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Attention to online sales: The role of brand image concerns

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Abstract

We provide a novel intuition for why manufacturers restrict their retailers' ability to resell brand products online. Our approach builds on models of salience-driven attention according to which price disparities across distribution channels guide a consumer's attention toward prices and lower her appreciation for quality. Absent vertical restraints, therefore, one of two salience distortions—a quality or a participation distortion—can arise in equilibrium. We show that, by ruling out both distortions, vertical restraints on online sales can be socially desirable but can also hurt consumers through higher retail prices. We thereby identify a novel trade-off between efficiency and consumer surplus.

1 | INTRODUCTION

Nowadays, many retailers not only operate brick-and-mortar stores, but they also sell products via the internet, either in own online stores or on platforms such as *Amazon* or *eBay*.[1] While online sales come with the advantage of lower retail costs (e.g., for service and personnel) as well as a larger base of potential customers (e.g., because geographical distance matters much less), manufacturers seem to fear that online sales can harm their brand image. A 2015 survey among 347 brand manufacturers ranging in size from more than $10 billion in annual sales to less than $100 million, singled out "protecting my company's brand image" as the "biggest e-commerce-related challenge."[2] In an attempt to protect their brand image, manufacturers have repeatedly tried to restrain retailers in their ability to sell products via the internet, with the particular goal of preventing online discounts. As a specific example, sports article manufacturer *adidas* (temporarily) banned the sale of adidas products via open marketplaces on the internet (such as *Amazon Marketplace* or *eBay*), explicitly referencing brand image concerns.[3] According to the German Federal Cartel Office, a key open question in competition law is how to assess this use of vertical restraints to protect a brand's image (Bundeskartellamt, 2013, p. 27).

We microfound the claim that online discounts can harm a brand's image through a model of salience-driven attention (Bordalo et al., 2013; Kőszegi & Szeidl, 2013). The business dictionary defines brand image as the "impression in the consumers' mind of a brand's [⋯] real and imaginary qualities and shortcomings,"[4] meaning that it partly reflects a brand product's objective and partly the product's perceived quality. Our notion of salience builds on the idea that "contrasts attract attention" (*contrast effect*), with direct implications for a product's perceived quality: online discounts, by creating contrast in prices, draw a consumer's attention toward a brand product's price, which in turn lowers the product's perceived quality. In equilibrium, manufacturers may then respond by lowering actual quality as well, thereby exacerbating the harm to their brand image. Our analysis highlights a novel externality that discounts in one distribution channel can have on consumers in another channel: namely, online discounts can reduce a consumer's perceived quality (and, thus, her willingness-to-pay) when buying offline. More importantly, it provides a rationale for why brand manufacturers, despite the advantages of lower retail costs and a larger customer base, try to restrain online sales by their retailers.

We introduce our baseline model in Section 2. A monopolistic manufacturer sells a single product at a linear wholesale price to a number of retailers. Besides specifying the wholesale price, the manufacturer also decides on the product's quality. Retailers serve final consumers via two channels: the online and the offline channel. Consistent with empirical evidence (see Lieber & Syverson, 2012, for an overview), we make two assumptions on channel characteristics that exert downward pressure on online prices. First, while retailers have some market power offline, we assume perfect competition in the online channel. Second, retailers have to cover higher retail costs for offline than for online sales. We assume that consumers are heterogeneous regarding their preferences for online shopping (as documented in Duch-Brown et al., 2017), so that it is efficient to serve some consumers via brick-and-mortar stores (the *offline* consumers) and others via the internet (the *online* consumers). All consumers, independent of their shopping preferences, are aware of both online and offline prices,[5] and equally susceptible to salience effects.

We argue in Section 3 that, absent vertical restraints, one of two salience distortions can arise in equilibrium: a *quality distortion* or a *participation distortion*. On the one hand, a quality distortion occurs if, in equilibrium, retail prices vary across distribution channels and thus attract a consumer's attention. In such a *price salient equilibrium* the consumers' valuation of high-quality goods is deteriorated and the manufacturer provides an inefficiently low quality in response. Both of these effects harm the brand's image. On the other hand, the manufacturer may distort the product's quality upward to *prevent* price variations across channels. In such an *excessive branding equilibrium* the manufacturer leaves the retailers a considerable share of joint profits to make them partially internalize the negative effect of online discounts on the consumers' willingness-to-pay. We show that an excessive branding equilibrium occurs if and only if the share of online consumers is low. A price salient equilibrium, in contrast, may exist for intermediate shares of online consumers. Finally, if the share of online consumers is large enough, the manufacturer offers a contract that does not allow retailers to profitably serve offline consumers, so that in equilibrium only online stores are operated (i.e., an *online equilibrium* arises). Because salience effects reduce manufacturer profits in a price salient and an excessive branding, but not in an online equilibrium, the latter becomes more attractive relative to a benchmark with rational consumers. Thus, relative to the rational benchmark, a participation distortion can arise because *too few* consumers might be served in equilibrium.

