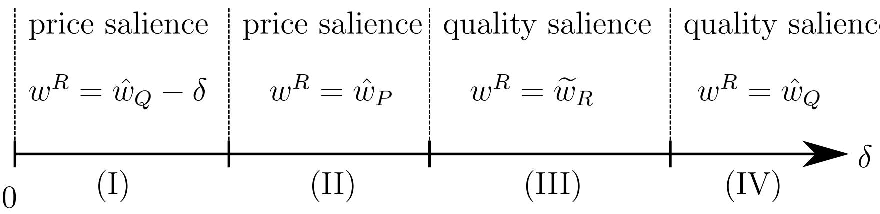

Figure 2: Restricted distribution.

The following proposition summarizes the equilibrium behavior under a distribution system with restrictions on online sales.

Proposition 3 (Restricted Distribution)**.**

(I) For a weak preference of the consumers to purchase at a local store, $\delta < \min\left\{\frac{1-\gamma^2}{\gamma} \times (q_H - q_L), \frac{2(q_H-q_L)}{q_H-2q_L}(\gamma q_L - c_L)\right\}$*, the manufacturer charges* $w^R = \hat{w}_Q - \delta$*. Quality is salient and only type* H *consumers purchase at the brick-and-mortar store.*

(II) For a weak intermediate preference of the consumers to purchase at a local store, $\frac{1-\gamma^2}{\gamma}(q_H - q_L) \leq \delta < \frac{2(q_H-q_L)}{q_H-2q_L}(\gamma q_L - c_L)$*, the manufacturer charges* $w^R = \hat{w}_P$*. Price is salient and both consumer types purchase at the brick-and-mortar store.*

(III) For a strong intermediate preference of the consumers to purchase at a local store, $\frac{2(q_H-q_L)}{q_H-2q_L}(\gamma q_L - c_L) \leq \delta < \frac{2(q_H-q_L)}{q_H-2q_L}\left(\frac{1}{\gamma}q_L - c_L\right)$*, the manufacturer charges* $w^R = \widetilde{w}_R$*. Quality is salient and both consumer types purchase at the brick-and-mortar store.*

(IV) For a strong preference of the consumers to purchase at a local store, $\delta \geq \frac{2(q_H-q_L)}{q_H-2q_L}\left(\frac{1}{\gamma}q_L - c_L\right)$*, the manufacturer charges* $w^R = \hat{w}_Q$*. Quality is salient and both consumer types purchase at the brick-and-mortar store.*

Notice that case (II) of Proposition 3 exists if and only if

$$(1-\gamma^2)q_H < 2(q_L - \gamma c_L). \tag{21}$$

The other cases, (I), (III), and (IV), always exist.

When the consumers have a strong preference for purchasing at a local store, a retailer can charge a high price at the store for the low-quality product which is also available online, $p_L^S = c_L + \delta$. This leads to a high price level which makes quality salient. The retailer charges $p_H^S = (q_H - q_L)/\gamma + c_L + \delta$ for the branded product and the brand manufacturer demands $w^R = \hat{w}_Q$.

For a slightly weaker preference of the consumers to purchase at a local store, it is optimal for the retailer to set the price for the branded product such that quality is just salient, i.e. $p_H^S = (2c_L + \delta)[q_H/(2q_L)]$. The price for the fringe product at the local store is $p_L^S = c_L + \delta$. For a relatively high δ, the necessary reduction in the price for the branded product at the local store in order to make quality salient is moderate. In this case, the manufacturer sets $w^R = \widetilde{w}_R$.

If consumers have only a weak preference for purchasing at the local store, the markup on the low-quality fringe product is low. Correspondingly, the price level is relatively low if the retailer sells both products. This highly restricts the price the retailer can charge for the branded product if he wants to keep quality salient. Thus, the retailer either sells both products and accepts that price is salient or sells only the high-quality product. In the former case, the retailer charges $p_L^S = c_L + \delta$ and $p_H^S = \gamma(q_H - q_L) + c_L + \delta$. Anticipating this behavior, the manufacturer sets $w^R = \hat{w}_P$. In the latter case, the retailer sets $p_H^S = (q_H - q_L)/\gamma + c_L + \delta$ and[30]

$$p_L^S \in \left(\frac{2q_L}{\gamma q_H}(q_H - q_L) - \frac{q_H - 2q_L}{q_H} c_L + \frac{2q_L}{q_H}\delta,\ p_H^S \right). \tag{22}$$

In this case, the manufacturer charges $w^R = \hat{w}_Q - \delta$. The manufacturer has to set the wholesale price such that the retailer can make a profit of 2δ per unit of the branded product sold. In other words, this strategy is relatively costly to the manufacturer if δ is high. Thus, this strategy occurs in equilibrium only for low levels of δ, i.e. only when the market power of a local store is weak.

4.3. Optimal Distribution System

Having analyzed the equilibrium behavior under a given distribution system, we can now answer the question which distribution system, free or restricted, the brand manufacturer should adopt. We say that the brand manufacturer prefers a restricted distribution system under which online sales are prohibited to a free distribution system if her profits are strictly higher under the former than under the latter, i.e. if $\Pi^R > \Pi^F$. Note that the profit is higher if the respective distribution system allows the manufacturer to charge the higher wholesale price: $\Pi^R > \Pi^F \iff w^R > w^F$.

The optimal wholesale prices under the two distribution systems as a function of δ (for one possible ordering of the thresholds) are depicted in Figure 3. The wholesale price under the free distribution system is represented by the solid and the price under the restricted distribution system by the dashed line, respectively. If consumers have a strong preference for purchasing at a local store, $w^F = w^R = \hat{w}_Q$. The salience constraint does not impose a binding restriction and thus quality is always the salient attribute. The manufacturer has no incentive to impose restraints on her retailers' distribution channels.

Note that the salience constraint imposes a binding restriction already for higher degrees of δ under the restricted than under the free distribution system. This is intuitive because the average price for the branded product is higher if it is sold only at local retailers. This also implies that the wholesale price that just satisfies the salience constraint is lower under the restricted than under the free distribution system, i.e. $\tilde{w}_R < \tilde{w}_F$.

[30] The price for the low-quality product at the local store is not uniquely defined. Note that the possible interval is non-empty under the imposed assumptions.

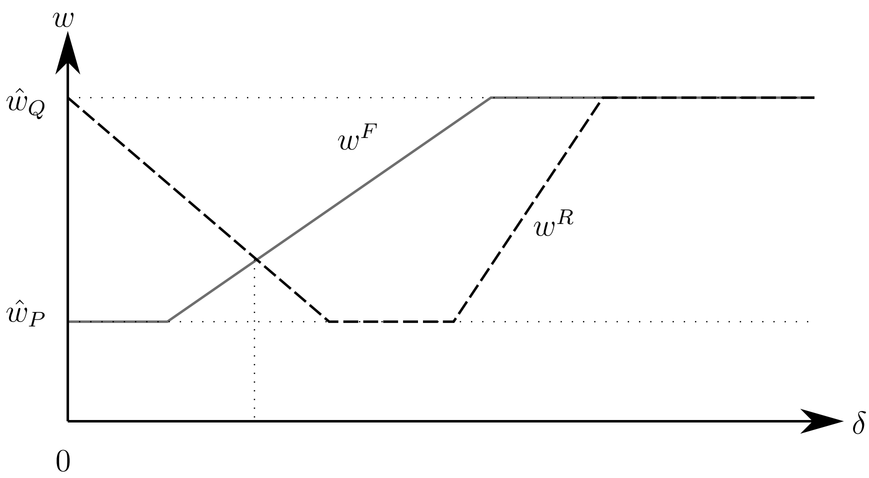

Figure 3: Comparison of distribution systems.

From the above considerations and Figure 3, it becomes apparent that the restricted distribution system can be optimal only if it leads to the situation that retailers create a quality-salient environment by using the fringe product sold at the local stores as a decoy good. In this situation, the manufacturer charges $w^R = \hat{w}_Q - \delta$. Recall that this case arises only if consumers' preference for purchasing at a local store is weak. For a very low preference to purchase at a local store, the optimal wholesale price under the free distribution system is $w^F = \hat{w}_P$. Thus, if consumers' preference for purchasing at a local store is sufficiently weak, the restricted distribution system is optimal because $\hat{w}_Q > \hat{w}_P$.

Proposition 4 (Comparison of Distribution Systems)**.** *The manufacturer strictly prefers a restricted distribution system under which online sales are prohibited to a free distribution system if and only if consumers' preference for purchasing at a physical store are weak. Formally, $D = R$ is optimal if and only if*

$$\delta < \begin{cases} (q_H - q_L)\frac{1-\gamma^2}{\gamma} \equiv \tilde{\delta} & \text{for } \gamma > \frac{1}{q_L+q_H}(c_L + \sqrt{q_H^2 - q_L^2 + c_L^2}), \\ \frac{2(q_H-q_L)}{q_H+q_L}\left(\frac{1}{\gamma}q_L - c_L\right) \equiv \bar{\delta} & \text{otherwise.} \end{cases} \tag{23}$$

The upper case of the case distinction regarding the critical δ arises if $w^F = \hat{w}_P$ for all δ so that $w^R = \hat{w}_Q - \delta$. Note that $\hat{w}_Q - \delta > \hat{w}_P \iff \delta < \tilde{\delta}$. This case arises if consumers' preferences are only mildly affected by salient thinking. The lower case arises if there are degrees of δ so that $w^R = \hat{w}_Q - \delta$ and $w^F = \tilde{w}_F$. Here, we have $\hat{w}_Q - \delta > \tilde{w}_F \iff \delta < \bar{\delta}$. This case is depicted in Figure 3.

According to Proposition 4, the brand manufacturer strictly prefers to forbid online sales if consumers have a weak or only moderate preference for purchasing at a physical store. In these cases, the market power of each local store is limited and thus the relative price difference is high if both products are also available online. Price is salient, which is not in the interest of the brand manufacturer. If, however, the brand manufacturer forbids online sales, a retailer can earn more than the low markup of δ on sales of the branded product. This creates an incentive for each retailer to render quality salient, which is also beneficial for the brand manufacturer. In other words, the restricted distribution system allows the brand manufacturer to align retailers' interests with her own, i.e. the imposed vertical restraint facilitates coordination of the supply chain. This feature is shared by orthodox models of industrial organization that investigate the role of vertical restraints, like resale price maintenance, exclusive territories, and many others. The crucial difference is that, in our model, the necessity for supply chain coordination is rooted in consumers' behavioral bias – salient thinking.

How crucial is the consumers' bias for the result that a restricted distribution system can be optimal? Figure 4 depicts the optimal distribution system in a (γ, δ)-diagram (depending on consumers preferences to purchase at a local store and their degree of salient thinking). Note that if consumers are rational, $\gamma \approx 1$, then the restricted distribution

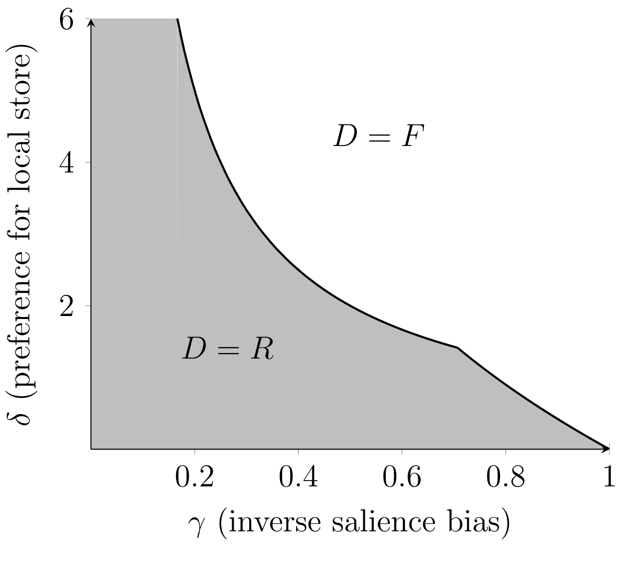

Figure 4: Optimal distribution system: Parameter specification $q_H = 3$, $q_L = 1$, and $c_L = 0$.

system is never optimal, formally: $\tilde{\delta} \to 0$ for $\gamma \to 1$. If consumers are strongly influenced by the salience of a particular product feature, the restricted distribution system is optimal already for milder preferences of the consumers to purchase from a brick-and-mortar store.

Corollary 1. *A restricted distribution system under which online sales are prohibited is "more likely" (in the sense of set inclusion) to be optimal, the more severe consumers' salience bias is. Formally, $\bar{\delta}'(\gamma) < 0$ and $\tilde{\delta}'(\gamma) < 0$.*

4.4. Welfare Implications

In this section, we investigate the welfare implications of a ban on distribution systems under which online sales are prohibited. That is, we assume that there is a law maker or an antitrust authority that can forbid certain vertical restraints. In the legal assessment of these restraints, a consumer welfare standard is applied.[31] Nevertheless, we briefly comment on the implications of such a ban for total welfare.

With biased consumers, welfare analysis is intricate because preferences are not stable but affected by the choice environment, i.e. by the salience of price or quality. In order to deal with this issue, we posit that the utility function distorted by salience corresponds to a consumer's *decision utility.* A consumer's *experienced* or *consumption utility* – the hedonic experience associated with the consumption of the good – is given by his unbiased utility function, $u_\theta^E = v_\theta(q) - p + \delta\mathbb{I}$.[32] This assumption seems plausible for goods that are not consumed immediately after purchase, which includes most goods that are typically sold online.

Consumer welfare: A ban on prohibiting internet sales has either no impact (large δ), or it leads to lower wholesale prices for the branded product that translate into lower final good prices (small δ). Thus, the following result is readily obtained.

Proposition 5 (Welfare)**.** *Suppose that consumers have only a mild preference for purchasing at a physical store, i.e. δ satisfies* (23)*. Then, a ban on distribution systems under which online sales are prohibited leads to lower final prices of the branded product, which increases consumer welfare.*

For low levels of δ, price is salient in a local store if internet sales are feasible, while quality is salient if internet sales are prohibited. In the former case, the prices in the store are $p_H^S = \gamma(q_H - q_L) + c_L + \delta$ and $p_L^S = c_L + \delta$, and both consumer types purchase there. If,

[31] The following quote from Joaquín Almunia, who was commissioner in charge of competition policy at that time, nicely illustrates that this is also the welfare standard applied by the European Commission: "Competition policy is a tool at the service of consumers. Consumer welfare is at the heart of our policy and its achievement drives our priorities and guides our decisions" ("Competition and consumers: the future of EU competition policy, speech at European Competition Day", Madrid, 12 May 2010).

[32] For an elaborate discussion on the differences between decision and experienced utility, see Kahneman and Thaler (2006).

on the other hand, internet sales are prohibited, the price for the branded product at the local store is $p_H^S = (q_H - q_L)/\gamma + c_L + \delta$. A type H consumer still purchases the branded product at his local store but now has to pay a higher price. A type L consumer purchases the fringe product on the internet at $p_L^I = c_L$. His experienced utility is independent of whether or not internet sales are allowed.

For low intermediate levels of δ so that $w^F = \widetilde{w}_F$ and $w^R = \hat{w}_Q - \delta$, quality is salient under either distribution system. If online sales are allowed, the salience constraint restricts the brand manufacturer – and the retailer alike – in her price setting. The prices at a local store are $p_H^S = \widetilde{w}_F + \delta$ and $p_L^S = c_L + \delta$. Both consumer types purchase at a local store. If internet sales are prohibited, the price for the branded product at a local store is again $p_H^S = (q_H - q_L)/\gamma + c_L + \delta > \widetilde{w}_F + \delta$ (in the relevant parameter range). Thus, a type H consumer, who purchases the high-quality product at his local store, is again harmed if internet sales are prohibited. A type L consumer purchases the fringe product online at $p_L^I = c_L$, and thus his utility is not affected by whether or not the branded product is also available on the internet.

In our simple model, where – on the equilibrium path – a type H consumer always buys the branded product and a type L consumer always buys the fringe product, the prices are welfare neutral transfers from consumers to firms. In other words, the price levels do not affect the volume of sales of the two products. In a richer model with elastic demand, higher prices translate into lower sales and also lower welfare. If this is the case, a prohibition of internet sales can be harmful to total welfare (sum of consumer and producer surplus). Nevertheless, whether or not internet sales are allowed has an impact on total welfare also in our model. From a welfare perspective, each consumer should purchase a good at his local store because they have a preference for shopping there rather than online. If internet sales are prohibited, type L consumers purchase from an online retailer, leading to a welfare loss of δ. Hence, a ban on prohibiting internet sales is beneficial for total welfare as inefficient internet sales are avoided.

Endogenous quality and long-run welfare: We assumed that the quality levels of both the brand manufacturer and the fringe firms are given. In the real world, firms react to policy changes and – at least in the long-run – may decide to adjust a product's design, i.e. its quality. For the sake of the argument, suppose that the brand manufacturer – at the beginning of the game – can choose to improve the quality of her branded product.

We abstract from costs for R&D but assume that the per-unit production cost $C(q_H)$

depends positively on the produced quality; Let $C(q_H) = \underline{c} + c(q_H - \underline{q})$, with $c(0) = c'(0) = 0$, $c'(\Delta) > 0$ for $\Delta > 0$ and $c''(\Delta) > 0$. Here, $\underline{q}$ denotes the existing quality level of the branded product and $\Delta = q_H - \underline{q}$ is the quality improvement. In order to be able to build on our previous analysis, we assume that $q_H \geq \underline{q} > 2q_L$.

The welfare optimal quality improvement maximizes the gross experienced utility of a type H consumer minus the production costs, $u_H^E - C(q_H)$, and thus is characterized by $c'(q_H^* - \underline{q}) = 1$.

The manufacturer's quality choice depends – next to the distribution system – on how strong consumers' tastes for purchasing at a physical store are. We focus on a weak preference of consumers to purchase at a local store, so that $w^F = \hat{w}_P$ and $w^R = \hat{w}_Q - \delta$. If the manufacturer is allowed to ban online sales, she will do so, quality is salient, and the equilibrium wholesale price is $\hat{w}_Q - \delta$. In this case, the manufacturer has an incentive to produce a too high quality, $q_H^R > q^*$, which is characterized by $1/\gamma = c'(q_H^R - \underline{q})$. If it is prohibited to ban online sales, price is salient and the equilibrium wholesale price is $\hat{w}_P$. In this case, the brand manufacturer produces a good of too low quality, $q_H^F < q^*$ with $\gamma = c'(q_H^F - \underline{q})$.

The consumers do not benefit from the higher quality of the branded product as a result of a restricted distribution system. If quality is salient, type H consumers are exploited in the sense that they are willing to pay too high a markup for obtaining the branded instead of the fringe product. This exploitation is more severe, the higher the quality of the branded product.

Moreover, allowing the manufacturer to restrict online sales of her retailers is also detrimental for total welfare (if the cost function is quadratic).

Proposition 6 (Endogenous Quality and Long-Run Welfare)**.** *Suppose consumers have only a mild preference for purchasing at a physical store, i.e.* $\delta < \min\left\{\frac{1-\gamma^2}{\gamma}(\underline{q} - q_L), 2(\gamma q_L - c_L)\right\}$.

(1) Then, the branded product is of higher quality if the manufacturer can forbid her retailers to sell the good online, $q_H^R > q_H^F$.

(2) Then, a ban on restricted distribution systems under which online sales are prohibited increases consumer welfare.

(3) Then, for $c(\Delta) = k\Delta^2$ *with* $k > 0$*, a ban on restricted distribution systems under which online sales are prohibited increases total welfare.*

5. Alternative Vertical Restraints

Dual pricing: In our model, the manufacturer cannot charge different wholesale prices for the same product if it is sold via different channels. The practice of discriminating according to the retail channel is called dual pricing. Obviously, banning internet sales is an extreme form of dual pricing with a prohibitively high wholesale price for online sales. Thus, if feasible, the manufacturer can achieve the same (and potentially even a higher) profit by engaging in dual pricing than restricting online sales. Dual pricing, however, requires that the manufacturer can monitor how many products are sold online and how many are sold at the brick-and-mortar store by a retailer. Moreover, dual pricing is often considered as illegal.[33]

Resale price maintenance (RPM): A classic vertical restraint is resale price maintenance, where the manufacturer can force the retailers to sell the branded product at a particular price. This practice is considered as illegal in many jurisdictions. If the manufacturer can specify the retail and the wholesale price, she can allow the retailers a sufficiently high margin so that the retailers strictly prefer selling the branded good to selling the fringe product. This also creates an incentive for retailers to make quality salient because if price is salient – at the same prices – type H consumers may prefer to buy the fringe product where the margin is lower. The drawback of RPM is that retailers cannot react to local demand information and generally, local prices have to be the same. With heterogeneous markets, retailers prefer different local prices which also enhance profits of the chain.

Nonlinear pricing: In our simple model with inelastic demand, a unit-wholesale price allows the manufacturer to extract all the rents that are generated by the existence of the branded product. This implies that the manufacturer cannot benefit from using a two-part wholesale tariff: Firstly, no fixed fee is needed to extract profits from the retailers. Secondly, also a two-part tariff has a constant marginal price and thus does not allow to control the retail price more effectively.

The manufacturer could benefit from using a non-linear tariff with increasing marginal prices. If the second unit is more expensive than the first one, retailers will increase their online prices. Higher online prices, in turn, increase the margin for selling the branded product at the local store. If this margin is sufficiently high, retailers may have an incentive to make quality salient so that the captive type H consumer purchases the

[33] European Commission (2010), paragraph 52 (d).

branded product at the local store rather than the fringe product. In our simple model, the optimal non-linear wholesale tariff is symmetric for all retailers. With heterogeneous retail markets, this is not the case and the manufacturer may not be able to avoid low online prices with a uniform wholesale tariff.

Exclusive territories: Sometimes selective distribution systems allow retailers to sell the products only within a certain geographic region. In some sense, our model could be interpreted as a situation where there is only one exclusive dealer for the branded product in each region (each local market). If, via the selective distribution system, the manufacturer can enforce that retailers also sell online only to customers that live in a certain region, e.g. a range of ZIP-codes, then there is no need to ban online sales. A retailer now has no incentive to offer the branded product online at a low price because he is competing only against his own offer at the brick-and-mortar store and cannot attract consumers from other geographical regions. Hence, such a distribution system would effectively hinder online competition. The equilibrium outcome would be the same as under a ban of online sales.

6. Extensions and Robustness

In several respects, our model is highly stylized. In this section we discuss a few extensions.

Elastic demand. Suppose in each local market there is a continuum of consumers. Each consumer has a type θ, which is distributed on some interval $[\underline{\theta}, \bar{\theta}] \subset \mathbb{R}_{>0}$. Let the gross unbiased utility be $v_\theta(q) = \theta q$. With this formulation, the demand functions are elastic. Nevertheless, under a free distribution system, a retailer cannot benefit from making quality salient. In order to see this, first note that the online prices for the branded and the fringe product are $p_H^I = w$ and $p_L^I = c_L$, respectively. If quality is salient, a consumer of type θ purchases the branded product at the brick-and-mortar store if

$$\frac{1}{\gamma}\theta q_H + \delta - p_H^S \geq \max\left\{\frac{1}{\gamma}\theta q_H - w, \frac{1}{\gamma}\theta q_L + \delta - p_L^S, \frac{1}{\gamma}\theta q_L - c_L\right\}. \tag{24}$$

In particular, purchasing the branded product at the brick-and-mortar store has to be preferred to purchasing it online. This restricts the price for the branded product at the local store to $p_H^S \leq w + \delta$. Importantly, if consumers have only a mild preference for purchasing at a physical store, this constraint is binding. Hence, the retailer cannot benefit from quality being salient. His maximal markup is determined by his market power – the ability to charge higher prices at the local store than online.

Now suppose that the branded product is sold only at the brick-and-mortar stores. Moreover, suppose the best alternative for a consumer of type θ to purchasing the branded product at the local store is to buy the fringe product online. Thus, for quality being salient, type θ purchases at the local store if

$$\begin{aligned} \frac{1}{\gamma}\theta q_H + \delta - p_H^S &\geq \frac{1}{\gamma}\theta q_L - c_L \\ \iff p_H^S &\leq \frac{1}{\gamma}\theta(q_H - q_L) + c_L + \delta \end{aligned} \tag{25}$$

Now, the retailer benefits from quality being salient instead of price. Firstly, the same set of consumers can be served at a higher price if quality is salient. Secondly, the number of consumers that purchase the branded product at the store – at a given price – is higher if quality is salient. The second effect, the increase in demand, is absent in our stylized model with inelastic demand.

Hence, also in a model with elastic demand, the manufacturer can align retailers' interests with his own by using a restrictive distribution system under which online sales are banned.[34]

An alternative formulation, which also leads to an elastic demand function, is to assume that for each consumer type, H and L, the preference for purchasing at a physical store is drawn randomly $\delta \in [0, \bar{\delta}]$. Suppose the best alternative for the marginal type H consumer is to purchase the branded product online. Then, irrespective of whether quality or price is salient, a consumer H of type δ purchases the branded product at the local store if

$$\delta \geq p_H^S - w. \tag{26}$$

A retailer – with the choice of p_H^S – can decide which types δ to serve at the local store and which types online. This trade-off and his profit is independent of whether quality or price is salient.

The crucial assumption for our result is not elastic demand but that the preference for purchasing at a brick-and-mortar store is not affected by salience. If the extra utility for purchasing from the local store is part of the perceived quality – and thus higher if quality is salient – retailers have an incentive to make quality salient also under the free distribution system.

[34] A full blown analysis of the model with elastic demand turned out to be not manageable.

Heterogeneous tastes for purchasing at a physical store. One might argue that the online channel is superfluous in our model: Without restrictions on online sales, each consumer purchases at a local store. Nevertheless, we have shown that the potential of retailers to use the (superfluous) online channel has an effect on the equilibrium outcome; it enhances intra-brand competition.

If not all consumers prefer to purchase from a local store, the internet channel is not superfluous. Indeed, as empirical evidence shows, preferences for or against purchases at a physical store are quite heterogeneous (Duch-Brown, Grzybowski, Romahn, and Verboven, 2017), i.e. some consumers strictly prefer to purchase online. For the sake of the argument, suppose a simple binary distribution of these preferences. Clearly, a type L consumer who prefers to purchase online will always do so. A type H consumer purchases online if the branded product is sold online. If he can purchase the branded product only at a local store, he has to trade off the advantage from the higher quality product against the disadvantage from purchasing at a physical store. Suppose that the disutility from purchasing at a brick-and-mortar store is so high, that these type H consumers rather buy the fringe product online than the branded product at a local store. Now, the manufacturer, in her decision whether to use a restricted distribution system, has to trade off charging a higher wholesale price but then serving only type H consumers who prefer to buy at a local store against a lower wholesale price and serving all type H consumers (via both channels). If not too many type H consumers have a preference for purchasing online, the restricted distribution system is still optimal. Nevertheless, the parameter range for which this is the case is reduced.[35]

Different degrees of preferences for purchasing at a brick-and-mortar store. We assumed that the willingness to pay in order to buy at a physical store rather than online is the same for both products. This willingness to pay, however, might also be increasing in the quality of the good. Suppose that it is less important to buy at a physical store if the product is of low quality. More precisely, the preference for purchasing quality q_i at a brick-and-mortar store is δ_i, with $\delta_H > \delta_L \geq 0$. The salience constraint (13) now becomes

$$\frac{q_H}{q_L} \geq \frac{2w + \delta_H}{2c_L + \delta_L}.$$

Thus, now it is "more likely" that, in setting her wholesale price, the brand manufacturer

[35]Assuming that all consumers prefer to purchase at a physical store is a conservative assumption regarding our welfare finding. If some consumers prefer to purchase online, the negative welfare effects of a distribution system that bans online sales are even more severe.

is restricted by salience. Moreover, compensating a retailer for not serving the type L consumer becomes cheaper. Hence, we conjecture that the brand manufacturer prefers to forbid online sales for an even broader set of parameters.

Search costs as alternative explanation. It is often argued that the internet has reduced consumer search costs, which is also confirmed empirically, e.g. by Brown and Goolsbee (2002). Moreover, from standard models of consumer search like Stahl (1989), we know that retailers' profits are typically increasing in consumers' search costs. This raises the question whether a model of consumer search can explain a manufacturer's preference to ban online sales.

For the sake of the argument, take the classic model proposed by Stahl (1989) and extend it for a single manufacturer. A consumer can inspect the prices at all retailers but in order to visit a new retailer, the consumer incurs a search cost. If the retailers have an online shop, these search costs are low (a quick online search), while these costs are high if the consumer has to visit the physical store in order to find out about that store's price. The Stahl-model is incorporated in a model of vertical relations by Janssen and Shelegia (2015). They show that retail prices decrease in search costs, thereby increasing consumer surplus and total welfare. The manufacturer, however, prefers lower search costs because they lead to lower retail margins. Janssen and Shelegia (2015) point out that the manufacturer has no incentive to reduce competition between retailers. Thus, a standard model of consumer search cannot explain why manufacturers prefer to ban online sales, thereby increasing consumers' search cost.[36]

Alternative models of relative thinking. Our modeling of context-dependent preferences builds on the ideas of the model of salient thinking by Bordalo, Gennaioli, and Shleifer (2013). In particular, Bordalo, Gennaioli, and Shleifer (2013) and we assume a diminishing sensitivity property of salience, which implies that quality is more likely to be salient if prices are high. Alternative theories are *focusing* (Kőszegi and Szeidl, 2013) and *relative thinking* (Bushong, Rabin, and Schwartzstein, 2016). In these alternative theories, the weight put on an attribute, say price, depends on the difference between the maximum price and the minimum price in the consideration set. In our model, the

[36] A search cost model can better account for the empirical observation that online prices seem to be volatile. Moreover, search on the internet for lower prices is affected by the prominence of certain search results (placement on an online search list). These issues are addressed for instance with models of consumer search cost (Armstrong, Vickers, and Zhou, 2009; Armstrong and Zhou, 2011). Moreover, the internet has not only reduced search cost but also enabled more targeted – sophisticated –search. A model of consumer search among categories is proposed by Fershtman, Fishman, and Zhou (2018). How intermediaries like search engines affect consumer search is analyzed by Chen and Zhang (2018).

maximum price is always the price for the branded product at the store and the minimum price is the one for low quality online. This is the case irrespective of whether the branded product is sold online or not. More importantly, in these alternative theories, a retailer cannot affect the weights by charging an intermediate price for the fringe product at the local store. Thus, these alternative theories cannot provide a rationale for banning online sales.

7. Conclusion

We provide an explanation for a brand manufacturer's rationale to restrict online sales of her retailers based on the assumption that consumers' purchasing decisions are distorted by salient thinking (Bordalo, Gennaioli, and Shleifer, 2013). If online sales of the branded good are banned, a multi-product retailer can charge a higher markup on the branded product than on competing products. Importantly, this markup is higher if quality is the salient product attribute for consumers. A ban on online sales aligns a retailer's interest with the manufacturer's interest and the retailer prefers to make quality salient, which enhances the demand for the branded product. The retailer achieves that consumers focus more on quality by using the fringe product sold at the brick-and-mortar store as a decoy good.

The mechanism is reminiscent to the classic demand enhancing service or advertising argument for RPM made by Telser (1960). His analysis applies to goods that are unfamiliar to consumers and thus, reducing intra-brand competition in order to enhance these investments by retailers is beneficial to consumers. If retailers can invest in persuasive advertising, the argument is closer to ours and a vertical restraint which reduces intra-brand competition can be harmful to consumers. The advantage of the salience model we use is that it provides a clear mechanism – based on psychological principles – how demand for the branded product can be enhanced and how this diverges a consumer's decision and experienced utility.

With salience being determined by the ratio of quality and prices, salience is determined endogenously by the strategic choices – the price choices – of retailers. This is a parsimonious concept of salience and reduces the modeler's degrees of freedom. Nevertheless, we believe that the mechanism we outlined applies also to broader concepts of salience: A nicely designed brick-and-mortar store or the right music played in the background may enhance consumers' willingness to pay for a high-quality branded product.[37] If internet sales destroy the margins of brick-and-mortar stores, retailers have no incentives to undertake the necessary investments. A ban on online sales can create incentives for retailers to create a shopping experience that is beneficial to the branded product. If these investments distort consumers' preferences so that they may value the branded product too highly, a ban on distribution systems that restrict online sales tends to be beneficial to consumers.

What is so special about internet sales? Online shops are considered as substitutes – even though not perfect substitutes – to traditional brick-and-mortar stores and thus enhance retail competition (Brynjolfsson, Hu, and Rahman, 2009; Choi and Bell, 2011). A simple ban on online sales reduces retail competition for all retailers that sell the manufacturer's product. The intra-brand competition that traditional retailers face among themselves depends on retailer specific aspects (how close is the next retailer, income of average customer, etc.). Here, an effective reduction of intra-brand competition may require restraints that are tailored to a particular retailer. Nevertheless, the mechanism we outlined also plays a role for traditional intra-brand competition, e.g. for competition between specialized stores, say for sports equipment, and department stores. Here, it may pay off for a brand manufacturer to sell her products only via specialized stores.

A. Proofs of Corollary and Propositions

Proof of Proposition 1. The proof follows from the arguments outlined in the main text. □

Proof of Proposition 2. To determine the manufacturer's optimal price-setting behavior, we first analyze which business strategy the retailer adopts for a given wholesale price. Thereafter, we solve for the manufacturer's optimal wholesale price. In the first part of the proof, we presume that the online prices for high and low quality are $p_H^I = w$ and $p_L^I = c_L$, respectively. At the end of the proof, we verify that these are indeed equilibrium prices.

There are six potential business strategies the retailer can choose:

(1) sell both the branded and the fringe product, make quality salient (both, quality)

[37] The impact of store design on sales is investigated by Dagger and Danaher (2014), while the atmospheric effects on shopping behavior are reviewed by Turley and Milliman (2000).

(2) sell both the branded and the fringe product, make price salient (both, price)

(3) effectively sell only the branded product, make quality salient (high, quality)

(4) effectively sell only the branded product, make price salient (high, price)

(5) effectively sell only the fringe product, make price salient (low, price)

(6) effectively sell only the fringe product, make quality salient (low, quality).

Note that if the retailer sells only one product, he still offers the other product at his local store. The retailer uses the product which is effectively not sold as a decoy good to affect consumers' salience. He has to ensure that the decoy is indeed not purchased by either consumer type.

In the following, we calculate the profits for each strategy (1)-(6).

Business strategy (1): If the retailer wants to sell both products making quality salient, he solves the following profit maximization problem:

$$\max_{p_H^S, p_L^S} \quad (p_H^S - w) + (p_L^S - c_L)$$

subject to

$$\frac{1}{\gamma} q_L + \delta - p_L^S \geq \frac{1}{\gamma} q_L - c_L \tag{IR$_L$}$$

$$\frac{1}{\gamma} q_H + \delta - p_H^S \geq \frac{1}{\gamma} q_H - w \tag{IR$_H^1$}$$

$$\frac{1}{\gamma} q_H + \delta - p_H^S \geq \frac{1}{\gamma} q_L + \delta - p_L^S \tag{IR$_H^2$}$$

$$\frac{1}{\gamma} q_H + \delta - p_H^S \geq \frac{1}{\gamma} q_L - c_L \tag{IR$_H^3$}$$

$$\frac{q_H}{q_L} \geq \frac{\frac{1}{2}(p_H^S + w)}{\frac{1}{2}(p_L^S + c_L)}. \tag{SC$_Q$}$$

Conditions (IR$_L$) and (IR$_H^1$) make sure that both the type L and the type H consumer purchase in the store instead of online. (IR$_H^2$) and (IR$_H^3$) have to be fulfilled to make type H purchase the branded good instead of the low-quality product. Note that (IR$_H^3$) is fulfilled if (IR$_L$) and (IR$_H^2$) are fulfilled, i.e. we can ignore it in the following. The salience constraint (SC$_Q$) ensures that quality is indeed the salient attribute. It is important to note that (IR$_L$) and (IR$_H^1$) define upper bounds for the prices in the store depending on

online prices: as both products are available online, the retailer can never set prices p_L^S and p_H^S in the store higher than $c_L + \delta$ and $w + \delta$, respectively. This implies that the maximum profit a retailer can possibly make (with any strategy) is $\pi = 2\delta$.
It is optimal to set p_L^S as high as possible, $p_L^S = c_L + \delta$, as (IR_H^2) and (SC_Q) are easier to fulfill if p_L^S is high. Inserting $p_L^S = c_L + \delta$, we get

$$p_H^S \leq \frac{1}{\gamma}(q_H - q_L) + c_L + \delta \tag{IR$_H^2$}$$

$$p_H^S \leq \frac{q_H}{q_L}(2c_L + \delta) - w. \tag{SC$_Q$}$$

The optimal price for the branded good depends on which of the constraints (IR_H^1), (IR_H^2) and (SC_Q) sets the most restrictive upper bound on p_H^S.