By preventing price variations across distribution channels, vertical restraints on internet sales can circumvent the adverse salience effects arising from the possibility to offer online discounts. We study the effects of different vertical restraints in Section 4: a *direct ban* on online sales, *resale price maintenance* (i.e., fixing retail prices), and *dual pricing* (i.e., conditioning the wholesale price on the distribution channel). Similar to third-degree price discrimination, dual pricing enables the manufacturer to enforce high online prices, and to maximize and extract industry profits. Alternatively, resale price maintenance or a ban on online sales ensure the supply of the efficient product specification, and can enhance not only the manufacturer's profit but also social welfare. Thus, while aligning retail prices across distribution channels through vertical restraints allows manufacturers to protect their brand image, it can harm consumers through higher retail prices. Our analysis thereby identifies a novel trade-off between efficiency and consumer surplus.

Section 5 presents a series of robustness checks, documenting that the qualitative insights derived from our baseline model still hold in more general setups. In a first set of robustness checks, we study richer contract spaces, allowing for two-part tariffs or retailer-specific contracts. A second set of robustness checks varies the market structure, either downstream (e.g., by introducing a manufacturer-owned online store or retailers that sell exclusively online) or upstream (e.g., by adding a horizontally differentiated manufacturer). Our qualitative insights on brand image concerns and the role of vertical restraints still hold in either case. Finally, we argue that context effects other than the contrast effect—such as the design of a brick-and-mortar store—can result in a *quality salient equilibrium*, but do not change our main findings.

We discuss the related literature in Section 6. While there exist several classical explanations for vertical restraints on online sales (e.g., free-riding on services or opportunism), our salience-based rationale for restricting online sales resonates much better with the brand image concerns put forward by the manufacturers. According to the contrast effect, online discounts reduce perceived quality and, as a consequence, manufacturers also have lower incentives to provide actual quality. Thus, when stating that online discounts harm brand image, we mean that both of its components—the objective and the perceived quality of the brand—decrease likewise. This combination of facts is hard to reconcile with classical approaches to vertical contracting.

We conclude in Section 7 by pointing out that the same salience mechanism can explain further restraints—such as minimum advertised price (MAP) policies or geoblocking—that manufacturers (try to) impose on their retailers. The arguments highlight once again the paper's common theme: a manufacturer may want to impose vertical restraints to prevent price salience.

2 | BASELINE MODEL

We introduce our formal setup in Section 2.1, and discuss our key assumptions in Section 2.2.

2.1 | Setup

Market structure. A manufacturer (he) produces a single good of quality $q \in [\underline{q}, \bar{q}\,] \subseteq \mathbb{R}_+$ at unit cost $c(q)$, and sells it to $N \geq 2$ retailers at a uniform, linear wholesale price $w \geq 0$. Each retailer i (she) can operate a "brick-and-mortar" (or offline) store, located in area i, and/or an online store, and she is free to charge different prices in each of these stores. Retailers incur unit retail costs of $r > 0$ for offline sales, while retail costs for online sales are normalized to zero. We impose standard Inada conditions on the manufacturer's cost of quality: (i) $c(\underline{q}\,) = 0$ and $\lim_{q \to \bar{q}} c(q) = \infty$, (ii) $c'(\underline{q}\,) = 0$ and $c'(q) > 0$ for all $q \in (\underline{q}, \bar{q}\,)$, and (iii) $c''(q) > 0$ for all $q \in [\underline{q}, \bar{q}\,)$.