(IR_H^1) is more restrictive than (IR_H^2) if

$$\begin{aligned} w + \delta &\leq \frac{1}{\gamma}(q_H - q_L) + c_L + \delta \\ \iff \quad w &\leq \frac{1}{\gamma}(q_H - q_L) + c_L \equiv \hat{w}_Q. \end{aligned} \tag{A.27}$$

(IR_H^1) is more restrictive than (SC_Q) if

$$\begin{aligned} w + \delta &\leq \frac{q_H}{q_L}(2c_L + \delta) - w \\ \iff \quad w &\leq \frac{q_H}{q_L}c_L + \frac{q_H - q_L}{2q_L}\delta \equiv \widetilde{w}_F. \end{aligned} \tag{A.28}$$

(IR_H^2) is more restrictive than (SC_Q) if

$$\begin{aligned} \frac{1}{\gamma}(q_H - q_L) + c_L + \delta &\leq \frac{q_H}{q_L}(2c_L + \delta) - w \\ \iff \quad w &\leq \frac{2q_H - q_L}{q_L}c_L + \frac{q_H - q_L}{q_L}\delta - \frac{1}{\gamma}(q_H - q_L) \equiv \bar{w}_Q. \end{aligned} \tag{A.29}$$

For these threshold wholesale prices, we have that

$$\begin{aligned}
&\hat{w}_Q > \widetilde{w}_F \\
\iff &\frac{1}{\gamma}(q_H - q_L) + c_L > \frac{q_H}{q_L}c_L + \frac{q_H - q_L}{2q_L}\delta \\
\iff &\delta < 2\left(\frac{1}{\gamma}q_L - c_L\right),
\end{aligned}$$

$$\begin{aligned}
&\hat{w}_Q > \bar{w}_Q \\
\iff &\frac{1}{\gamma}(q_H - q_L) + c_L > \frac{2q_H - q_L}{q_L}c_L + \frac{q_H - q_L}{q_L}\delta - \frac{1}{\gamma}(q_H - q_L) \\
\iff &\delta < 2\left(\frac{1}{\gamma}q_L - c_L\right),
\end{aligned}$$

and

$$\begin{aligned}
&\widetilde{w}_F > \bar{w}_Q \\
\iff &\frac{q_H}{q_L}c_L + \frac{q_H - q_L}{2q_L}\delta > \frac{2q_H - q_L}{q_L}c_L + \frac{q_H - q_L}{q_L}\delta - \frac{1}{\gamma}(q_H - q_L) \\
\iff &\delta < 2\left(\frac{1}{\gamma}q_L - c_L\right).
\end{aligned}$$

Correspondingly, the retailer must distinguish the following cases:

Case (I): $\delta < 2\left(\frac{1}{\gamma}q_L - c_L\right)$, i.e. $\bar{w}_Q < \widetilde{w}_F < \hat{w}_Q$.

(i): $w \leq \bar{w}_Q$

In this case, (IR_H^1) is most restrictive and the retailer sets $p_L^S = c_L + \delta$ and $p_H^S = w + \delta$. The corresponding profit is $\pi(\text{both, quality}) = 2\delta$.

(ii) $\bar{w}_Q < w \leq \widetilde{w}_F$

(IR_H^1) is most restrictive and the retailer sets $p_L^S = c_L + \delta$ and $p_H^S = w + \delta$. The corresponding profit is $\pi(\text{both, quality}) = 2\delta$.

(iii) $\widetilde{w}_F < w \leq \hat{w}_Q$

(SC_Q) is most restrictive and the retailer sets $p_L^S = c_L + \delta$ and $p_H^S = \frac{q_H}{q_L}(2c_L + \delta) - w$. The corresponding profit is $\pi(\text{high, quality}) = \delta + \frac{q_H}{q_L}(2c_L + \delta) - w - w < 2\delta$, as $w > \widetilde{w}_F$.

(iv) $w > \hat{w}_Q$

(SC_Q) is most restrictive and the retailer sets $p_L^S = c_L + \delta$ and $p_H^S = \frac{q_H}{q_L}(2c_L + \delta) - w$. The corresponding profit is $\pi(\text{high, quality}) = \delta + \frac{q_H}{q_L}(2c_L + \delta) - w - w < 2\delta$, as $w > \widetilde{w}_F$.

Case (II): $\delta \geq 2\left(\frac{1}{\gamma}q_L - c_L\right)$, i.e. $\hat{w}_Q < \widetilde{w}_F < \bar{w}_Q$.

(i) $w \leq \hat{w}_Q$

(IR_H^1) is most restrictive. The retailer sets $p_L^S = c_L + \delta$ and $p_H^S = w + \delta$. The corresponding profit is $\pi(\text{both, quality}) = 2\delta$.

(ii) $\hat{w}_Q < w \leq \widetilde{w}_F$

(IR_H^2) is most restrictive and the retailer sets $p_L^S = c_L + \delta$ and $p_H^S = \frac{1}{\gamma}(q_H - q_L) + c_L + \delta$. The corresponding profit is $\pi(\text{both, quality}) = \delta + \frac{1}{\gamma}(q_H - q_L) + c_L + \delta - w < 2\delta$ as $w > \hat{w}_Q$.

(iii) $\widetilde{w}_F < w \leq \bar{w}_Q$

(IR_H^2) is most restrictive and the retailer sets $p_L^S = c_L + \delta$ and $p_H^S = \frac{1}{\gamma}(q_H - q_L) + c_L + \delta$. The corresponding profit is $\pi(\text{both, quality}) = \delta + \frac{1}{\gamma}(q_H - q_L) + c_L + \delta - w < 2\delta$ as $w > \hat{w}_Q$.

(iv) $\bar{w}_Q < w$

(SC_Q) is most restrictive. The retailer sets $p_L^S = c_L + \delta$ and $p_H^S = \frac{q_H}{q_L}(2c_L + \delta) - w$. The corresponding profit is $\pi(\text{both, quality}) = \delta + \frac{q_H}{q_L}(2c_L + \delta) - w - w < 2\delta$ as $w > \widetilde{w}_F$.

Business strategy (2): If the retailer decides to sell both qualities and make price salient, he solves the following maximization problem:

$$\max_{p_H^S, p_L^S} \quad (p_L^S - c_L) + (p_H^S - w)$$

subject to

$$\gamma q_L + \delta - p_L^S \geq \gamma q_L - c_L \tag{IR$_L$}$$

$$\gamma q_H + \delta - p_H^S \geq \gamma q_H - w \tag{IR$_H^1$}$$

$$\gamma q_H + \delta - p_H^S \geq \gamma q_L + \delta - p_L^S \tag{IR$_H^2$}$$

$$\gamma q_H + \delta - p_H^S \geq \gamma q_L - c_L \tag{IR$_H^3$}$$

$$\frac{q_H}{q_L} < \frac{\frac{1}{2}(p_H^S + w)}{\frac{1}{2}(p_L^S + c_L)}. \tag{SC$_P$}$$

Again, as (IR$_H^3$) is fulfilled if (IR$_L$) is satisfied, we can ignore it. p_L^S and p_H^S are bounded from above by (IR$_L$) and (SC$_P$), and (IR$_H^1$) and (IR$_H^2$), respectively. Thus, we have to distinguish four cases:

(i) (IR$_L$) and (IR$_H^1$) are binding

The retailer sets $p_L^S = c_L + \delta$ and $p_H^S = w + \delta$. The corresponding profit is $\pi(\text{both, price}) = 2\delta$. At these prices, (IR$_H^2$) is satisfied if

$$\begin{aligned} \gamma q_H + \delta - (w + \delta) &\geq \gamma q_L + \delta - (c_L + \delta) \\ \iff w &\leq \gamma(q_H - q_L) + c_L \equiv \hat{w}_P. \end{aligned} \tag{A.30}$$

(SC$_P$) is satisfied if

$$\begin{aligned} \frac{q_H}{q_L} &< \frac{w + \delta + w}{c_L + \delta + c_L} \\ \iff w &> \frac{q_H}{q_L} c_L + \frac{q_H - q_L}{2q_L}\delta \equiv \widetilde{w}_F. \end{aligned} \tag{A.31}$$

This case, $\widetilde{w}_F < w \leq \hat{w}_P$, exists only if

$$\begin{aligned} \frac{q_H}{q_L} c_L + \frac{q_H - q_L}{2q_L}\delta &< \gamma(q_H - q_L) + c_L \\ \iff \delta &< 2\left(\gamma q_L - c_L\right). \end{aligned} \tag{A.32}$$

(ii) (IR$_L$) and (IR$_H^2$) are binding.

The retailer sets $p_L^S = c_L + \delta$ and $p_H^S = \gamma(q_H - q_L) + c_L + \delta$. At these prices, (IR$_H^1$) is satisfied if

$$\begin{aligned} \gamma q_H + \delta - [\gamma(q_H - q_L) + c_L + \delta] &\geq \gamma q_H - w \\ \iff w &\geq \gamma(q_H - q_L) + c_L \equiv \hat{w}_P. \end{aligned} \tag{A.33}$$

As in this case, this business strategy is only feasible if $w \geq \hat{w}_P$, the retailer's profit $\pi(\text{both, price}) = \delta + \gamma(q_H - q_L) + c_L + \delta - w \leq 2\delta$.
(SC$_P$) is fulfilled if

$$\begin{aligned} &\frac{q_H}{q_L} < \frac{\gamma(q_H - q_L) + c_L + \delta + w}{c_L + \delta + c_L} \\ \iff &w > \frac{2q_H - q_L}{q_L} c_L + \frac{q_H - q_L}{q_L}\delta - \gamma(q_H - q_L) \equiv \bar{w}_P. \end{aligned} \tag{A.34}$$

(iii) (IR$_H^1$) and (SC$_P$) are binding and (iv) (IR$_H^2$) and (SC$_P$) are binding.

In the following, we argue that if the salience constraint is a binding restriction, business strategy (both, price) is dominated by strategy (both, quality). Suppose there are candidates for p_H^S and p_L^S that are optimally satisfying (IR$_L$), (IR$_H^1$) and (IR$_H^2$) but violating (SC$_P$) (which means that they fulfill (SC$_Q$)). Prices that satisfy the constraints (IR$_L$), (IR$_H^1$) and (IR$_H^2$) under price salience also fulfill the (identical) constraints (IR$_L$) and (IR$_H^1$) as well as the less restrictive (IR$_H^2$) under quality salience (business strategy (1)). Thus, if (SC$_P$) becomes a binding restriction, the retailer can either adjust the prices to fulfill (SC$_P$), which however means to reduce profit, or not adjust the prices to fulfill (SC$_P$) but let quality be salient instead. As the latter option allows for higher prices, business strategy (both, quality) dominates (both, price) in cases where (SC$_P$) is binding.

Business strategy (3): The retailer sells only the branded good to the type H consumer and makes quality salient. The low-quality good is still offered, but only as a decoy good. The fringe product offered at the store affects salience only if it is not dominated by the branded good sold at the store. Therefore, the low-quality good may not be more expensive than the branded good. Thus, the retailer's maximization problem is the following:

$$\max_{p_H^S, p_L^S} \quad (p_H^S - w)$$

subject to

$$\frac{1}{\gamma}q_H + \delta - p_H^S \geq \frac{1}{\gamma}q_H - w \tag{IR$_H^1$}$$

$$\frac{1}{\gamma}q_H + \delta - p_H^S \geq \frac{1}{\gamma}q_L + \delta - p_L^S \tag{IR$_H^2$}$$

$$\frac{1}{\gamma}q_H + \delta - p_H^S \geq \frac{1}{\gamma}q_L - c_L \tag{IR$_H^3$}$$

$$\frac{q_H}{q_L} \geq \frac{\frac{1}{2}(p_H^S + w)}{\frac{1}{2}(p_L^S + c_L)} \tag{SC$_Q$}$$

$$p_L^S < p_H^S \tag{ND}$$

First, let us ignore (ND). We will see later that even then, business strategy (3) is never optimal, as it is always dominated by another strategy. Ignoring (ND), it is optimal to set p_L^S prohibitively high to fulfill (IR$_H^2$) and the salience constraint. The price for the branded good is then bounded from above by (IR$_H^1$) or (IR$_H^3$). (IR$_H^1$) is more restrictive than (IR$_H^3$) if

$$\begin{aligned} w + \delta &\leq \frac{1}{\gamma}(q_H - q_L) + c_L + \delta \\ \Longleftrightarrow \quad w &\leq \frac{1}{\gamma}(q_H - q_L) + c_L \equiv \hat{w}_Q. \end{aligned}$$

Thus, we have to distinguish two cases:
(i) $w \leq \hat{w}_Q$

(IR$_H^1$) is binding. The retailer sets $p_H^S = w + \delta$ and p_L^S prohibitively high. Only the type H consumer purchases in the store. The retailer's profit is $\pi(\text{high, quality}) = \delta$.

(ii) $w > \hat{w}_Q$

(IR$_H^3$) is binding. The retailer sets $p_H^S = \frac{1}{\gamma}(q_H - q_L) + c_L + \delta$ and p_L^S prohibitively high. Only the type H consumer purchases in the store. The retailer's profit is $\pi(\text{high, quality}) = \frac{1}{\gamma}(q_H - q_L) + c_L + \delta - w < \delta$ as $w > \hat{w}_Q$.

Business strategy (4): The retailer solves the following maximization problem:

$$\max_{p_H^S, p_L^S} \quad (p_H^S - w)$$

subject to

$$\gamma q_H + \delta - p_H^S \geq \gamma q_H - w \tag{IR$_H^1$}$$

$$\gamma q_H + \delta - p_H^S \geq \gamma q_L + \delta - p_L^S \tag{IR$_H^2$}$$

$$\gamma q_H + \delta - p_H^S \geq \gamma q_L - c_L \tag{IR$_H^3$}$$

$$\frac{q_H}{q_L} < \frac{\frac{1}{2}(p_H^S + w)}{\frac{1}{2}(p_L^S + c_L)} \tag{SC$_P$}$$

$$p_L^S < p_H^S. \tag{ND}$$

It is easy to see that this business strategy is dominated by strategy (3): Firstly, if the retailer makes quality salient, he can charge a higher mark-up on the high-quality product relative to the low-quality product as the quality difference is perceived to be higher (see the respective constraints (IR$_H^2$) and (IR$_H^3$)). Secondly, if the retailer makes quality salient, the salience constraint is easily fulfilled by setting p_L^S high, whereas it might be binding if he wants to make price salient. Therefore, if the retailer wants to sell only the branded good, it is optimal to make quality the salient attribute.

Business strategy (5): The retailer's maximization problem is:

$$\max_{p_H^S, p_L^S} \quad (p_L^S - c_L)$$

subject to

$$\gamma q_L + \delta - p_L^S \geq \gamma q_L - c_L \tag{IR$_L$}$$

$$\gamma q_L + \delta - p_L^S \geq \gamma q_H - w \tag{IR$_H^1$}$$

$$\gamma q_L + \delta - p_L^S \geq \gamma q_H + \delta - p_H^S \tag{IR$_H^2$}$$

$$\frac{q_H}{q_L} < \frac{\frac{1}{2}(p_H^S + w)}{\frac{1}{2}(p_L^S + c_L)}. \tag{SC$_P$}$$

It is optimal to set p_H^S prohibitively high to make price salient and to fulfill (IR$_H^2$). Of the two remaining constraints, (IR$_H^1$) sets the more restrictive upper bound on p_L^S if

$$\begin{aligned} & \gamma q_H - w \geq \gamma q_L - c_L \\ \iff & w \leq \gamma(q_H - q_L) + c_L \equiv \hat{w}_P. \end{aligned} \tag{A.35}$$

Thus, we have to distinguish two cases:

(i) $w \leq \hat{w}_P$

(IR_H^1) is binding and the retailer sets $p_L^S = w + \delta - \gamma(q_H - q_L)$ and p_H^S prohibitively high. The corresponding profit is $\pi(\text{low, price}) = 2[w + \delta - \gamma(q_H - q_L) - c_L] \leq 2\delta$ as $w \leq \hat{w}_P$ in this case.

(ii) $w > \hat{w}_P$

The retailer sets $p_L^S = c_L + \delta$ and p_H^S prohibitively high. The corresponding profit is $\pi(\text{low, price}) = 2\delta$.

Business strategy (6) The retailer's maximization problem is:

$$\max_{p_H^S, p_L^S} \quad (p_L^S - c_L)$$

subject to

$$\frac{1}{\gamma}q_L + \delta - p_L^S \geq \frac{1}{\gamma}q_L - c_L \tag{IR$_L$}$$

$$\frac{1}{\gamma}q_L + \delta - p_L^S \geq \frac{1}{\gamma}q_H - w \tag{IR$_H^1$}$$

$$\frac{1}{\gamma}q_L + \delta - p_L^S \geq \frac{1}{\gamma}q_H + \delta - p_H^S \tag{IR$_H^2$}$$

$$\frac{q_H}{q_L} \geq \frac{\frac{1}{2}(p_H^S + w)}{\frac{1}{2}(p_L^S + c_L)}. \tag{SC$_Q$}$$

It is easy to see that this business strategy is dominated by strategy (5): Firstly, the respective constraints (IR_H^1) and (IR_H^2) are less restrictive if price is salient instead of quality. Secondly, if the retailer wants to make price salient, the salience constraint is easily fulfilled by setting p_H^S high, whereas it might be binding if quality is supposed to be salient. Therefore, if the retailer wants to sell only the low-quality product, it is optimal to make price the salient attribute.

Now that we have derived the profits under all possible business strategies, we can determine the retailer's optimal strategy. Remember that the highest possible profit a retailer can make is $\pi = 2\delta$. Note that this is never feasible by selling only the branded good. We now want to show that for every wholesale price, there exists a business strategy that allows the retailer to make a profit of $\pi = 2\delta$. The retailer can earn 2δ with business strategy

$$\begin{aligned}
&\text{(both, quality)} \quad \text{if} \quad w \leq \widetilde{w}_F \quad \text{and} \quad \delta < 2\left(\frac{1}{\gamma}q_L - c_L\right) && \text{(A.36)}\\
&\text{(both, quality)} \quad \text{if} \quad w < \hat{w}_Q \quad \text{and} \quad \delta \geq 2\left(\frac{1}{\gamma}q_L - c_L\right) && \text{(A.37)}\\
&\text{(both, price)} \quad \text{if} \quad \widetilde{w}_F < w \leq \hat{w}_P \quad \text{and} \quad \delta < 2\left(\gamma q_L - c_L\right) && \text{(A.38)}\\
&\text{(low, price)} \quad \text{if} \quad w > \hat{w}_P. && \text{(A.39)}
\end{aligned}$$

For the respective threshold wholesale prices we have that $\hat{w}_Q > \hat{w}_P \iff \frac{1}{\gamma}(q_H - q_L) + c_L > \gamma(q_H - q_L) + c_L$, as $\gamma < 1$. Next, $\widetilde{w}_F < \hat{w}_P$, if

$$\begin{aligned}
\frac{q_H}{q_L}c_L + \frac{q_H - q_L}{2q_L}\delta &< \gamma(q_H - q_L) + c_L \\
\iff \delta &< 2(\gamma q_L - c_L), && \text{(A.40)}
\end{aligned}$$

and recall that $\widetilde{w}_F < \hat{w}_Q$, if $\delta < 2\left(\frac{1}{\gamma}q_L - c_L\right)$.