There is a unit mass of consumers—equally distributed across the N areas—who buy at most one unit. All consumers value a good of quality $q \in [\underline{q}, \bar{q}\,]$ at $v(q)$, with $v'(q) > 0$ and $v''(q) \leq 0$. We distinguish, however, between two types of consumers based on their shopping preferences. A share $1 - \alpha \in (0, 1)$ of consumers incur some fixed disutility $l > r$ from online purchases. Because it is efficient to serve these consumers offline, we call them *offline* consumers. The remaining share of consumers is indifferent between online and offline shopping. Due to the offline retail costs, it is efficient to serve these consumers online, so we call them *online* consumers. Independent of their shopping preferences, for consumers in area i, we refer to the brick-and-mortar store located in this area as their *local* store. When shopping online or when shopping at their local store, no "transportation cost" arises. If a consumer shops in a brick-and-mortar store located in a different area, however, transportation costs of $t > 0$ accrue.[6] Absent salience effects, thus, both consumer types obtain a consumption utility of $v(q) - p_{i,\text{off}}$ when purchasing at their local store, and a consumption utility of $v(q) - p_{j,\text{off}} - t$ when buying in a foreign brick-and-mortar store. Buying at retailer i's online store yields a consumption utility of $v(q) - p_{i,\text{on}}$ or $v(q) - p_{i,\text{on}} - l$ to online and offline consumers, respectively. Consumers may also decide not to buy at all, with a consumption utility normalized to zero. Figure 1 illustrates the market structure.

Salience and welfare. We assume that consumers are *salient thinkers* (Bordalo et al., 2013; Kőszegi & Szeidl, 2013) who, instead of maximizing their consumption utility, decide based on a *salience-weighted* utility shaped by the choice context. The choice context is captured by the salient thinker's *consideration set*: that is, the set of options she has on her mind when making the purchase decision. We assume that consumers consider all available offers and then discount the choice dimension—either the product's quality or its price—that is less salient within this consideration set by some salience parameter $\delta \in (0, 1)$. Following Bordalo et al. (2013, 2015) and Kőszegi and Szeidl (2013), we assume that large contrasts in outcomes along a particular choice dimension attract a consumer's attention (*contrast effect*). Precisely, a product's price is salient if and only if the available offers "vary more" along the price than along the

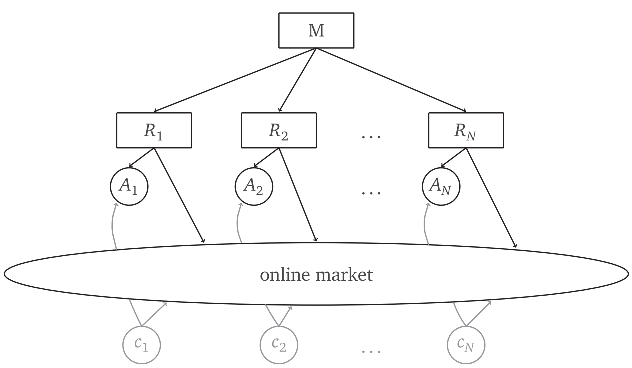

FIGURE 1 The manufacturer M sells his product to $N \geq 2$ retailers, where retailer R_i is located in area A_i. Consumers located in area A_i—the group c_i—can buy in each online and offline store, with grey arrows indicating purchase opportunities for which no transportation costs arise

quality dimension. In particular, if all offers (i.e., all price-quality pairs) are identical, neither quality nor price is salient, and a product's salience-weighted utility coincides with its consumption utility. And if there is variation in only one dimension then this dimension is automatically salient.

As we consider a market with a monopolistic manufacturer producing a single good, by assumption, there is no variation along the quality dimension. Hence, consumers either focus on the product's price or, alternatively, quality and price are equally salient. The product's price is indeed salient if and only if retail prices vary across stores. Table 1 summarizes the salience-weighted utility in such a "price-salient environment" for any consumer-store combination.

We restrict our analysis to the case where salience distortions are not extremely strong:

Assumption 1 (Salience distortion). $\delta > \max\left\{1 - \frac{N-1}{N} \cdot \frac{r}{v(\bar{q})}, \frac{r}{v(\underline{q})}\right\}$.

The first part ensures that the manufacturer cannot prevent a price-salient environment by simply charging a sufficiently high wholesale price. The second part implies that, whether or not price is salient, even the lowest quality product is "worth" the cost of offline retailing.

Following the literature (e.g., Kőszegi & Szeidl, 2013), we assume that consumer surplus is determined by consumption utility.[7] Accordingly, we denote as $q^* := \arg\max_q [v(q) - c(q)]$ the *efficient* quality level, which is implicitly defined via $v'(q^*) = c'(q^*)$. Accounting for the heterogeneity in shopping preferences and offline retail costs, we say that *all consumers are served efficiently* if offline consumers buy at their local store and online consumers buy online.