Now, we can summarize our findings. Depending on δ, we must distinguish three cases (see Proposition 2). For each case, we find the retailer's optimal business strategy and derive the manufacturer's optimal wholesale price. The manufacturer always chooses the highest wholesale price that makes it still optimal for the retailer to offer the branded good.[38]

Case (I): If $\delta < 2(\gamma q_L - c_L)$, i.e. for a weak preference of the consumers to purchase at a local store, $\widetilde{w} < \hat{w}_P$. The retailer chooses business strategy

$$\begin{aligned}
&\text{(both, quality)} \quad \text{if} \quad w \leq \widetilde{w}_F \quad \text{or} \\
&\text{(both, price)} \quad \text{if} \quad \widetilde{w}_F < w \leq \hat{w}_P \quad \text{or} \\
&\text{(low, price)} \quad \text{if} \quad w > \hat{w}_P. && \text{(A.41)}
\end{aligned}$$

Therefore, the manufacturer sets $w^F = \hat{w}_P$.

[38]Remember that we assume that, if the retailer is indifferent between selling both products and selling only the fringe product, he offers both products.

Case (II): If $2(\gamma q_L - c_L) \leq \delta < 2\left(\frac{1}{\gamma}q_L - c_L\right)$, i.e. for an intermediate preference of the consumers to purchase at a local store, $\hat{w}_P \leq \widetilde{w}_F < \hat{w}_Q$. The retailer chooses business strategy

$$\begin{aligned} &\text{(both, quality)} \quad \text{if} \quad w \leq \widetilde{w}_F \quad \text{or} \\ &\text{(low, price)} \quad \text{if} \quad w > \widetilde{w}_F. \end{aligned} \tag{A.42}$$

Therefore, the manufacturer sets $w^F = \widetilde{w}_F$.

Case (III): If $\delta \geq 2\left(\frac{1}{\gamma}q_L - c_L\right)$, i.e. for a strong preference of the consumers to purchase at a local store, $\widetilde{w}_F \geq \hat{w}_Q$. The retailer chooses business strategy

$$\begin{aligned} &\text{(both, quality)} \quad \text{if} \quad w \leq \hat{w}_Q \quad \text{or} \\ &\text{(low, price)} \quad \text{if} \quad w > \hat{w}_Q. \end{aligned} \tag{A.43}$$

Therefore, the manufacturer sets $w^F = \hat{w}_Q$.

Internet prices: Can a retailer benefit from deviating from the equilibrium candidate, where $p_H^I = w$ and $p_L^I = c_L$? In the following we will argue that the answer is no.

First, note that if all competitors sell both products at cost online, then a retailer cannot make strictly positive profits with online sales. Hence, a deviation from the proposed internet prices can be beneficial only if it increases profits from sales at the local store by changing the salient attribute.

Second, recall that salience is affected only by the lowest internet price for each given quality. This immediately implies that a deviation to higher online prices has no effect on the salient attribute. It also does not affect the constraints because if a consumer decides to purchase online, he will purchase from the cheapest store. Thus, a retailer cannot benefit from choosing higher internet prices.

Now, suppose a retailer deviates from the proposed equilibrium by setting $p_H^S < w$. This may change the salience from price salience to quality salience and thus enhance consumers' willingness to pay. The retailer, however, cannot benefit from this increased willingness to pay. In particular, all type H consumers now have an incentive to purchase the good online. The retailer also has to lower p_H^S below $w + \delta$ and thus always makes a profit of strictly less than 2δ (potentially he makes a loss because the type H consumers from other markets purchase the good online from this retailer at a price below costs).

Alternatively, a retailer could deviate by setting $p_L^I < c_L$. If this deviation has an effect on salience, then a former quality salient environment has become a price salient one.

This reduces the set of feasible store prices, i.e. the set of prices (p_L^S, p_H^S) that satisfy all constraints but the salience constraint. Hence, triggering price salience cannot increase a retailer's profit. $\square$

Proof of Proposition 3. First, we investigate the optimal strategy of a retailer that faces wholesale price w. We presume that the equilibrium price for low-quality online is $p_L^I = c_L$, and verify this at the end of the proof. After having characterized a retailer's optimal behavior, we solve for the manufacturer's optimal wholesale price w^R.

Before proceeding with the various strategies a retailer can pursuit, it is useful to point out that a retailer can always make a profit of $\pi = 2\delta$ by effectively selling only the low-quality good. The retailer sets $p_L^S = c_L + \delta$ and p_H^S prohibitively high. Thus, the wholesale price must allow the retailer to make a profit of at least 2δ, otherwise the branded product is not sold.

There are four possible business strategies for selling the branded product:

(1) sell both the branded and the fringe product, make quality salient (both, quality)

(2) sell both the branded and the fringe product, make price salient (both, price)

(3) effectively sell only the branded product, make quality salient (high, quality)

(4) effectively sell only the branded product, make price salient (high, price)

We start with the two strategies under which both products are sold (and purchased) at the brick-and-mortar store.

Business strategy (1): In this case a retailer's maximization problem is

$$\max_{p_L^S, p_H^S} \quad (p_H^S - w) + (p_L^S - c_L) \tag{A.44}$$

subject to

$$p_L^S \leq c_L + \delta \tag{IR$_L$}$$

$$p_H^S \leq \frac{1}{\gamma}(q_H - q_L) + p_L^S \tag{IR$_H$}$$

$$p_H^S \leq \frac{q_H}{2q_L}(p_L^S + c_L). \tag{SC$_Q$}$$

The type L consumer has to prefer to purchase at the local store rather than online. This is ensured by constraint (IR$_L$). Given (IR$_L$) holds, the best alternative for the type H

consumer to purchasing the branded product at the local store, is to purchase the fringe product at the local store. Constraint (IR_H) ensures that the type H consumer purchases the branded product. Finally, the retailer has to choose the prices so that indeed quality is salient.

First, note that it is optimal to set p_L^S as high as possible, i.e. $p_L^S = c_L + \delta$. This increases the target function and relaxes the constraints (IR_H) and (SC_Q). The two remaining constraints impose an upper bound on p_H^S. The profit is increasing in p_H^S, thus

$$p_H^S = \min\left\{\frac{1}{\gamma}(q_H - q_L) + c_L + \delta,\ \frac{q_H}{2q_L}(2c_L + \delta)\right\}, \tag{A.45}$$

is optimal. The optimal price for the branded product is given by the former term if constraint (IR_H) is binding while (SC_Q) is slack. This is the case if and only if

$$\frac{1}{\gamma}(q_H - q_L) + c_L + \delta \leq \frac{q_H}{2q_L}(2c_L + \delta) \tag{A.46}$$

$$\iff \delta\frac{2q_L - q_H}{2q_L} \leq \frac{q_H - q_L}{q_L}c_L - \frac{1}{\gamma}(q_H - q_L). \tag{A.47}$$

Under the imposed assumption that $q_H > 2q_L$, the above condition holds if and only if

$$\delta \geq \frac{2(q_H - q_L)}{q_H - 2q_L}\left(\frac{1}{\gamma}q_L - c_L\right). \tag{A.48}$$

A retailer's profit in this case is

$$\pi(\text{both, quality}) = \begin{cases} 2\delta + \frac{1}{\gamma}(q_H - q_L) + c_L - w & \text{if (A.48) holds} \\ \delta + \frac{q_H}{2q_L}(2c_L + \delta) - w & \text{if (A.48) is violated} \end{cases} \tag{A.49}$$

Business strategy (2): Now, the retailer sells both products in a price salient environment. The optimization program is

$$\max_{p_L^S, p_H^S} \quad (p_H^S - w) + (p_L^S - c_L) \tag{A.50}$$

subject to

$$p_L^S \leq c_L + \delta \tag{IR_L}$$

$$p_H^S \leq \gamma(q_H - q_L) + p_L^S \tag{IR_H}$$

$$p_H^S > \frac{q_H}{2q_L}(p_L^S + c_L). \tag{SC_P}$$

First, we ignore constraint (SQ_P). In this case, it is optimal to set $p_L^S = c_L + \delta$ and $p_H^S = \gamma(q_H - q_L) + c_L + \delta$. For these prices, the salience constraint is indeed satisfied – price is salient – if and only if

$$\delta < \frac{2(q_H - q_L)}{q_H - 2q_L}(\gamma q_L - c_L). \tag{A.51}$$

Now suppose that for the store prices $p_L^S = c_L + \delta$ and $p_H^S = \gamma(q_H - q_L) + c_L + \delta$ the salience constraint is violated. From (SC_P), it follows that the retailer has to reduce p_L^S. For a lower p_L^S, by constraint (IR_H), price p_H^S needs to be reduced as well. The prices $p_L^S = c_L + \delta$ and $p_H^S = \gamma(q_H - q_L) + c_L + \delta$, however, satisfy all constraints under quality salience (program (A.44)). Hence, if (SC_P) imposes a binding restriction, price salience is dominated by quality salience.

The retailer's profit amounts to

$$\pi(\text{both,price}) = 2\delta + \gamma(q_H - q_L) + c_L - w. \tag{A.52}$$

Before proceeding with the analysis of the business strategies where the retailer effectively sells only the branded product at the local store, we compare the two strategies analyzed so far. If the salience constraint does not impose a binding restriction, quality salience outperforms price salience. The question is whether making quality just salient is preferred to price salience. This is the case if and only if

$$\delta + \frac{q_H}{2q_L}(2c_L + \delta) - w \geq 2\delta + \gamma(q_H - q_L) + c_L - w \tag{A.53}$$

$$\iff \delta \geq \frac{2(q_H - q_L)}{q_H - 2q_L}(\gamma q_L - c_L). \tag{A.54}$$

The following result summarizes the above observations.

Lemma 1 (Restricted Distribution – Selling both Qualities)**.** *Let $q_H > 2q_L$ and suppose the retailer wants to sell both products at the brick-and-mortar store. Then, the optimal response of the retailer is:*

(I) For $\delta < \frac{2(q_H-q_L)}{q_H-2q_L}(\gamma q_L - c_L)$, the prices at the store are $p_L^S = c_L+\delta$ and $p_H^S = \hat{w}_P+\delta$. Price is salient and the retailer makes a profit of $\pi = 2\delta + \gamma(q_H - q_L) + c_L - w$.

(II) For $\frac{2(q_H-q_L)}{q_H-2q_L}\left(\frac{1}{\gamma}q_L - c_L\right) > \delta \geq \frac{2(q_H-q_L)}{q_H-2q_L}(\gamma q_L - c_L)$, the prices at the store are $p_L^S = c_L + \delta$ and $p_H^S = \widetilde{w}_R + \delta$. Quality is salient and the retailer makes a profit of $\pi = \delta + \frac{q_H}{2q_L}(2c_L + \delta) - w$.

(III) For $\delta \geq \frac{2(q_H-q_L)}{q_H-2q_L}\left(\frac{1}{\gamma}q_L - c_L\right)$, the prices at the store are $p_L^S = c_L+\delta$ and $p_H^S = \hat{w}_Q+\delta$. Quality is salient and the retailer makes a profit of $\pi = 2\delta + (q_H - q_L)/\gamma + c_L - w$.

Business strategy (3): Suppose the retailer wants to sell only the branded product in a quality salient environment. The retailer still offers the fringe product, which he can use as a decoy good. The fringe product offered at the store affects salience only if it is not dominated by the branded product sold at the store, i.e., if $p_H^S > p_L^S$. The optimization program is

$$\max_{p_H^S, p_L^S} \quad p_H^S - w \tag{A.55}$$

subject to

$$p_H^S \leq \frac{1}{\gamma}(q_H - q_L) + c_L + \delta \tag{IR$_H$}$$

$$\frac{q_H}{q_L} \geq \frac{p_H^S}{(c_L + p_L^S)/2} \tag{SC$_Q$}$$

$$p_L^S < p_H^S \tag{ND}$$

The type H consumer has to purchase the branded product at the store, which he does if constraint (IR$_H$) holds. Note that his best alternative is to purchase the low-quality good online. Quality is indeed salient if (SC$_Q$) holds and the low-quality good at the store is not dominated if (ND) holds.

First, note that for $q_H > 2q_L$ the salience constraint is always satisfied if p_L^S is sufficiently close to p_H^S. For $p_L^S \to p_H^S$ the salience constraint is given by

$$\frac{q_H}{q_L} c_L > -\frac{q_H - 2q_L}{q_L} p_H^S. \tag{A.56}$$

The retailer can always use the fringe product as a decoy good that makes quality salient. The optimal price for the branded product is $p_H^S = \frac{1}{\gamma}(q_H - q_L) + c_L + \delta$ and the retailer's profit is

$$\pi(\text{high, quality}) = \frac{1}{\gamma}(q_H - q_L) + c_L + \delta - w. \tag{A.57}$$

Business strategy (4): The strategy of effectively selling only the branded product in a price salient environment is dominated by strategy (3) and also by strategy (2).

Finally we compare the retailer's profit from selling both products with his profit from selling only the branded product. We distinguish three cases.

First, for $\delta \geq \frac{2(q_H - q_L)}{q_H - 2q_L}\left(\frac{1}{\gamma} q_L - c_L\right)$, the retailer prefers to sell both goods at the local store if and only if

$$2\delta + \frac{1}{\gamma}(q_H - q_L) + c_L - w \geq \delta + \frac{1}{\gamma}(q_H - q_L) + c_L - w, \tag{A.58}$$

which is always satisfied as $\delta \geq 0$.

Second, for $\frac{2(q_H-q_L)}{q_H-2q_L}\left(\frac{1}{\gamma}q_L-c_L\right) > \delta \geq \frac{2(q_H-q_L)}{q_H-2q_L}(\gamma q_L - c_L)$ the retailer prefers to sell both goods at the local store if and only if

$$\delta + \frac{q_H}{2q_L}(2c_L+\delta) - w \geq \delta + \frac{1}{\gamma}(q_H-q_L) + c_L - w \tag{A.59}$$

$$\iff \delta \geq \frac{2(q_H-q_L)}{q_H}\left(\frac{1}{\gamma}q_L - c_L\right). \tag{A.60}$$

The critical δ is lower than the upper bound of this case. It is larger than the lower bound if and only if

$$\frac{2(q_H-q_L)}{q_H}\left(\frac{1}{\gamma}q_L - c_L\right) > \frac{2(q_H-q_L)}{q_H-2q_L}(\gamma q_L - c_L) \tag{A.61}$$

$$\iff (1-\gamma^2)q_H > 2(q_L - \gamma c_L). \tag{A.62}$$

Third, for $\delta < \frac{2(q_H-q_L)}{q_H-2q_L}(\gamma q_L - c_L)$ the retailer prefers to sell both goods at the local store if and only if

$$\delta \geq (q_H - q_L)\frac{1-\gamma^2}{\gamma} \tag{A.63}$$

The critical δ is below the upper bound of this case if and only if

$$(1-\gamma^2)q_H < 2(q_L - \gamma c_L). \tag{A.64}$$

The retailer will indeed sell the branded product if the wholesale price is such that he makes a profit of at least 2δ, which he can always make by selling only the low-quality product. This constraint determines the optimal wholesale price charged by the manufacturer. The proposition now follows from the outlined arguments.

Online prices: Can a retailer benefit from deviating from the equilibrium candidate, where $p_L^I = c_L$? If a competitor sells at cost online, then it is not possible to make profitable online sales. The only reason to deviate from the proposed equilibrium is to affect salience in a profitable way, i.e. by choosing the online price for low quality so that quality rather than price is salient. The salience constraint is

$$\frac{q_H}{q_L} \geq \frac{p_H^S}{(p_L^S + p_L^I)/2}, \tag{SC$_Q$}$$

where p_L^I is the lowest price charged for the fringe product online. A higher online price for low quality is attractive to a retailer because it relaxes the salience constraint. The online price considered by a consumer, however, is the lowest available online price. Therefore, a unilateral deviation of a local retailer to a higher online price than the price $p_L^I = c_L$ charged by all competitors does not relax the salience constraint. Hence, a retailer does not have a (strict) incentive to deviate from the online price $p_L^I = c_L$. □

Proof of Proposition 4.

Preliminary considerations: The manufacturer prefers the distribution system that allows her to charge the highest wholesale price because the per retailer profit is $\Pi = w - c_H$. The highest possible wholesale price is $\hat{w}_Q$, i.e. whenever the manufacturer can charge $\hat{w}_Q$ under a distribution system D, then D is an optimal distribution system. Moreover, $\widetilde{w}_F > \widetilde{w}_R$. Note that

$$\hat{w}_Q - \delta > \hat{w}_P \iff \delta < (q_H - q_L)\frac{1-\gamma^2}{\gamma} \equiv \tilde{\delta} \tag{A.65}$$

$$\hat{w}_Q - \delta > \widetilde{w}_F \iff \delta < \frac{2(q_H - q_L)}{q_H + q_L}\left(\frac{1)}{\gamma}q_L - c_L\right) \equiv \bar{\delta} \tag{A.66}$$

Before proceeding with the actual comparison of the two distribution systems, it is useful to define the relevant δ-thresholds. Under free distribution the thresholds are

$$\delta_{1F} \equiv 2(\gamma q_L - c_L) \quad \text{and} \quad \delta_{2F} \equiv 2\left(\frac{1}{\gamma}q_L - c_L\right). \tag{A.67}$$

Note that $\delta_{1F} < \delta_{2F}$. Moreover, $\delta < \delta_{1F} \iff \hat{w}_P > \widetilde{w}_F$.

Under the restricted distribution system, the relevant thresholds, next to $\tilde{\delta}$, are

$$\delta_{1R} \equiv \frac{2(q_H - q_L)}{q_H - 2q_L}(\gamma q_L - c_L), \tag{A.68}$$

$$\delta_{2R} \equiv \frac{2(q_H - q_L)}{q_H - 2q_L}\left(\frac{1}{\gamma}q_L - c_L\right), \tag{A.69}$$

$$\text{and} \quad \delta_{3R} \equiv \frac{2(q_H - q_L)}{q_H}\left(\frac{1}{\gamma}q_L - c_L\right). \tag{A.70}$$

Note that $\delta_{1R} < \delta_{2R}$ and $\delta_{3R} < \delta_{2R}$. It is useful to recall that $\delta < \delta_{1R} \iff \hat{w}_P > \widetilde{w}_R$ and that $\delta < \delta_{2R} \iff \hat{w}_Q - \delta > \widetilde{w}_R$.

Comparing the thresholds across the distribution systems reveals that

$$\delta_{1F} < \delta_{1R} \quad \text{and} \quad \delta_{2F} < \delta_{2R}. \tag{A.71}$$

Comparison of the distribution systems: The comparison is decomposed into two main cases, namely $(1-\gamma^2)q_H \lesseqgtr 2(q_L - \gamma c_L)$.

Case (a): $(1-\gamma^2)q_H < 2(q_L - \gamma c_L)$.