Timing and solution concept. In a first stage, the manufacturer chooses a quality $q \in [\underline{q}, \bar{q}]$, and a linear wholesale price $w \geq 0$. In a second stage, taking the quality and wholesale price as given, retailers simultaneously choose their distribution channels and retail prices. Precisely, retailer i chooses her distribution channels $C_i \subseteq \{\text{on}, \text{off}\}$, and, for any $k \in C_i$, a price $p_{i,k} \geq 0$. In a third stage, consumers observe all offers and decide based on their salience-weighted utility.

Because we are analyzing a game of complete information, we solve for the set of subgame-perfect equilibria. To ease exposition, we impose the tie-breaking assumption that all retailers that set the same online price serve the same share of consumers at their online stores. We refer to an equilibrium in the second-stage continuation game as a *retail* equilibrium, and adopt the selection criterion of payoff-dominance: if there are multiple retail equilibria in a given subgame, we assume that retailers select the one with the highest retailer profits (for a recent application of this selection criterion, see Johnen, 2020). All our results are robust, however, to imposing a selection criterion in the spirit of risk-dominance (Harsanyi & Selten, 1988) instead.[8]

2.2 | Discussion of modeling assumptions

We briefly discuss the key assumptions of our model.

Shopping preferences. We impose the canonical assumption that for each distribution channel there is one type of consumer that is efficiently served via this channel (for supportive evidence see, e.g., Duch-Brown et al., 2017). While we assume that online consumers are indifferent between purchasing on- and offline, our results still hold if these consumers have a slight, but strict preference for either on- or offline purchases. Indeed, our results only rely on the plausible heterogeneity that it is efficient to serve some consumers offline and others online.

Retail costs. Our qualitative results rely on the assumption that online sales significantly reduce retail costs (for an overview of supportive evidence see Lieber & Syverson, 2012). Unlike online stores, brick-and-mortar stores need attractive locations, which are accompanied by high property prices or rents. Moreover, costs for service and personnel

TABLE 1 Salience-weighted utility under price salience for some price $p \geq 0$ and quality $q \in [\underline{q}, \bar{q}]$

	Local store	Foreign offline store	Online store
offline consumers	$\delta v(q) - p$	$\delta v(q) - p - t$	$\delta v(q) - p - l$
online consumers	$\delta v(q) - p$	$\delta v(q) - p - t$	$\delta v(q) - p$

are typically higher for brick-and-mortar stores. Because shelf space is limited offline but not online, brick-and-mortar stores also face higher (opportunity) costs for offering additional units of a product.

Up- and downstream competition. Because antitrust authorities are mostly concerned about adverse effects of vertical restraints on intra-brand competition, we focus on the case of a monopolistic manufacturer, thereby abstracting from inter-brand competition. But our qualitative results do not rely on this assumption, and continue to hold when adding a horizontally differentiated manufacturer to our baseline model (see Section 5). Our results do rely, however, on retail competition being fiercer online than offline, which is supported by existing empirical evidence (see sections 3.1 and 4.4 in Lieber & Syverson, 2012, as well as the references therein).

Contrast effect. Our main behavioral assumption constitutes that large contrasts in outcomes attract a disproportionate amount of attention. This assumption is a central ingredient of recent as well as older models of context-dependent behavior (e.g., Bordalo et al., 2013; Kőszegi & Szeidl, 2013; Rubinstein, 1988; Simonson & Tversky, 1992; Tversky, 1969, 1972; Tversky & Simonson, 1993), and it is consistent with numerous empirical and experimental observations (Dertwinkel-Kalt et al., forthcoming, 2017; Dunn et al., 2003; Schkade & Kahneman, 1998). Importantly, Dertwinkel-Kalt et al. (2017) provide direct experimental support for the mechanism that we employ in this paper: consumers who previously saw lower prices for certain products tend to be more price-sensitive than consumers who are used to the given price level.[9]

One remark is in order regarding the "rank-based" salience model—going back to Bordalo et al. (2013, 2015)—that we adopt in this paper. Assuming that the less salient dimension is discounted by a constant factor $\delta \in (0, 1)$, instead of introducing an arguably more realistic, continuous salience weight (as in Kőszegi & Szeidl, 2013), drastically simplifies the exposition of our results, but it has no effect on the underlying economic logic (see Section 3.3).

Consideration set. We assume that *all* consumers are aware of *all* online and offline prices. All we need for our results to hold, however, is for offline consumers to be aware of online prices and the price in their local brick-and-mortar store. This is consistent with survey evidence suggesting that before offline shopping consumers often browse the respective goods online.[10]

Alternative products, on the other hand, are not included in a consumer's consideration set.[11] Because we consider a monopolistic manufacturer that is producing a single product, this assumption is canonical in our model. Still, it implies that—in terms of our model—quality cannot be salient, which might be seen as a limitation in a more general context. On the other hand, it seems to be a common practice among retailers (and manufacturers) not to present brand products alongside low-quality substitutes, which effectively restricts a consumer's consideration set to products of a similar quality. Even department stores comprise separate brand shops for major brands like *Levis*, *Nike*, or *Apple*.[12] In this sense, assuming away quality salience in terms of our model, might be a good approximation of reality. In fact, instead of introducing "contrasts in qualities," retailers seem to manipulate the arrangement of products or the store environment (e.g., background music, scents, or colors) in a way that highlights quality. This kind of salience is not included in our baseline model, but we study an extension along these lines in Section 5, and we show that—although quality might be salient—our qualitative results still hold.

3 | EQUILIBRIUM ANALYSIS

As a benchmark, and to highlight the basic trade-offs a manufacturer faces absent salience effects, in Section 3.1 we describe the equilibrium with rational consumers. Subsequently, we derive the equilibrium outcome when consumers are salient thinkers (Section 3.2), and verify its robustness to assuming continuous rather than rank-based salience distortions (Section 3.3).

3.1 | Benchmark without salience distortions

Suppose that consumers aim to maximize their consumption utility (i.e., let $\delta = 1$). The manufacturer then charges either a high wholesale price and serves only online consumers or he charges a low wholesale price and serves all consumers. It immediately follows that all consumers are served in equilibrium if and only if the share of online consumers, α, is sufficiently small.

We flesh out the economic logic in a bit more detail. Suppose that the manufacturer wants all consumers to be served in equilibrium. Because retailers incur retail costs of $r > 0$ for offline sales and offline consumers derive a disutility of $l > r$ from online purchases, the manufacturer optimally charges a wholesale price of $w = v(q) - r$, which allows retailers to break even on offline sales with a retail price of $v(q)$. A standard Bertrand-type argument further implies that competition drives down online prices to costs, equal to the wholesale price w. Hence, in equilibrium, all consumers are served efficiently, and the manufacturer earns $v(q) - r - c(q)$. If instead only online consumers are served in equilibrium, the manufacturer optimally charges a wholesale price of $w = v(q)$, and earns $\alpha \cdot [v(q) - c(q)]$. In either case, the manufacturer chooses the efficient quality $q = q^*$. We conclude that there exists a critical share of online consumers,

$$\alpha_R := \frac{v(q^*) - r - c(q^*)}{v(q^*) - c(q^*)} \in (0, 1),$$

below which all consumers will be served in equilibrium. We obtain the following benchmark:

Lemma 1 (Benchmark). *Let $\delta = 1$. In any subgame-perfect equilibrium, the manufacturer sets the efficient quality $q = q^*$. If $\alpha < \alpha_R$, all consumers are served efficiently. Otherwise, only online consumers are served* (via the online *channel). Retailers earn zero profits in either case.*

3.2 | Equilibrium with salience distortions

We start by providing some intuition for why salience effects change the equilibrium outcome. Suppose that—just like in the rational benchmark for $\alpha < \alpha_R$—the manufacturer charges a wholesale price of $w = v(q) - r$, all retailers charge a price of $v(q)$ in their offline stores, and at least two retailers offer the product online at a price of w. Because retail prices differ across channels, the product's price is salient, consumers are willing to pay at most $\delta v(q)$, and offline consumers do not buy. Going one step further, with salient thinkers, the manufacturer cannot serve all consumers while simultaneously charging a wholesale price of $w = v(q) - r$. Why?

Given this wholesale price, to break even in offline sales, retailers need to charge at least $v(q)$ in their brick-and-mortar stores, and to keep offline consumers buying at this price, they have to prevent a price-salient environment by charging the same price online. Because a retailer, thus, earns a relatively high margin on online consumers, but nothing on offline consumers, under Assumption 1, she prefers to lower her price to $\delta v(q)$ to attract all online consumers:

$$\alpha \cdot \underbrace{[\delta v(q) - w]}_{=r-(1-\delta)v(q)} > \frac{\alpha}{N} \cdot \underbrace{[v(q) - w]}_{=r} \qquad \text{or, equivalently,} \qquad \delta > 1 - \frac{N-1}{N} \cdot \frac{r}{v(q)};$$

that is, retailers—in contrast to the manufacturer—prefer to "drop" offline sales at sufficiently high wholesale prices. As a consequence, the manufacturer cannot serve all consumers in equilibrium, while at the same time charging the same wholesale price as in the rational benchmark.