First, note that in case (a) we have $\tilde{\delta} < \delta_{2F}$. Suppose, in contradiction, that $\tilde{\delta} \geq \delta_{2F}$, which is equivalent to

$$(3-\gamma^2)q_L - 2\gamma c_L \leq (1-\gamma^2)q_H. \tag{A.72}$$

Inserting the upper bound for the right-hand side and rearranging yields

$$(1-\gamma^2)q_L \leq 0, \tag{A.73}$$

a contradiction.

Next, it can be shown that in the allowed parameter range $\delta_{2F} \lesseqgtr \delta_{1R}$, i.e. both cases are possible. Moreover, $\delta_{1F} < \tilde{\delta}$ if and only if

$$(1+\gamma^2)q_L - 2\gamma c_L < (1-\gamma^2)q_H \tag{A.74}$$

It is useful to note that if condition (A.74) holds, then $\bar{\delta} \in (\delta_{1F}, \tilde{\delta})$.

From the above considerations, it follows that there are four cases – four sequences of the δ-thresholds – that we need to consider.

(i) $\delta_{1F} < \tilde{\delta} < \delta_{2F} < \delta_{1R} < \delta_{2R}$

(ii) $\delta_{1F} < \tilde{\delta} < \delta_{1R} < \delta_{2F} < \delta_{2R}$

(iii) $\tilde{\delta} < \delta_{1F} < \delta_{2F} < \delta_{1R} < \delta_{2R}$

(iv) $\tilde{\delta} < \delta_{1F} < \delta_{1R} < \delta_{2F} < \delta_{2R}$

We consider the subcases subsequently.

(i) For $\delta \geq \delta_{2R}$ we have $w^R = w^F = \hat{w}_Q$ (compare with Propositions 2 and 3). The manufacturer is indifferent and thus chooses $D = F$.

For $\delta \in [\delta_{1R}, \delta_{2R})$ we have $w^F = \hat{w}_Q > \widetilde{w}_R = w^R$. Thus, $D = F$ is strictly optimal.

For $\delta \in [\delta_{2F}, \delta_{1R})$ we have $w^F = \hat{w}_Q > \hat{w}_P = w^R$ and thus $D = F$ is strictly optimal.

For $\delta \in [\tilde{\delta}, \delta_{2F})$ we have $w^F = \widetilde{w}_F > \hat{w}_P = w^R$ and thus $D = F$ is strictly optimal.

For $\delta \in [\delta_{1F}, \tilde{\delta})$ we have $w^F = \widetilde{w}_F$ and $w^R = \hat{w}_Q - \delta$. The restricted distribution system is preferred, $\hat{w}_Q - \delta > \widetilde{w}_F$, iff $\delta < \bar{\delta}$.

For $\delta < \delta_{1F}$ we have $w^F = \hat{w}_P < \hat{w}_Q - \delta = w^R$ and thus $D = R$ is strictly optimal.

In summary, $D = R$ iff $\delta < \bar{\delta}$.

(ii) For $\delta \geq \delta_{2R}$ and for $\delta < \tilde{\delta}$ the comparisons are the same as in case (i).

For $\delta \in [\delta_{2F}, \delta_{2R})$ we have $w^F = \hat{w}_Q > \widetilde{w}_R = w^R$ and thus $D = F$ is strictly optimal.

For $\delta \in [\delta_{1R}, \delta_{2F})$ we have $w^F = \widetilde{w}_F > \widetilde{w}_R = w^R$ and thus $D = F$ is strictly optimal.

For $\delta \in [\widetilde{\delta}, \delta_{1R})$, we have $w^F = \widetilde{w}_F > \hat{w}_P = w^R$ and thus $D = F$ is strictly optimal.

In summary, $D = R$ iff $\delta < \bar{\delta}$.

(iii) For $\delta \geq \delta_{2F}$ the comparisons are the same as in case (i).

For $\delta \in [\delta_{1F}, \delta_{2F})$, we have $w^F = \widetilde{w}_F > \hat{w}_P = w^R$ and thus $D = F$ is strictly optimal.

For $\delta \in [\tilde{\delta}, \delta_{1F})$ we have $w^F = \hat{w}_P = w^R$. The manufacturer is indifferent an chooses $D = F$.

For $\delta < \tilde{\delta}$ we have $w^F = \hat{w}_P < \hat{w}_Q - \delta = w^R$ and thus $D = R$ is strictly optimal.

In summary, $D = R$ iff $\delta < \tilde{\delta}$.

(iv) For $\delta < \delta_{1F}$ the comparison is the same as in case (iii) and for $\delta \geq \delta_{1R}$ as in case (ii).

For $\delta \in [\delta_{1F}, \delta_{1R})$ we have $w^F = \widetilde{w}_F > \hat{w}_P = w^R$ and thus $D = F$ is strictly optimal.

In summary, $D = R$ iff $\delta < \tilde{\delta}$.

Case (b): $(1 - \gamma^2)q_H \geq 2(q_L - \gamma c_L)$.

First note that $\delta_{1F} < \delta_{3R}$ is equivalent to

$$q_L - \gamma c_L < (1 - \gamma^2)q_H, \tag{A.75}$$

which always holds in case (b). Moreover, it holds that $\delta_{2F} > \delta_{3R}$. Hence, there is only one case – a unique sequence of δ-thresholds – that we need to consider:

$$\delta_{1F} < \delta_{3R} < \delta_{2F} < \delta_{2R}.$$

It is useful to note that $\bar{\delta} \in (\delta_{1F}, \delta_{3R})$. The observation $\bar{\delta} < \delta_{3R}$ is obvious. $\bar{\delta} > \delta_{1F}$ is equivalent to inequality (A.74), which holds under the condition of case (b).

The optimal distribution system, depending on the level of δ, is as follows.

For $\delta \geq \delta_{2R}$ we have $w^R = w^F = \hat{w}_Q$. The manufacturer is indifferent and thus chooses $D = F$.

For $\delta \in [\delta_{2F}, \delta_{2R})$ we have $w^F = \hat{w}_Q > \widetilde{w}_R = w^R$. Thus, $D = F$ is strictly optimal.

For $\delta \in [\delta_{3R}, \delta_{2F})$ we have $w^F = \widetilde{w}_F > \widetilde{w}_R = w^R$ and thus $D = F$ is strictly optimal.

For $\delta \in [\delta_{1F}, \delta_{3R})$ we have $w^F = \widetilde{w}_F$ and $w^R = \hat{w}_Q - \delta$. The restricted distribution system is preferred, $\hat{w}_Q - \delta > \widetilde{w}_F$, iff $\delta < \bar{\delta}$.

For $\delta < \delta_{1F}$ we have $w^F = \hat{w}_P < \hat{w}_Q - \delta = w^R$ and thus $D = R$ is strictly optimal.

In summary, $D = R$ iff $\delta < \bar{\delta}$.

Combining the results from case (a) and case (b) and noting that (A.74) is equivalent to

$$\gamma < \frac{1}{q_L + q_H}\left(c_L + \sqrt{q_H^2 - q_L^2 + c_L^2}\right) \tag{A.76}$$

completes the proof. $\square$

Proof of Corollary 1. The result follows immediately from Proposition 4. $\square$

Proof of Proposition 5. The unbiased – experienced utility – of a consumer of type H is $u_H^E(q,p) = q - p + \mathbb{I}\delta$ and of type L is $u_L^E(q,p) = \min\{q, q_L\} - p + \mathbb{I}\delta$. Consumer welfare is defined as the sum of experienced utility of a type L and a type H consumer. A type L consumer either purchases quality q_L at a brick-and-mortar store at price $p_L^S = c_L + \delta$ or on the internet at $p_L^I = c_L$. Thus, his utility in equilibrium is always $u_L^E = q_L - c_L$. A consumer of type H always purchases quality q_H at a brick-and-mortar store, i.e. at price p_H^S. From the proof of Proposition 4 it follows that there are effectively two cases to consider.

First, $\delta < \delta_{1F}$ and satisfies (23). For $D = F$ we have $w^F = \hat{w}_P$ and $p_H^S = \hat{w}_P + \delta$. For $D = R$ the wholesale price is $w^R = \hat{w}_Q - \delta$ and the retailer sets $p_H^S = \hat{w}_Q + \delta$. As $\hat{w}_Q > \hat{w}_P$, the branded product is cheaper and consumer welfare is higher if it is illegal to ban internet sales.

Secondly, $\delta \geq \delta_{1F}$ and satisfies (23). For $D = F$ we have $w^F = \widetilde{w}_F$ and $p_H^S = \widetilde{w}_F + \delta$. For $D = R$ the wholesale and the retail prices are $w^R = \hat{w}_Q - \delta$ and $p_H^S = \hat{w}_Q + \delta$, respectively. As in the relevant parameter range $\hat{w}_Q > \widetilde{w}_F$, the branded product is cheaper and consumer welfare is higher if it is illegal to ban internet sales.

$\square$

Proof of Proposition 6. For the free distribution system we know from Proposition 2 that if $\delta < 2(\gamma q_L - c_L)$, then $w^F = \hat{w}_P$. Price is salient and each retailer charges $p_H^S = \hat{w}_P + \delta$ and $p_L^S = c_L + \delta$ at his local store. Both consumer types purchase at their local store.

For the restricted distribution system we know from Proposition 3 that if $\delta < \min\{\frac{1-\gamma^2}{\gamma}(q_H - q_L), \frac{2(q_H - q_L)}{q_H - 2q_L}(\gamma q_L - c_L)\}$, then $w^R = \hat{w}_Q - \delta$. Quality is salient and each retailer charges $p_H^S = \hat{w}_Q + \delta$ and p_L^S close to p_H^S at his local store. The price for the fringe product online is $p_L^I = c_L$. Type H consumers purchase from the local store and type L consumers online.

Thus, for

$$\delta < \min\left\{\frac{1-\gamma^2}{\gamma}(\underline{q} - q_L), 2(\gamma q_L - c_L)\right\} \tag{A.77}$$

the above two cases apply for any quality choice $q_H \geq \underline{q}$. Moreover, if δ satisfies (A.77), the manufacturer prefers the restricted distribution system. Thus, if the law maker does not forbid a restricted distribution system, then $D = R$ and otherwise $D = F$.

Now, we prove the three claims of the proposition separately.

(1) If restricted distribution systems are forbidden, the manufacturer maximizes

$$\Pi^F(q_H) = \hat{w}_P(q_H) - C(q_H) \tag{A.78}$$

$$= \gamma(q_H - q_L) + c_L - \underline{c} - c(q_H - \underline{q}). \tag{A.79}$$

The first-order condition, which is here necessary and sufficient, is

$$c'(q_H^F - \underline{q}) = \gamma. \tag{A.80}$$

If restricted distribution systems are allowed, the manufacturer maximizes

$$\Pi^R(q_H) = \hat{w}_Q(q_H) - \delta - C(q_H) \tag{A.81}$$

$$= \frac{1}{\gamma}(q_H - q_L) + c_L - \underline{c} - c(q_H - \underline{q}). \tag{A.82}$$

The first-order condition is

$$c'(q_H^R - \underline{q}) = \frac{1}{\gamma}. \tag{A.83}$$

From the assumptions that $c''(\cdot) > 0$ and $\gamma \in (0,1)$, it follows immediately that $q_H^R > q_H^F$.

(2) Consumer welfare is defined as the sum of the net experienced utilities of the two consumer types:

$$CW = q_H - p_H^I + \mathbb{I}_H[\delta - (p_H^S - p_H^I)] + q_L - p_L^I + \mathbb{I}_L[\delta - (p_L^S - p_L^I)], \tag{A.84}$$

where $\mathbb{I}_\tau \in \{0,1\}$ with $\mathbb{I}_\tau = 1$ if the consumer of type $\tau = L, H$ purchases at a local store and $\mathbb{I}_\tau = 0$ if he purchases online.

If restricted distribution systems are forbidden, consumer welfare is given by

$$CW^F = q_H^F + \delta - [\gamma(q_H^F - q_L) + c_L + \delta] + (q_L - c_L) \tag{A.85}$$

$$= (1-\gamma)q_H^F + \gamma q_L - c_L + (q_L - c_L). \tag{A.86}$$

If restricted distribution systems are allowed, consumer welfare is given by

$$CW^R = q_H^R + \delta - \left[\frac{1}{\gamma}(q_H^R - q_L) + c_L + \delta\right] + (q_L - c_L) \tag{A.87}$$

$$= -\frac{1-\gamma}{\gamma}q_H^R + \frac{1}{\gamma}q_L - c_L + (q_L - c_L). \tag{A.88}$$

Thus, $CW^F \geq CW^R$ if and only if

$$(1-\gamma)q_H^F + \gamma q_L - c_L \geq -\frac{1-\gamma}{\gamma}q_H^R + \frac{1}{\gamma}q_L - c_L \tag{A.89}$$

$$\iff q_H^F + \frac{1}{\gamma}q_H^R \geq \frac{1+\gamma}{\gamma}q_L. \tag{A.90}$$

The above condition is always satisfied since $q_H^R > q_H^F > q_L$.

(3) If restricted distribution systems are forbidden, total welfare is given by

$$W^F = q_H^F + \delta - \underline{c} - c(q_H^F - \underline{q}) + q_L - c_L + \delta. \tag{A.91}$$

If restricted distribution systems are allowed, total welfare is

$$W^R = q_H^R + \delta - \underline{c} - c(q_H^R - \underline{q}) + q_L - c_L. \tag{A.92}$$

Note, here type L consumers purchase online, which is inefficient from a welfare perspective. Thus, $W^F > W^R$ if and only if

$$q_H^F - c(q_H^F - \underline{q}) + \delta > q_H^R - c(q_H^R - \underline{q}). \tag{A.93}$$

For $c(\Delta) = k\Delta^2$ we have

$$q_H^F = \underline{q} + \frac{\gamma}{2k} \quad \text{and} \quad q_H^R = \underline{q} + \frac{1}{2k\gamma}. \tag{A.94}$$

For this specification of the cost function, inequality (A.93) is equivalent to

$$\begin{aligned} &\underline{q}+\frac{\gamma}{2k} - k\left(\frac{\gamma}{2k}\right)^2 + \delta \geq \underline{q} + \frac{1}{2k\gamma} - k\left(\frac{1}{2k\gamma}\right)^2 && \text{(A.95)}\\ \iff\ &\delta \geq \frac{1}{2k}\,\frac{1-\gamma^2}{\gamma} - \frac{1}{4k}\,\frac{1-\gamma^4}{\gamma^2} && \text{(A.96)}\\ \iff\ &\delta \geq \frac{1}{2k}\,\frac{1-\gamma^2}{\gamma}\left(1 - \frac{1+\gamma^2}{2\gamma}\right). && \text{(A.97)} \end{aligned}$$

The right-hand side is always negative because

$$1 - \frac{1+\gamma^2}{2\gamma} < 0 \iff (1-\gamma)^2 > 0. \tag{A.98}$$

Hence, for any $\delta \geq 0$ we have $W^F > W^R$.

□

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B. Further Results and Robustness Checks

B.1. Low Differences in Quality, $q_H \leq 2q_L$

The proof of Proposition (2) does not make use of the assumption $q_H > 2q_L$. Thus, Proposition (2) characterizes the equilibrium of the free distribution subgame also for the case $q_H \leq 2q_L$. Apart from the assumption on differences in quality, all assumptions are the same as outlined in the main paper. In the following, we first solve for the manufacturer's optimal wholesale price under a restricted distribution system and then compare the wholesale prices under free and restricted distribution system.

B.1.1. Restricted Distribution

First, we investigate the optimal strategy of a retailer that faces wholesale price w. As before, the equilibrium price for the low-quality product online is $p_L^I = c_L$. After having characterized a retailer's optimal behavior, we solve for the manufacturer's optimal wholesale price w^R.

Before proceeding with the various strategies a retailer can pursuit, it is useful to point out that a retailer can always make a profit of $\pi = 2\delta$ by effectively selling only the low-quality good: the retailer sets $p_L^S = c_L + \delta$ and p_H^S prohibitively high. Thus, the wholesale price must allow the retailer to make a profit of at least 2δ, otherwise the branded product is not sold.

There are four possible business strategies for selling the branded product:

(1) sell both the branded and the fringe product, make quality salient (both, quality)

(2) sell both the branded and the fringe product, make price salient (both, price)

(3) effectively sell only the branded product, make quality salient (high, quality)

(4) effectively sell only the branded product, make price salient (high, price)

Business strategy (1): In this case a retailer's maximization problem is

$$\max_{p_L^S, p_H^S} \quad (p_H^S - w) + (p_L^S - c_L) \tag{B.1}$$

subject to

$$p_L^S \leq c_L + \delta \tag{IR$_L$}$$

$$p_H^S \leq \frac{1}{\gamma}(q_H - q_L) + p_L^S \tag{IR$_H^1$}$$

$$p_H^S \leq \frac{1}{\gamma}(q_H - q_L) + c_L + \delta \tag{IR$_H^2$}$$

$$p_H^S \leq \frac{q_H}{2q_L}(p_L^S + c_L) \tag{SC$_Q$}$$

$$p_L^S < p_H^S. \tag{ND}$$

Note that (IR$_H^2$) is fulfilled if (IR$_H^1$) and (IR$_L$) are satisfied. Therefore, we can ignore it. We have to distinguish three cases:

(i) (SC$_Q$) and (ND) are binding.

The optimal prices are $p_H^S = \frac{q_H}{2q_L - q_H} c_L$ and $p_L^S = p_H^S$. Note that in order to get a well-defined solution, we allow for $p_L^S = p_H^S$. Strictly speaking, p_L^S has to be marginally smaller than p_H^S to fulfill (ND). Constraint (IR$_L$) is satisfied if and only if

$$\frac{q_H}{2q_L - q_H} c_L \leq c_L + \delta \tag{B.2}$$

$$\iff \delta \geq \frac{2(q_H - q_L)}{2q_L - q_H} \tag{B.3}$$

A retailer's profit in this case is

$$\pi(\text{both, quality}) = \frac{3q_H - 2q_L}{2q_L - q_H} c_L - w. \tag{B.4}$$

(ii) (IR$_L$) and (SC$_Q$) are binding.

The optimal prices are $p_H^S = \frac{q_H}{2q_L}(2c_L + \delta)$ and $p_L^S = c_L + \delta$. Constraint (ND) is satisfied if and only if

$$\delta < \frac{2(q_H - q_L)}{2q_L - q_H} c_L. \tag{B.5}$$

The corresponding profit is

$$\pi(\text{both, quality}) = \delta + \frac{q_H}{2q_L}(2c_L + \delta) - w. \tag{B.6}$$

(iii) (IR$_L$) and (IR$_H^1$) are binding.

The optimal prices are $p_H^S = \frac{1}{\gamma}(q_H - q_L) + c_L + \delta$ and $p_L^S = c_L + \delta$. However, at these prices the salience constraint is never satisfied, because $2q_L \geq q_H$ and $q_L > \gamma q_L$. That means the case where only (IR_L) and (IR_H^1) are binding does not exist.

Business strategy (2): Now, the retailer sells both products in a price -salient environment. The optimization program is

$$\max_{p_L^S, p_H^S} \quad (p_H^S - w) + (p_L^S - c_L) \tag{B.7}$$

subject to

$$\begin{aligned}
p_L^S &\leq c_L + \delta && (\mathrm{IR}_L)\\
p_H^S &\leq \gamma(q_H - q_L) + p_L^S && (\mathrm{IR}_H^1)\\
p_H^S &\leq \gamma(q_H - q_L) + c_L + \delta && (\mathrm{IR}_H^2)\\
p_H^S &> \frac{q_H}{2q_L}(p_L^S + c_L) && (\mathrm{SC}_P)\\
p_L^S &< p_H^S. && (\mathrm{ND})
\end{aligned}$$

Again, (IR_H^2) is fulfilled if (IR_H^1) and (IR_L) hold. The optimal prices are $p_H^S = \gamma(q_H - q_L) + c_L + \delta$ and $p_L^S = c_L + \delta$. At these prices, (SC_P) and (ND) are always satisfied. The corresponding profit is

$$\pi(\text{both, price}) = 2\delta + \gamma(q_H - q_L) + c_L - w. \tag{B.8}$$

Business strategy (3): Suppose the retailer wants to sell effectively only the branded product in a quality-salient environment. The retailer still offers the fringe product, which he can use as a decoy good. The fringe product offered at the store affects salience only if it is not dominated by the branded product sold at the store, i.e., if $p_H^S > p_L^S$. The optimization program is

$$\max_{p_H^S, p_L^S} \quad p_H^S - w \tag{B.9}$$

subject to

$$\begin{aligned}
p_H^S &\leq \frac{1}{\gamma}(q_H - q_L) + p_L^S && (\mathrm{IR}_H^1)\\
p_H^S &\leq \frac{1}{\gamma}(q_H - q_L) + c_L + \delta && (\mathrm{IR}_H^2)\\
p_H^S &\leq \frac{q_H}{2q_L}(c_L + p_L^S) && (\mathrm{SC}_Q)\\
p_L^S &< p_H^S && (\mathrm{ND})
\end{aligned}$$

Note that constraint (IR_H^1) never imposes a binding restriction. We have to distinguish two cases:

(i) (IR_H^2) and (ND) are binding.

The optimal prices are $p_H^S = p_L^S = \frac{1}{\gamma}(q_H - q_L) + c_L + \delta$. At these prices, the salience constraint is satisfied if and only if

$$\delta < \frac{2(q_H - q_L)}{2q_L - q_H} c_L - \frac{1}{\gamma}(q_H - q_L). \tag{B.10}$$

A retailer's profit in this case is

$$\pi(\text{high, quality}) = \frac{1}{\gamma}(q_H - q_L) + c_L + \delta - w. \tag{B.11}$$

(ii) (SC_Q) and (ND) are binding.

The optimal prices are $p_H^S = p_L^S = \frac{q_H}{2q_L - q_H} c_L$. At these prices, ($\text{IR}_H^2$) is satisfied if and only if

$$\delta \geq \frac{2(q_H - q_L)}{2q_L - q_H} c_L - \frac{1}{\gamma}(q_H - q_L). \tag{B.12}$$

The corresponding profit is

$$\pi(\text{high, quality}) = \frac{q_H}{2q_L - q_H} c_L - w. \tag{B.13}$$

Business strategy (4): The strategy of effectively selling only the branded product in a price-salient environment is dominated by strategy (2).

Finally we compare the retailer's profit from the three remaining business strategies. We distinguish the following three cases:

(i) $\delta \geq \frac{2(q_H - q_L)}{2q_L - q_H} c_L$.

The retailer prefers business strategy (2) over business strategy (1) if and only if

$$2\delta + \gamma(q_H - q_L) + c_L - w > \frac{3q_H - 2q_L}{2q_L - q_H} c_L - w \tag{B.14}$$

$$\iff \delta > \frac{2(q_H - q_L)}{2q_L - q_H} c_L - \frac{\gamma}{2}(q_H - q_L), \tag{B.15}$$

which is alwasy satisfied in this case.

Next, he prefers to sell both goods instead of only the branded good if and only if

$$2\delta + \gamma(q_H - q_L) + c_L - w \geq \frac{q_H}{2q_L - q_H} c_L - w \tag{B.16}$$

$$\iff \delta \geq \frac{q_H - q_L}{2q_L - q_H} c_L - \frac{\gamma}{2}(q_H - q_L). \tag{B.17}$$

As the critical δ is smaller than the lower bound of this case, the retailer always prefers business strategy (both, price) over (high, quality).

The retailer will indeed sell the branded product if the wholesale price is such that he makes a profit of at least 2δ, which he can always make by selling only the low-quality product. This constraint determines the optimal wholesale price charged by the manufacturer. The optimal wholesale price in this case is $w^R = \gamma(q_H - q_L) + c_L \equiv \hat{w}_P$.

(ii) $\frac{2(q_H - q_L)}{2q_L - q_H} c_L - \frac{1}{\gamma}(q_H - q_L) \leq \delta < \frac{2(q_H - q_L)}{2q_L - q_H} c_L$

The retailer prefers business strategy (2) over business strategy (1) if and only if

$$2\delta + \gamma(q_H - q_L) + c_L - w > \delta + \frac{q_H}{2q_L}(2c_L + \delta) - w \tag{B.18}$$

$$\iff \delta > \frac{2(q_H - q_L)}{2q_L - q_H}(c_L - \gamma q_L), \tag{B.19}$$

which is always fulfilled, as the right hand side is smaller than zero and $\delta \geq 0$.

Next, the retailer prefers to sell only the branded good if and only if

$$\frac{q_H}{2q_L - q_H} c_L - w > 2\delta + \gamma(q_H - q_L) + c_L - w \tag{B.20}$$

$$\iff \delta < \frac{q_H - q_L}{2q_L - q_H} c_L - \frac{\gamma}{2}(q_H - q_L). \tag{B.21}$$

The critical δ is smaller than the upper bound in this case. It is larger than the lower bound if and only if

$$\frac{q_H - q_L}{2q_L - q_H} c_L - \frac{\gamma}{2}(q_H - q_L) \geq \frac{2(q_H - q_L)}{2q_L - q_H} c_L - \frac{1}{\gamma}(q_H - q_L) \tag{B.22}$$

$$\iff \frac{2 - \gamma^2}{\gamma} q_L - c_L \geq \frac{2 - \gamma^2}{2\gamma} q_H. \tag{B.23}$$

Depending on condition (B.23), we must distinguish two cases:

- (B.23) holds.

If $\frac{q_H-q_L}{2q_L-q_H}c_L - \frac{\gamma}{2}(q_H-q_L) \le \delta < \frac{2(q_H-q_L)}{2q_L-q_H}c_L$, then $\pi(\text{both, price}) \ge \pi(\text{high, quality})$. The brand manufacturer's optimal wholesale price is $w^R = \gamma(q_H-q_L)+c_L \equiv \hat{w}_P$.

If $\frac{2(q_H-q_L)}{2q_L-q_H}c_L - \frac{1}{\gamma}(q_H-q_L) \le \delta < \frac{q_H-q_L}{2q_L-q_H}c_L - \frac{\gamma}{2}(q_H-q_L)$, then $\pi(\text{high, quality}) > \pi(\text{both, price})$. The brand manufacturer's optimal wholesale price is

$$w^R = \frac{q_H c_L}{2q_L-q_H} - 2\delta \equiv \widetilde{w}_R. \tag{B.24}$$

- (B.23) is violated.

  The critical δ given by (B.21) does not lie within the relevant range, i.e. in this case, $\pi(\text{both, price}) > \pi(\text{high, quality})$. Therefore, the brand manufacturer's optimal wholesale price is $w^R = \gamma(q_H-q_L)+c_L \equiv \hat{w}_P$.

(iii) $\delta < \frac{2(q_H-q_L)}{2q_L-q_H}c_L - \frac{1}{\gamma}(q_H-q_L)$

As shown above, if the retailer wants to sell both goods, he prefers price salience over quality salience. He sells only the branded good if and only if

$$\pi(\text{high, quality}) > \pi(\text{both, price}) \tag{B.25}$$

$$\iff \delta < \frac{1-\gamma^2}{\gamma}(q_H-q_L). \tag{B.26}$$

This critical δ is larger than the upper bound of this case if and only if

$$\frac{1-\gamma^2}{\gamma}(q_H-q_L) \ge \frac{2(q_H-q_L)}{2q_L-q_H}c_L - \frac{1}{\gamma}(q_H-q_L) \tag{B.27}$$

$$\iff \frac{2-\gamma^2}{\gamma}q_L - c_L \ge \frac{2-\gamma^2}{2\gamma}q_H. \tag{B.28}$$

Note that this condition is equivalent to (B.23). Correspondingly, we have to distinguish two cases:

- (B.23) holds.

  As the critical δ given by (B.26) is larger than the upper bound in this case, $\pi(\text{high, quality}) > \pi(\text{both, price})$. The manufacturer's optimal wholesale price is $w^R = \frac{1}{\gamma}(q_H-q_L)+c_L-\delta \equiv \hat{w}_Q - \delta$.

- (B.23) is violated.

  If $\frac{1-\gamma^2}{\gamma}(q_H - q_L) \leq \delta < \frac{2(q_H-q_L)}{2q_L-q_H}c_L - \frac{1}{\gamma}(q_H - q_L)$, then $\pi(\text{both, price}) \geq \pi(\text{high, quality})$. The brand manufacturer's optimal wholesale price is $w^R = \gamma(q_H - q_L) + c_L \equiv \hat{w}_P$.

  If $\delta < \frac{1-\gamma^2}{\gamma}(q_H - q_L)$, then $\pi(\text{high, quality}) > \pi(\text{both, price})$. The manufacturer's optimal wholesale price is $w^R = \frac{1}{\gamma}(q_H - q_L) + c_L - \delta \equiv \hat{w}_Q - \delta$.

The proposition follows from the above analysis.

Proposition 7 (Restricted Distribution)**.** *Suppose that $q_H \leq 2q_L$.*

(a) Let $\frac{2-\gamma^2}{\gamma}q_L - c_L \geq \frac{2-\gamma^2}{2\gamma}q_H$.

(I) For $\delta < \frac{2(q_H-q_L)}{2q_L-q_H}c_L - \frac{1}{\gamma}(q_H - q_L)$, the manufacturer charges $w^R = \hat{w}_Q - \delta$. Quality is salient and only type H consumers purchase at the brick-and-mortar store.

(II) For $\frac{2(q_H-q_L)}{2q_L-q_H}c_L - \frac{1}{\gamma}(q_H - q_L) \leq \delta < \frac{q_H-q_L}{2q_L-q_H}c_L - \frac{\gamma}{2}(q_H - q_L)$, the manufacturer charges $w^R = \widetilde{w}_R$. Quality is salient and only type H consumers purchases at the brick-and-mortar store.

(III) For $\delta \geq \frac{q_H-q_L}{2q_L-q_H}c_L - \frac{\gamma}{2}(q_H - q_L)$, the manufacturer charges $w^R = \hat{w}_P$. Price is salient and both consumer types purchase at the brick-and-mortar store.

(b) Let $\frac{2-\gamma^2}{\gamma}q_L - c_L < \frac{2-\gamma^2}{2\gamma}q_H$.

(I) For $\delta < \frac{1-\gamma^2}{\gamma}(q_H - q_L)$, the manufacturer charges $w^R = \hat{w}_Q - \delta$. Quality is salient and only type H consumers purchase at the brick-and-mortar store.

(II) For $\delta \geq \frac{1-\gamma^2}{\gamma}(q_H - q_L)$, the manufacturer charges $w^R = \hat{w}_P$. Price is salient and both consumer types purchase at the brick-and-mortar store.

B.1.2. Comparison of Distribution Systems

The manufacturer prefers the distribution system that allows her to charge the highest wholesale price, because the per retailer profit is $\pi = w - c_H$. The highest possible wholesale price is $\hat{w}_Q$, i.e. whenever the manufacturer can charge $\hat{w}_Q$ under a distribution system D, then D is an optimal distribution system.

In the following, we compare the respective wholesale prices under the free and the restricted distribution system. It is useful to define the relevant δ-thresholds. Under the free distribution system, the thresholds are

$$\widetilde{w}_F < \hat{w}_P \iff \delta < 2(\gamma q_L - c_L) \equiv \delta_{1F} \tag{B.29}$$

$$\widetilde{w}_F < \hat{w}_Q \iff \delta < 2\left(\frac{1}{\gamma}q_L - c_L\right) \equiv \delta_{2F}, \tag{B.30}$$

where $\delta_{1F} < \delta_{2F}$. The thresholds under the restricted distribution system are

$$\hat{w}_Q - \delta > \widetilde{w}_R \iff \delta < \frac{2(q_H - q_L)}{2q_L - q_H}c_L - \frac{1}{\gamma}(q_H - q_L) \equiv \delta_{1R}, \tag{B.31}$$

$$\widetilde{w}_R > \hat{w}_P \iff \delta < \frac{q_H - q_L}{2q_L - q_H}c_L - \frac{\gamma}{2}(q_H - q_L) \equiv \delta_{2R} \tag{B.32}$$

$$\text{and} \quad \hat{w}_Q - \delta > \hat{w}_P \iff \delta < \frac{1-\gamma^2}{\gamma}(q_H - q_L) \equiv \widetilde{\delta}. \tag{B.33}$$

Moreover, let us define the following thresholds:

$$\hat{w}_Q - \delta > \widetilde{w}_F \iff \delta < \frac{2(q_H - q_L)}{q_H + q_L}\left(\frac{1}{\gamma}q_L - c_L\right) \equiv \bar{\delta} \tag{B.34}$$

$$\widetilde{w}_F < \widetilde{w}_R \iff \delta < \frac{2q_H(q_H - q_L)}{(2q_L - q_H)(q_H + 3q_L)}c_L \equiv \hat{\delta}. \tag{B.35}$$

Comparing the threshold levels yields the following results:

$$\delta_{2R} \geq \delta_{1R} \iff \frac{2-\gamma^2}{\gamma}q_L - c_L \geq \frac{2-\gamma^2}{2\gamma}q_H \tag{B.36}$$

$$\delta_{1F} < \widetilde{\delta} \iff (1+\gamma^2)q_L - 2\gamma c_L < (1-\gamma^2)q_H \tag{B.37}$$

$$\delta_{2F} < \widetilde{\delta} \iff (3-\gamma^2)q_L - 2\gamma c_L < (1-\gamma^2)q_H \tag{B.38}$$

If condition (B.36) holds, then we also have $\delta_{2R} < \widetilde{\delta}$. If condition (B.37) holds, then we also have $\delta_{1F} < \bar{\delta} < \widetilde{\delta}$. Furthermore, it can be shown that $\delta_{1F} \lesseqgtr \delta_{1R}$ and $\delta_{1F} \lesseqgtr \delta_{2R}$ as well as $\delta_{2F} \lesseqgtr \delta_{1R}$ and $\delta_{2F} \lesseqgtr \delta_{2R}$, i.e. all cases are possible.

Case (a): Condition (B.36) holds.

From the above considerations, it follows that there are six cases, i.e. sequences of the δ-thresholds, that we need to consider.

(i) $\delta_{1R} < \delta_{2R} < \delta_{1F} < \delta_{2F}$

(ii) $\delta_{1R} < \delta_{1F} < \delta_{2R} < \delta_{2F}$

(iii) $\delta_{1R} < \delta_{1F} < \delta_{2F} < \delta_{2R}$

(iv) $\delta_{1F} < \delta_{1R} < \delta_{2F} < \delta_{2R}$

(v) $\delta_{1F} < \delta_{2F} < \delta_{1R} < \delta_{2R}$

(vi) $\delta_{1F} < \delta_{1R} < \delta_{2R} < \delta_{2F}$

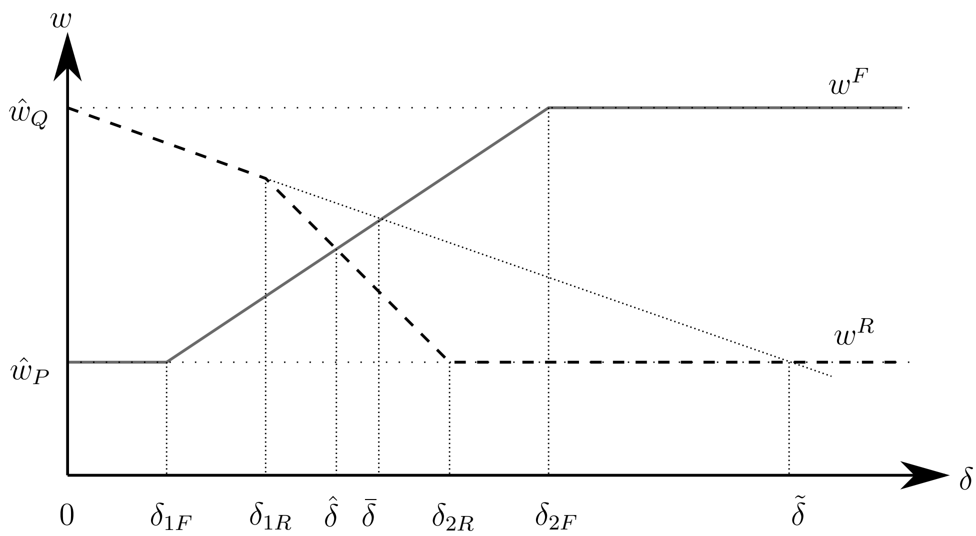

Figure 5: Comparison of distribution systems.

Figure 5 illustrates the respective wholesale prices under a free and under a restricted distribution system for the sequence of critical δs analyzed in case (vi). We consider the cases subsequently.

(i) $\delta_{1R} < \delta_{2R} < \delta_{1F} < \delta_{2F}$

For $\delta \geq \delta_{2F}$, we have $w^F = \hat{w}_Q > \hat{w}_P = w^R$. Thus, $D = F$ is strictly optimal. For $\delta_{1F} \leq \delta < \delta_{2F}$, we have $w^F = \widetilde{w}_F > \hat{w}_P = w^R$. Thus, $D = F$ is strictly optimal. For $\delta_{2R} \leq \delta < \delta_{1F}$, we have $w^F = \hat{w}_P = w^R$. The manufacturer is indifferent and thus chooses $D = F$.

For $\delta_{1R} \leq \delta < \delta_{2R}$, we have $w^F = \hat{w}_P < \widetilde{w}_R = w^R$. Thus, $D = R$ is strictly optimal.