The precise equilibrium implications of salience effects can be summarized as follows:

Proposition 1 (Equilibrium with salient thinkers). *There exist $0 < \alpha'_S \le \alpha''_S < 1$, so that, depending on the share of online consumers, in any subgame-perfect equilibrium it holds that:*

i) *If $\alpha < \alpha'_S$, then price is nonsalient, the manufacturer sets an inefficiently high quality $q = q^S_{\text{ex}}(\alpha, \delta) > q^*$, all consumers are served efficiently, and retailers earn positive profits.*
ii) *If $\alpha'_S \le \alpha < \alpha''_S$, then price is salient, the manufacturer sets an inefficiently low quality $q = q^S_{\text{ps}}(\delta) < q^*$, all consumers are served efficiently, and retailers earn zero profits.*
iii) *If $\alpha \ge \alpha''_S$, then price is nonsalient, the manufacturer sets the efficient quality $q = q^*$, only online consumers are served (via the online channel), and retailers earn zero profits.*

By lowering the wholesale price and leaving retailers a positive margin in their offline sales, the manufacturer can —at least for small shares of online consumers—incentivize retailers to charge equal, and high, prices across both channels: here, a retailer's incentive constraint

$$\frac{1-\alpha}{N}\cdot\underbrace{[v(q)-r-w]}_{\text{offline margin}}+\frac{\alpha}{N}\cdot\underbrace{[v(q)-w]}_{\text{online margin}}\geq\underbrace{\alpha\cdot[\delta v(q)-w]}_{\text{profit from attracting all online consumers}}\tag{1}$$

holds if and only if the share of online consumers is small enough *and* the wholesale price satisfies

$$w\leq v(q)\cdot\left(\frac{1-\alpha\delta N}{1-\alpha N}\right)-r\cdot\left(\frac{1-\alpha}{1-\alpha N}\right).$$

With only a few online consumers in the market (i.e., $\alpha<\alpha_S'$), a retailer's "salience threat," to drop offline sales at high wholesale prices, warrants her a considerable share of industry profits in equilibrium. Interestingly, because the decrease in a consumer's willingness-to-pay due to price salience, $(1-\delta)v(q)$, increases with the provided quality q, the manufacturer makes online price cuts less attractive by increasing the product's quality beyond the efficient level. Hence, we term this first part of the equilibrium with salient thinkers an *excessive branding equilibrium*.

For intermediate shares of online consumers (i.e., $\alpha_S'\leq\alpha<\alpha_S''$), the manufacturer wants all consumers to be served, but it is either impossible or unprofitable to incentivize retailers to charge equal prices across channels. Since the manufacturer cannot avoid a price-salient environment, he optimally charges a wholesale price that allows retailers to break even on offline sales under price salience, so again all consumers are served efficiently in equilibrium. In such a *price salient equilibrium* the manufacturer has fewer incentives to invest in quality however, meaning that not only the perceived quality is deteriorated, but the actual quality is also inefficiently low.

If the share of online consumers is sufficiently high (i.e., $\alpha\geq\alpha_S''$), the manufacturer charges a wholesale price of $w=v(q)$, so that in equilibrium only online consumers are served. We denote this last part of the equilibrium an *online equilibrium*. As in the rational benchmark, if there are only few offline consumers in the market, the manufacturer does not find it worthwhile to lower the wholesale price by the amount of offline retail costs to enable profitable offline sales. Since the high wholesale price rules out any meaningful variation in retail prices, price is nonsalient in equilibrium, and the manufacturer sets the efficient quality level $q=q^*$.

In sum, salience effects can result in one of two inefficiencies. First, with relatively few online consumers in the market (i.e., $\alpha<\alpha_S''$), a *quality distortion* arises: the manufacturer either produces an excessive quality to prevent a price-salient environment or an insufficient quality in case prices are salient in equilibrium. A price salient equilibrium exists (i.e., $\alpha_S'<\alpha_S''$) as long as salience effects are not too strong; that is, as long as δ is sufficiently close to one.