For $\delta < \delta_{1R}$, we have $w^F = \hat{w}_P$ and $w^R = \hat{w}_Q - \delta$. Remember that $\hat{w}_Q - \delta > \hat{w}_P \iff \delta < \widetilde{\delta}$, and that if condition (B.36) holds, $\widetilde{\delta} > \delta_{2R}$. As (B.36) is fulfilled in case (a), all δ in the relevant range are smaller than $\widetilde{\delta}$. Thus, we have $w^F = \hat{w}_P < \hat{w}_Q - \delta = w^R$ and $D = R$ is strictly optimal.

(ii) $\delta_{1R} < \delta_{1F} < \delta_{2R} < \delta_{2F}$

For $\delta \geq \delta_{2F}$, we have $w^F = \hat{w}_Q > \hat{w}_P = w^R$. Thus, $D = F$ is strictly optimal.

For $\delta_{2R} \leq \delta < \delta_{2F}$, we have $w^F = \widetilde{w}_F > \hat{w}_P = w^R$. Thus, $D = F$ is strictly optimal.

For $\delta_{1F} \leq \delta < \delta_{2R}$, we have $w^F = \widetilde{w}_F$ and $w^R = \widetilde{w}_R$. We know that $\widetilde{w}_F < \widetilde{w}_R \iff \delta < \hat{\delta}$. Thus, for $\delta \geq \hat{\delta}$, we have $w^F = \widetilde{w}_F > \widetilde{w}_R = w^R$ and $D = F$ is strictly optimal. For $\delta < \hat{\delta}$, we have $w^F = \widetilde{w}_F < \widetilde{w}_R = w^R$ and $D = R$ is strictly optimal. The threshold $\hat{\delta}$ lies indeed in the interval $[\delta_{1F}, \delta_{2R})$: In the case we consider, $\delta_{1F} < \delta_{2R}$. It can be shown that this is the case if and only if $\gamma < \frac{2c_L(3q_L - q_H)}{(2q_L - q_H)(q_H + 3q_L)}$, and that under the same condition $\delta_{1F} < \hat{\delta} < \delta_{2R}$.

For $\delta_{1R} \leq \delta < \delta_{1F}$, we have $w^F = \hat{w}_P < \widetilde{w}_R = w^R$. Thus, $D = R$ is strictly optimal.

For $\delta < \delta_{1R}$, $w^F = \hat{w}_P < \hat{w}_Q - \delta = w^R$, as all δ in the relevant range are smaller than $\widetilde{\delta}$. Thus, $D = R$ is strictly optimal.

(iii) $\delta_{1R} < \delta_{1F} < \delta_{2F} < \delta_{2R}$

For $\delta \geq \delta_{2R}$, we have $w^F = \hat{w}_Q > \hat{w}_P = w^R$. Thus, $D = F$ is strictly optimal.

For $\delta_{2F} \leq \delta < \delta_{2R}$, we have $w^F = \hat{w}_Q > \widetilde{w}_R = w^R$. Thus, $D = F$ is strictly optimal.

For $\delta_{1F} \leq \delta < \delta_{2F}$, we have $w^F = \widetilde{w}_F$ and $w^R = \widetilde{w}_R$. We know that $\widetilde{w}_F < \widetilde{w}_R \iff \delta < \hat{\delta}$. Thus, for $\delta \geq \hat{\delta}$, we have $w^F = \widetilde{w}_F > \widetilde{w}_R = w^R$ and $D = F$ is strictly optimal. For $\delta < \hat{\delta}$, we have $w^F = \widetilde{w}_F < \widetilde{w}_R = w^R$ and $D = R$ is strictly optimal. The threshold $\hat{\delta}$ lies indeed in the relevant interval: As shown above, if $\delta_{1F} < \delta_{2R}$, then also $\delta_{1F} < \hat{\delta} < \delta_{2R}$. Next, $\hat{\delta}$ is smaller than δ_{2F} if and only if $\gamma < \frac{(2q_L - q_H)(q_H + 3q_L)}{2c_L(3q_L - q_H)}$. In the case we consider, $\delta_{1R} < \delta_{2F}$. This is the case if and only if $\gamma < \frac{(2q_L - q_H)(q_H + q_L)}{2c_L q_L}$. This upper bound on γ is smaller than the upper bound on γ derived from the condition $\hat{\delta} < \delta_{2F}$. Thus, if $\delta_{1R} < \delta_{2F}$, then also $\hat{\delta} < \delta_{2F}$.

For $\delta_{1R} \leq \delta < \delta_{1F}$, we have $w^F = \hat{w}_P < \widetilde{w}_R = w^R$. Thus, $D = R$ is strictly optimal.

For $\delta < \delta_{1R}$, we have $w^F = \hat{w}_P < \hat{w}_Q - \delta = w^R$, as all δ in the relevant range are smaller than $\widetilde{\delta}$. Thus, $D = R$ is strictly optimal.

(iv) $\delta_{1F} < \delta_{1R} < \delta_{2F} < \delta_{2R}$

For $\delta \geq \delta_{2R}$, we have $w^F = \hat{w}_Q > \hat{w}_P = w^R$. Thus, $D = F$ is strictly optimal.

For $\delta_{2F} \leq \delta < \delta_{2R}$, we have $w^F = \hat{w}_Q > \widetilde{w}_R = w^R$. Thus, $D = F$ is strictly optimal.

For $\delta_{1R} \leq \delta < \delta_{2F}$, we have $w^F = \widetilde{w}_F$ and $w^R = \widetilde{w}_R$. We know that $\widetilde{w}_F < \widetilde{w}_R \iff \delta < \hat{\delta}$. Does the threshold $\hat{\delta}$ lie in the relevant interval? As shown above, if $\delta_{1R} < \delta_{2F}$, then also $\hat{\delta} < \delta_{2F}$. Next, it can be shown that $\hat{\delta} > \delta_{1R} \iff \gamma < \frac{(2q_L - q_H)(q_H + 3q_L)}{6c_L q_L}$. Depending on this condition, we distinguish two cases: Suppose $\gamma < \frac{(2q_L - q_H)(q_H + 3q_L)}{6c_L q_L}$. For $\delta \geq \hat{\delta}$, we have $w^F = \widetilde{w}_F > \widetilde{w}_R = w^R$, and $D = F$ is strictly optimal. For $\delta < \hat{\delta}$, we have $w^F = \widetilde{w}_F < \widetilde{w}_R = w^R$, and $D = R$ is strictly optimal. Suppose that $\gamma > \frac{(2q_L - q_H)(q_H + 3q_L)}{6c_L q_L}$. In this case, $\hat{\delta} < \delta_{1R}$, i.e. all δ in the relevant range are larger than $\hat{\delta}$. Thus, we have $w^F = \widetilde{w}_F > \widetilde{w}_R = w^R$, and $D = F$ is strictly optimal.

For $\delta_{1F} \leq \delta < \delta_{1R}$, we have $w^F = \widetilde{w}_F$ and $w^R = \hat{w}_Q - \delta$. We have $\hat{w}_Q - \delta > \widetilde{w}_F \iff \delta < \bar{\delta}$. Comparing the threshold levels $\hat{\delta}$ and $\bar{\delta}$, we get $\hat{\delta} < \bar{\delta} \iff \gamma < \frac{(2q_L - q_H)(q_H + 3q_L)}{6c_L q_L}$. Note that under the same condition, $\hat{\delta} > \delta_{1R}$. Correspondingly, we must distinguish two cases: Suppose that $\gamma < \frac{(2q_L - q_H)(q_H + 3q_L)}{6c_L q_L}$. Then, $\bar{\delta} > \hat{\delta} > \delta_{1R}$. Thus, all δ in the relevant range are smaller than $\bar{\delta}$. We have $w^F = \widetilde{w}_F < \hat{w}_Q - \delta = w^R$, and $D = R$ is strictly optimal. Suppose that $\gamma > \frac{(2q_L - q_H)(q_H + 3q_L)}{6c_L q_L}$. Then, $\bar{\delta} < \hat{\delta} < \delta_{1R}$. For $\delta \geq \bar{\delta}$, we have $w^F = \widetilde{w}_F > \hat{w}_Q - \delta = w^R$ and $D = F$ is strictly optimal. For $\delta < \bar{\delta}$, we have $w^F = \widetilde{w}_F < \hat{w}_Q - \delta$, and $D = R$ is strictly optimal. The threshold $\bar{\delta}$ is larger than δ_{1F}, i.e. it lies indeed in the relevant interval: In the case we consider, $\delta_{1F} < \delta_{2R}$. According to condition (B.36), $\widetilde{\delta} > \delta_{2R}$. This implies that $\widetilde{\delta}$ is also larger than δ_{1F}. This is the case if and only if (B.37) is fulfilled. If condition (B.37) is fulfilled, then we also have $\bar{\delta} > \delta_{1F}$.

For $\delta < \delta_{1F}$, we have $w^F = \hat{w}_P < \hat{w}_Q - \delta = w^R$ as all δ in the relevant range are smaller than $\widetilde{\delta}$. Thus, $D = R$ is strictly optimal.

(v) $\delta_{1F} < \delta_{2F} < \delta_{1R} < \delta_{2R}$

For $\delta \geq \delta_{2R}$, we have $w^F = \hat{w}_Q > \hat{w}_P = w^R$. Thus, $D = F$ is strictly optimal.

For $\delta_{1R} \leq \delta < \delta_{2R}$, we have $w^F = \hat{w}_Q > \widetilde{w}_R = w^R$. Thus, $D = F$ is strictly optimal.

For $\delta_{2F} \leq \delta < \delta_{1R}$, we have $w^F = \hat{w}_Q > \hat{w}_Q - \delta$. Thus, $D = F$ is strictly optimal.

For $\delta_{1F} \leq \delta < \delta_{2F}$, we have $w^F = \widetilde{w}_F$ and $w^R = \hat{w}_Q - \delta$. We know that $\widetilde{w}_F < \hat{w}_Q - \delta \iff \delta < \bar{\delta}$. Moreover, $\bar{\delta} > \delta_{1F}$ if condition (B.37) holds. We show that in the case we consider here, (B.37) is always fulfilled. Suppose that, on the contrary, (B.37) is violated. This implies that $\widetilde{\delta} < \delta_{1F}$. As in case (a), $\widetilde{\delta} > \delta_{1R}$, this would also imply that $\delta_{1R} < \widetilde{\delta} < \delta_{1F}$ – a contradiction to the assumption in this case that $\delta_{1F} < \delta_{1R}$. Thus, if we assume $\delta_{1F} < \delta_{1R}$, condition (B.37) has to be fulfilled and $\bar{\delta}$ is always larger than δ_{1F}. Obviously, $\bar{\delta}$ is also smaller than δ_{2F}. Thus, $\bar{\delta}$ lies in the relevant interval. For $\delta \geq \bar{\delta}$, we have $w^F = \widetilde{w}_F > \hat{w}_Q - \delta = w^R$ and $D = F$ is strictly optimal. For $\delta < \bar{\delta}$, we have $w^F = \widetilde{w}_F < \hat{w}_Q - \delta$ and $D = R$ is strictly optimal.

For $\delta < \delta_{1F}$, we have $w^F = \hat{w}_P < \hat{w}_Q - \delta = w^R$ as all δ in the relevant range are smaller than $\widetilde{\delta}$. Thus, $D = R$ is strictly optimal.

(vi) $\delta_{1F} < \delta_{1R} < \delta_{2R} < \delta_{2F}$

For $\delta \geq \delta_{2F}$, we have $w^F = \hat{w}_Q > \hat{w}_P = w^R$. Thus, $D = F$ is strictly optimal.

For $\delta_{2R} \leq \delta < \delta_{2F}$, we have $w^F = \widetilde{w}_F > \hat{w}_P = w^R$. Thus, $D = F$ is strictly optimal.

For $\delta_{1R} \leq \delta < \delta_{2R}$, we have $w^F = \widetilde{w}_F$ and $w^R = \widetilde{w}_R$. We know that $\widetilde{w}_F < \widetilde{w}_R \iff \delta < \hat{\delta}$. Does the threshold $\hat{\delta}$ lie in the relevant range of δs? As shown above, if $\delta_{1F} < \delta_{2R}$, then also $\delta_{1F} < \hat{\delta} < \delta_{2R}$. Next, $\hat{\delta} > \delta_{1R} \iff \gamma < \frac{(2q_L - q_H)(q_H + 3q_L)}{6c_L q_L}$. Depending on this condition, we distinguish two cases: Suppose $\gamma < \frac{(2q_L - q_H)(q_H + 3q_L)}{6c_L q_L}$. For $\delta \geq \hat{\delta}$, we have $w^F = \widetilde{w}_F > \widetilde{w}_R = w^R$, and $D = F$ is strictly optimal. For $\delta < \hat{\delta}$, we have $w^F = \widetilde{w}_F < \widetilde{w}_R = w^R$, and $D = R$ is strictly optimal. Suppose that $\gamma > \frac{(2q_L - q_H)(q_H + 3q_L)}{6c_L q_L}$. In this case, $\hat{\delta} < \delta_{1R}$, i.e. all δ in the relevant range are larger than $\hat{\delta}$. Thus, we have $w^F = \widetilde{w}_F > \widetilde{w}_R = w^R$, and $D = F$ is strictly optimal.

For $\delta_{1F} \leq \delta < \delta_{1R}$, we have $w^F = \widetilde{w}_F$ and $w^R = \hat{w}_Q - \delta$. Like in case (iv), we must distinguish two cases: Suppose that $\gamma < \frac{(2q_L - q_H)(q_H + 3q_L)}{6c_L q_L}$. Then, $\bar{\delta} > \hat{\delta} > \delta_{1R}$. Thus, all δ in the relevant range are smaller than $\bar{\delta}$. We have $w^F = \widetilde{w}_F < \hat{w}_Q - \delta = w^R$, and $D = R$ is strictly optimal. Suppose that $\gamma > \frac{(2q_L - q_H)(q_H + 3q_L)}{6c_L q_L}$. Then, $\bar{\delta} < \hat{\delta} < \delta_{1R}$. For $\delta \geq \bar{\delta}$, we have $w^F = \widetilde{w}_F > \hat{w}_Q - \delta = w^R$ and $D = F$ is strictly optimal. For $\delta < \bar{\delta}$, we have $w^F = \widetilde{w}_F < \hat{w}_Q - \delta$, and $D = R$ is strictly optimal. As shown in case (iv), under the given assumptions, $\bar{\delta}$ lies indeed in the relevant interval.

For $\delta < \delta_{1F}$, we have $w^F = \hat{w}_P < \hat{w}_Q - \delta = w^R$ as all δ in the relevant range are smaller than $\widetilde{\delta}$. Thus, $D = R$ is strictly optimal.

Now, we can summarize our results for case (a). Comparing the δ-thresholds where a restricted distribution system becomes optimal for the manufacturer across the different cases, we notice the following: Whenever $\hat{\delta} < \delta_{1R}$, the manufacturer prefers a restricted distribution system if and only if $\delta < \bar{\delta}$. If $\delta_{1R} \leq \hat{\delta} < \delta_{2R}$, the manufacturer prefers a restricted distribution system if and only if $\delta < \hat{\delta}$. If $\hat{\delta} \geq \delta_{2R}$, the manufacturer prefers a restricted distribution system if and only if $\delta < \delta_{2R}$.
Let us define the following thresholds:

$$\hat{\delta} < \delta_{1R} \iff \gamma > \frac{(2q_L - q_H)(q_H + 3q_L)}{6c_L q_L} \equiv \gamma_1 \tag{B.39}$$

$$\hat{\delta} < \delta_{2R} \iff \gamma < \frac{2c_L(3q_L - q_H)}{(2q_L - q_H)(q_H + 3q_L)} \equiv \gamma_2. \tag{B.40}$$

Using these γ-thresholds, the three cases mentioned above are

(i) $\hat{\delta} < \delta_{1R} < \delta_{2R} \iff \gamma_1 < \gamma < \gamma_2$

(ii) $\delta_{1R} \leq \hat{\delta} < \delta_{2R} \iff \gamma < \min\{\gamma_1, \gamma_2\}$

(iii) $\delta_{1R} < \delta_{2R} < \hat{\delta} \iff \gamma_2 < \gamma < \gamma_1$.

To further clarify the cases, it is useful to rearrange condition (B.36) and define the respective γ-threshold:

$$\frac{2-\gamma^2}{\gamma} q_L - c_L \geq \frac{2-\gamma^2}{2\gamma} q_H \iff \gamma \leq \frac{-c_L + \sqrt{c_L^2 + 2(2q_L - q_H)^2}}{2q_L - q_H} \equiv \gamma^{case}, \tag{B.41}$$

i.e. in case (a), the relevant γs are smaller than γ^{case}.

In the following, we will show that if $\gamma_1 < \gamma^{case}$, then $\gamma_2 > \gamma^{case}$, and that if $\gamma_2 < \gamma^{case}$, then $\gamma_1 > \gamma^{case}$. First, note that δ_{1R} is an increasing function of γ, $\delta_{1R}(\gamma)$, while δ_{2R} is a decreasing function of γ, $\delta_{2R}(\gamma)$. By definition,

- $\delta_{1R}(\gamma^{case}) \equiv \delta_{2R}(\gamma^{case})$,
- $\delta_{1R}(\gamma_1) \equiv \hat{\delta}$ and
- $\delta_{2R}(\gamma_2) \equiv \hat{\delta}$.

Suppose now that $\gamma_1 < \gamma^{case}$. This implies that $\hat{\delta} \equiv \delta_{1R}(\gamma_1) < \delta_{1R}(\gamma^{case}) \equiv \delta_{2R}(\gamma^{case})$. If $\hat{\delta} \equiv \delta_{2R}(\gamma_2) < \delta_{2R}(\gamma^{case})$, then γ_2 must be larger than γ^{case} as δ_{2R} is increasing in γ. Next, suppose that $\gamma_2 < \gamma^{case}$. This implies that $\hat{\delta} \equiv \delta_{2R}(\gamma_2) > \delta_{2R}(\gamma^{case}) \equiv \delta_{1R}(\gamma^{case})$. If $\hat{\delta} \equiv \delta_{1R}(\gamma_1) < \delta_{1R}(\gamma^{case})$, then γ_1 must be larger than γ^{case}, as δ_{1R} is increasing in γ.

We summarize our results in Proposition 8 below.

Case (b): Condition (B.36) is violated.

The relevant δ-thresholds in this case are δ_{1F}, δ_{2F} and $\widetilde{\delta}$. By condition (B.37),

$$\widetilde{\delta} > \delta_{1F} \iff (1-\gamma^2)q_H > (1+\gamma^2)q_L - 2\gamma c_L. \tag{B.42}$$

Next, we have that

$$\widetilde{\delta} > \delta_{2F} \iff (1-\gamma^2)q_H > (3-\gamma^2)q_L - 2\gamma c_L. \tag{B.43}$$

Clearly, if $\widetilde{\delta} > \delta_{2F}$, then also $\widetilde{\delta} > \delta_{1F}$. We must distinguish three cases, i.e. three possible sequences of the δ-thresholds:

(i) $(1-\gamma^2)q_H \geq (3-\gamma^2)q_L - 2\gamma c_L$, i.e. $\delta_{1F} < \delta_{2F} < \widetilde{\delta}$.