Corollary 1. *There exists some $\underline{\delta}<1$ such that for any $\delta>\underline{\delta}$ a price salient equilibrium exists.*

Second, for a larger share of online consumers (i.e., $\alpha_S''\leq\alpha<\alpha_R$), salience effects induce a *participation distortion*. Because salience effects reduce manufacturer profits in a price salient and an excessive branding, but not in an online equilibrium, the latter becomes more attractive relative to the benchmark with rational consumers. Hence, compared to the rational benchmark, offline consumers are less likely—in the sense of set inclusion—to be served (i.e., $\alpha_S''<\alpha_R$).

3.3 | Robustness to continuous salience weights

At first glance, the excessive branding equilibrium seems to rely on even a marginal price difference translating into a "discrete" drop in the consumers' willingness-to-pay or, in other words, on the rank-based version of salience distortions that we impose. This is not the case, however. To be more precise, as long as the weight on a product's price is sufficiently steep at zero contrast, all parts of our baseline equilibrium (Proposition 1)—namely, the excessive branding equilibrium, the price salient equilibrium, and the online equilibrium—exist also with continuous salience weights.

Denote as $D(\mathscr{C}):=\max_{(i,k)\in\mathscr{C}}p_{i,k}-\min_{(i,k)\in\mathscr{C}}p_{i,k}$ the "range of retail prices" within the consumer's consideration set $\mathscr{C}:=\{(i,k)|1\leq i\leq N\text{ and }k\in C_i\}$, including all available offers. A consumer's perceived value is then given by

$v(q)/g(D)$, with the salience weight $g(\cdot)$ being twice continuously differentiable, strictly increasing (to capture the contrast effect as in Kőszegi & Szeidl, 2013), and concave in the price range. We further impose $g(0) = 1$, so that absent price variation, price is nonsalient; $g'(0) > \frac{1}{v(\underline{q})}$, saying that the salience weight is sufficiently steep at zero contrast; and $1/g(r) > r/v(\underline{q})$, a continuous analogue to the second part of Assumption 1.

3.3.1 | Preliminaries (no bertrand competition)

We first argue that the (potential) lack of competition in the online market, driving the excessive branding equilibrium, is *not* an artifact of the rank-based salience model, but arises likewise with continuous salience weights. More formally, starting from a situation with symmetric retail prices $p_{i,k} = v(q)$ for all $(i, k) \in \mathscr{C}$, a marginal price cut does not suffice to attract all online consumers, severely limiting price competition:

Lemma 2. *For any quality $q \in [\underline{q}, \bar{q}]$ there exists a unique retail price $\hat{p}(q) \in (0, v(q))$ such that*

$$\hat{p}(q) = \frac{v(q)}{g(v(q) - \hat{p}(q))}. \tag{2}$$

Moreover, $p > \frac{v(q)}{g(v(q)-p)}$ for any price $p \in (\hat{p}, v(q))$, and $p < \frac{v(q)}{g(v(q)-p)}$ for any price $p \in (0, \hat{p})$.

This lemma further allows us to build a bridge between the continuous salience weight $g(\cdot)$ and the salience parameter δ in the rank-based model: for any quality $q \in [\underline{q}, \bar{q}]$, we define as $\delta(q) := \frac{1}{g(v(q)-\hat{p}(q))}$ the drop in a consumer's willingness-to-pay due to the "discrete" price cut that is necessary to attract all online consumers when the other retailers set an online price of $v(q)$. Since $g(\cdot)$ is concave, the necessary price cut, $v(q) - \hat{p}(q)$, strictly increases with quality q (see Lemma 3 in Appendix A). We can, thus, impose the following analogue to Assumption 1.

Assumption 2 (Continuous salience distortion). $\delta(\bar{q}) > \max\{1 - \frac{N-1}{N} \cdot \frac{r}{v(\bar{q})}, \frac{r}{v(\underline{q})}\}$.

3.3.2 | Equilibrium

By the same arguments as in the proof of Proposition 1, given our selection criterion, also with continuous salience distortions any relevant retail equilibrium has to be symmetric (or essentially equivalent to a symmetric one). Restricting attention to symmetric retail equilibria, we now show that the same economic logic as in the rank-based model operates.