For $\delta \geq \widetilde{\delta}$, we have $w^F = \hat{w}_Q > \hat{w}_P = w^R$. Thus, $D = F$ is strictly optimal.

For $\delta_{2F} \leq \delta < \widetilde{\delta}$, we have $w^F = \hat{w}_Q > \hat{w}_Q - \delta = w^R$. Thus, $D = F$ is strictly optimal.

For $\delta_{1F} \leq \delta < \delta_{2F}$, we have $w^F = \widetilde{w}_F$ and $w^R = \hat{w}_Q - \delta$. We know that $\hat{w}_Q - \delta > \widetilde{w}_F \iff \delta < \bar{\delta}$ and that $\delta_{1F} < \bar{\delta} < \widetilde{\delta}$ if condition (B.36) holds. As this is the case here and as $\bar{\delta}$ is obviously smaller than δ_{2F}, we have $\bar{\delta} \in [\delta_{1F}, \delta_{2F})$. If $\delta \geq \bar{\delta}$, we have $w^F = \widetilde{w}_F > \hat{w}_Q - \delta = w^R$ and $D = F$ is strictly optimal. If $\delta < \bar{\delta}$, we have $w^F = \widetilde{w}_F < \hat{w}_Q - \delta$ and $D = R$ is strictly optimal.

For $\delta < \delta_{1F}$, we have $w^F = \hat{w}_P < \hat{w}_Q - \delta = w^R$. Thus, $D = R$ is strictly optimal.

(ii) $(1+\gamma^2)q_L - 2\gamma c_L \leq (1-\gamma^2)q_H < (3-\gamma^2)q_L - 2\gamma c_L$, i.e. $\delta_{1F} \leq \widetilde{\delta} < \delta_{2F}$.

For $\delta \geq \delta_{2F}$, we have $w^F = \hat{w}_Q > \hat{w}_P = w^R$. Thus, $D = F$ is strictly optimal.

For $\widetilde{\delta} \leq \delta < \delta_{2F}$, we have $w^F = \widetilde{w}_F > \hat{w}_P = w^R$. Thus, $D = F$ is strictly optimal.

For $\delta_{1F} \leq \delta < \widetilde{\delta}$, we have $w^F = \widetilde{w}_F$ and $w^R = \hat{w}_Q - \delta$. We know that $\hat{w}_Q - \delta > \widetilde{w}_F \iff \delta < \bar{\delta}$. In this case, condition (B.37) holds, which implies that $\delta_{1F} < \bar{\delta} < \widetilde{\delta}$. If $\delta \geq \bar{\delta}$, we have $w^F = \widetilde{w}_F > \hat{w}_Q - \delta$ and $D = F$ is optimal. If $\delta < \bar{\delta}$, we have $w^F = \widetilde{w}_F < \hat{w}_Q - \delta$ and $D = R$ is strictly optimal.

For $\delta < \delta_{1F}$, we have $w^F = \hat{w}_P < \hat{w}_Q - \delta = w^R$. Thus, $D = R$ is strictly optimal.

(iii) $(1-\gamma^2)q_H < (1+\gamma^2)q_L - 2\gamma c_L$, i.e. $\widetilde{\delta} < \delta_{1F} < \delta_{2F}$.

For $\delta > \delta_{2F}$, we have $w^F = \hat{w}_Q > \hat{w}_P = w^R$. Thus, $D = F$ is strictly optimal.

For $\delta_{1F} \leq \delta < \delta_{2F}$, we have $w^F = \widetilde{w}_F > \hat{w}_P = w^R$. Thus, $D = F$ is strictly optimal.

For $\widetilde{\delta} \leq \delta < \delta_{1F}$, we have $w^F = \hat{w}_P = w^R$. Thus, the manufacturer is indifferent between the two distribution systems. He chooses $D = F$.

For $\delta < \widetilde{\delta}$, we have $w^F = \hat{w}_P < \hat{w}_Q - \delta$. Thus, $D = R$ is optimal.

Now, we can summarize our results for case (b): If (B.37) holds, then the manufacturer strictly prefers a restricted distribution system to a free distribution system if and only if $\delta < \bar{\delta}$. If (B.37) does not hold, the manufacturer prefers a restricted distribution system to a free distribution system if and only if $\delta < \widetilde{\delta}$.

Proposition 8 (Comparison of Distribution Systems)**.** *Let $q_H \leq 2q_L$. The manufacturer strictly prefers a restricted distribution system under which online sales are prohibited to a free distribution system if and only if consumers' preferences for purchasing at a physical store are weak. Formally:*

(a) Let $\gamma \leq \frac{1}{2q_L - q_H}\left(-c_L + \sqrt{c_L^2 + 2(2q_L - q_H)^2}\right)$. Then $D = R$ is optimal if and only if

(I) $\delta < \frac{2(q_H - q_L)}{q_H + q_L}\left(\frac{1}{\gamma}q_L - c_L\right) \equiv \bar{\delta}$ for $\gamma > \frac{(2q_L - q_H)(q_H + 3q_L)}{6c_L q_L}$.

(II) $\delta < \frac{q_H - q_L}{2q_L - q_H}c_L - \frac{\gamma}{2}(q_H - q_L) \equiv \delta_{2R}$ for $\gamma > \frac{2c_L(3q_L - q_H)}{(2q_L - q_H)(q_H + 3q_L)}$.

(III) $\delta < \frac{2q_H(q_H - q_L)}{(2q_L - q_H)(q_H + 3q_L)}c_L \equiv \hat{\delta}$ for $\gamma < \min\left\{\frac{(2q_L - q_H)(q_H + 3q_L)}{6c_L q_L}, \frac{2c_L(3q_L - q_H)}{(2q_L - q_H)(q_H + 3q_L)}\right\}$.

(b) Let $\gamma > \frac{1}{2q_L - q_H}\left(-c_L + \sqrt{c_L^2 + 2(2q_L - q_H)^2}\right)$. Then $D = R$ is optimal if and only if

(I) $\delta < \frac{2(q_H - q_L)}{q_H + q_L}\left(\frac{1}{\gamma}q_L - c_L\right) \equiv \bar{\delta}$ *for* $\gamma \leq \frac{1}{q_H+q_L}\left(c_L + \sqrt{c_L^2 + q_H^2 - q_L^2}\right)$.

(II) $\delta < \frac{1-\gamma^2}{\gamma}(q_H - q_L) \equiv \widetilde{\delta}$ *otherwise.*

Figure 6 illustrates the results in a (γ,δ)-diagram. The parameters are specified as follows: $c_L = 4$, $q_L = 8$, and $q_H = 10$. This implies that $\gamma \in \left(\frac{1}{2}, 1\right]$. By Proposition 8, the manufacturer prefers a restricted distribution system over a free distribution system if and only if

$$\delta < \begin{cases} \frac{40}{51} = \hat{\delta} & \text{for} \quad \gamma < 0.549 \\ \frac{4}{3} - \gamma = \delta_{2R} & \text{for} \quad \gamma \in [0.549, 0.8968) \\ \frac{1-\gamma^2}{\gamma} = \widetilde{\delta} & \text{for} \quad \gamma \geq 0.8968. \end{cases} \tag{B.44}$$

The thresholds are continuous in γ. In this example, the cases (a) (II) and (III), and (b) (II) arise.

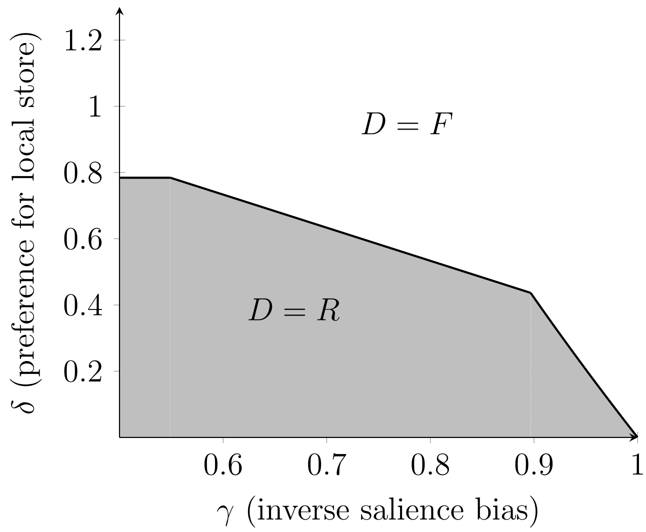

Figure 6: Optimal distribution system: Parameter specification $q_H = 10$, $q_L = 8$, and $c_L = 4$.

B.1.3. Welfare Implications

Proposition 9 (Welfare)**.** *Suppose that consumers have only a mild preference for purchasing at a physical store, i.e. such that the manufacturer prefers a restricted distribution system to a free distribution system. Then, a ban on distribution systems under which online sales are prohibited leads to lower final prices of the branded product, which increases consumer welfare.*

The precise thresholds for δ are given in Proposition 8. For low levels of δ, i.e. for δs for which the manufacturer prefers a restricted distribution system, the final prices a retailer charges from consumers are always equal to the wholesale price plus δ in a free distribution system. With a restricted distribution system where, for low levels of δ, the retailer effectively sells only the high-quality good, he charges the wholesale price plus 2δ for the branded good. Moreover, the manufacturer only chooses a restricted distribution system if $w^R > w^F$. Thus, the final prices for the branded good are always larger under the restricted distribution system. Consumers of type H who still purchase the high-quality good are worse off than with a free distribution system. The utility of type L consumers is not affected by whether or not online sales are prohibited.

B.2. Uniqueness of the Equilibrium Outcomes

In this part of the appendix, we show that the outcomes of all symmetric equilibria are unique. We focus on equilibria in undominated strategies. This rules out equilibria with prices below costs. We will show that even if the online prices are above costs, the prices at which the products are purchased by the consumers are the same as the ones derived in the main text.

Free Distribution: First, we will show that if type H consumers purchase the branded product, then $p_H^S = w + \delta$. In contradiction, suppose there is an equilibrium with prices $(p_H^S, p_H^I, p_L^S, p_L^I)$, where $p_H^S > w + \delta$. In any equilibrium in which type H consumers buy the branded product, they do so at the local store. This implies $p_H^I \geq p_H^S - \delta$. Otherwise, a retailer can increase his profit by reducing $p_H^S > p_H^I$ so that the local type H consumer purchases at the local store.

Now, suppose a retailer deviates and sets the prices:

$$\begin{aligned}
\tilde{p}_H^S &= p_H^S - \varepsilon, \\
\tilde{p}_H^I &= p_H^S - \delta - \varepsilon \ < p_H^I, \\
\tilde{p}_L^S &= p_L^S - \varepsilon, \\
\tilde{p}_L^I &= \max\{p_L^I - \varepsilon, c_L\},
\end{aligned}$$

with $\varepsilon > 0$. All constraints – irrespective of the business strategy – but the salience constraint are satisfied under the new prices. Recall that the set of feasible prices (prices that satisfy all individual rationality constraints) is strictly higher under quality salience than under price salience. Prices that satisfy the individual rationality constraints under price salience also satisfy the individual rationality constraints under quality salience. Note that for $\varepsilon \to 0$ we have

$$\frac{\tilde{p}_H^S + \tilde{p}_H^I}{\tilde{p}_L^S + \tilde{p}_L^I} < \frac{p_H^S + p_H^I}{p_L^S + p_L^I} \tag{B.45}$$

since $\tilde{p}_H^I < p_H^I$ even for $\varepsilon = 0$. Thus, if there is a change in salience triggered by the deviation, then from price to quality salience.

This implies that for $\varepsilon \to 0$ the deviation leads to approximately the same profits as the proposed equilibrium for sales of (i) high quality at the local store, (ii) low quality at the local store, (iii) low quality online. The profits from selling the branded product online, however, increase by

$$(r-1)(p_H^S - \delta - w) > 0. \tag{B.46}$$

Now, all type H consumers from the remaining $r-1$ markets purchase the branded product from the online shop of the deviating retailer.

Hence, in any equilibrium of the free distribution subgame in which type H consumers purchase the branded product, it holds that

$$p_H^S = w + \delta.$$

In other words, a retailer cannot earn more than a markup of δ by selling the branded product under the free distribution system.

Secondly, we show that in any equilibrium in which low quality is purchased at the local store, the online price is $p_L^I = c_L$ (which implies – as we will show – that $p_H^S = c_L + \delta$).

Again, we establish this result by assuming the opposite. Consider a potential equilibrium price vector $(p_H^S, p_H^I, p_L^S, p_L^I)$, where $p_L^I > c_L$. If L-types purchase at the local stores, the individual rationality constraint is binding in equilibrium:

$$p_L^S = p_L^I + \delta. \tag{B.47}$$

Otherwise, a retailer can increase his profit by slightly increasing p_L^S; This relaxes the individual rationality constraints of type H. Moreover, if this price increase affects salience, then by triggering a change from price salience to quality salience. As argued above, a change in the salience is problematic only if the deviation triggers price to be salient. If there is no change in the salience or a change from price to quality salience, the new prices satisfy all individual rationality constraints.

Now, suppose a retailer deviates and sets the prices:

$$\begin{aligned}
\tilde{p}_H^S &= p_H^S - \alpha\varepsilon, \\
\tilde{p}_H^I &= p_H^I - \alpha\varepsilon, \\
\tilde{p}_L^S &= p_L^S - \varepsilon = p_L^I + \delta - \varepsilon, \\
\tilde{p}_L^I &= p_L^I - \varepsilon,
\end{aligned}$$

with $\alpha, \varepsilon > 0$. Note that if there is no change in the salience or a change from price to quality salience, the new prices satisfy all individual rationality constraints. Let

$$\begin{aligned}
R(\varepsilon) &\equiv \frac{p_H^S - \alpha\varepsilon + p_H^I - \alpha\varepsilon}{p_L^I - \varepsilon + p_L^I + \delta - \varepsilon} \\
&= \frac{p_H^S + p_H^I - 2\alpha\varepsilon}{2p_L^I + \delta - 2\varepsilon}
\end{aligned}$$

and note that

$$R'(\varepsilon) = \frac{2(p_H^S + p_H^I) - \alpha(4p_L^I + 2\delta)}{(2p_L^I + \delta - 2\varepsilon)^2}.$$

Thus, it holds that

$$R'(\varepsilon) \leq 0 \iff \alpha \geq \frac{p_H^S + p_H^I}{2p_L^I + \delta} =: \bar{\alpha}, \tag{B.48}$$

with $\bar{\alpha} > 1$. Quality is salient if $q_H/q_L \geq R(\varepsilon)$. This implies that the retailer can avoid that the deviation triggers an unfavorable change in the salience (from quality to price) by choosing $\alpha \geq \bar{\alpha}$. For these levels of α, the new prices satisfy all constraints – irrespective of the business strategy.[39]

Hence, for $\varepsilon \to 0$ and $\alpha = \bar{\alpha}$ the deviation leads to approximately the same profits from selling (i) the high quality at the local store, (ii) the high quality online, (iii) the low quality at the local store. The profits from selling low quality online strictly increase (at least) by

$$(r - 1)(p_L^S - \delta - c_L) > 0. \tag{B.49}$$

Now all type L consumers (and potentially also the type H consumers) from the $r - 1$ remaining markets purchase the fringe product at the online shop of the deviating retailer.

[39] This is obvious for the individual rationality constraints and holds by construction for the salience constraint. For some business strategies, the retailer has to satisfy the *no dominance* constraint, $p_H^S > p_L^S$. For the relevant strategies this condition is never binding and thus the new prices satisfy this constraint if $\varepsilon > 0$ is sufficiently low.

Hence, if consumers of type L purchase at the local stores in equilibrium, then $p_L^I = c_L$ and $p_L^S = c_L + \delta$.

Thirdly, if in equilibrium the low-quality good is purchased online, then $p_L^I = c_L$. If this is not the case, a retailer can benefit from a similar deviation as above. The retailer slightly decreases all prices without affecting the salience. This keeps the revenues from the captive (local) consumers approximately constant but generates additional profits from online sales. Now, all type L consumers purchase at the online shop of the deviating retailer, who charges a strictly positive markup on online sales.

Restricted Distribution: We will show that in the restricted distribution subgame we have $p_L^I = c_L$.

First, suppose the low-quality good is purchased at the local stores in equilibrium. Again, in contradiction to what we want to show, suppose there is an equilibrium price vector (p_H^S, p_L^S, p_L^I), where $p_L^I > c_L$. This implies that $p_L^S = p_L^I + \delta$ (if not, a retailer can increase the price and make a higher profit).

Now, suppose a retailer deviates and sets the prices:

$$\begin{aligned}\tilde{p}_H^S &= p_H^S - \beta\varepsilon,\\ \tilde{p}_L^S &= p_L^S - \varepsilon = p_L^I + \delta - \varepsilon,\\ \tilde{p}_L^I &= p_L^I - \varepsilon,\end{aligned}$$

with $\beta, \varepsilon > 0$. Note that the new prices satisfy all individual rationality constraints as long as this deviation does not trigger a change in salience from quality salience to price salience.

Let

$$R(\varepsilon) = \frac{2(p_H^S - \beta\varepsilon)}{2p_L^I + \delta - 2\varepsilon} \tag{B.50}$$

with

$$R'(\varepsilon) = \frac{2[p_H^S - \beta(p_L^I + \delta)]}{(2p_L^I + \delta - 2\varepsilon)^2} \tag{B.51}$$

and note that

$$R'(\varepsilon) \leq 0 \iff \beta \geq \frac{p_H^S}{p_L^I + \delta} =: \bar{\beta}. \tag{B.52}$$

For the proposed equilibrium price vector, (p_H^S, p_L^S, p_L^I), quality is salient if $q_H/q_L \geq R(0)$. Hence, for $\beta \geq \bar{\beta}$ the new prices do not trigger a change in salience from price to quality salience. Thus, for $\varepsilon \to 0$ and $\beta = \bar{\beta}$ the deviation leads to approximately the same profits from selling (i) high quality at the store, and (ii) low quality at the store. The profits from selling low quality online strictly increase (at least) by

$$(r-1)(p_L^I - c_L) > 0. \tag{B.53}$$

Thus, there is always a profitable deviation as long as $p_L^I > c_L$.

Secondly, suppose the low-quality product is purchased online. If $p_L^I > c_L$, a retailer has an incentive to slightly reduce his prices – in a way that keeps salience unaffected (as above) – so that revenues from sales at the local store are approximately the same as before but revenues from online sales increase significantly.