Excessive branding equilibrium. Fix some quality level $q \in [\underline{q}, \bar{q}]$ and some wholesale price $w \in [\delta v(q) - r, v(q) - r]$, and suppose that all retailers charge a price of $v(q)$ in both channels. Because, by Lemma 2, a deviating retailer i has to charge an online price of $p_{i,\text{on}} \leq \hat{p}(q)$ to attract all online consumers, this constitutes a retail equilibrium if and only if

$$\frac{1-\alpha}{N} \cdot [v(q) - r - w] + \frac{\alpha}{N} \cdot [v(q) - w] \geq \alpha \cdot [\delta v(q) - w]. \tag{3}$$

This is basically the same incentive constraint as in the rank-based salience model (see Equation 1), with the only difference being that $\delta = \delta(q)$ is now a function of quality. Again, the constraint holds if and only if the share of online consumers is small enough *and* the wholesale price satisfies

$$w \leq v(q) \cdot \left(\frac{1 - \alpha\delta N}{1 - \alpha N}\right) - r \cdot \left(\frac{1-\alpha}{1-\alpha N}\right) =: w_{\text{df}}^{C}(q; \alpha).$$

Since $\delta(q)$ decreases in the product's quality (see Lemma 3 in Appendix A), we conclude that

$$\frac{\partial}{\partial q} w_{\text{df}}^{C}(q;\alpha) = v'(q) \cdot \left(\frac{1-\alpha\delta N}{1-\alpha N}\right) - v(q) \cdot \left(\frac{\alpha N}{1-\alpha N}\right)\delta'(q) > v'(q),$$

so that the manufacturer indeed offers an excessive quality in this type of equilibrium.

Price salient equilibrium. Fix some quality $q \in [\underline{q}, \overline{q}\,]$ and wholesale price $w \geq 0$, and suppose that all consumers are served efficiently and retailers charge a higher price offline than online.

We first argue that $p_{\text{on}} = w$ holds in any such retail equilibrium. For the sake of a contradiction, assume $p_{\text{on}} > w$. Since $\frac{v(q)}{g(p_{\text{off}} - p_{\text{on}})} \geq p_{\text{off}}$ (as otherwise offline consumers would not buy) and, thus, $\frac{v(q)}{g(p_{\text{off}} - p_{\text{on}})} > p_{\text{on}}$, by continuity of $g(\cdot)$, there exists some $\epsilon > 0$, so that $\frac{v(q)}{g(p_{\text{off}} - p)} \geq p$ for any $p \in [p_{\text{on}} - \epsilon, p_{\text{on}}]$. Hence, a marginal reduction in her online price enables retailer i to attract all online consumers, increasing her profits from online consumers by roughly $\alpha(\frac{N-1}{N})(p_{\text{on}} - w)$. If retailer i earns zero profits in offline sales, this clearly gives a profitable deviation. Otherwise, retailer i can also marginally reduce her offline price, just enough to keep offline consumers buying. Because of the discrete increase in profits from online consumers, this again gives a profitable deviation; a contradiction. Hence, $p_{\text{on}} = w$ in any price salient retail equilibrium.

Moreover, because otherwise retailers were not able to cover the retail costs for offline sales, $p_{\text{off}} - p_{\text{on}} \geq r$ in any price salient retail equilibrium. It is then optimal for the manufacturer to charge a wholesale price of $w_{\text{ps}}^{C}(q) = \frac{v(q)}{g(r)} - r$, thereby inducing retail prices of $p_{\text{off}} = \frac{v(q)}{g(r)}$ and $p_{\text{on}} = w$. This minimizes the variation in retail prices and, thus, the salience distortion. Still, the manufacturer always provides an inefficiently low quality level in a price salient equilibrium.

Online equilibrium. At a wholesale price of $w = v(q)$, retailers can profitably sell only online to the online consumers. Because such a high wholesale price rules out any meaningful variation in retail prices, the manufacturer provides the efficient quality $q = q^*$ in any online equilibrium.

Summary. By the exact same arguments as for the rank-based salience model, the manufacturer induces an excessive branding equilibrium if the share of online consumers is sufficiently small and an online equilibrium if the share of online consumers is sufficiently large. And, as in our baseline, a price salient equilibrium may exist for intermediate shares of online consumers.

4 | THE EFFECTS OF VERTICAL RESTRAINTS ON ONLINE SALES

We now extend our baseline model by allowing the manufacturer to impose one of three vertical restraints: a direct ban on online sales (Section 4.1), resale price maintenance (Section 4.2), or dual pricing (Section 4.3). To break any ties, we adopt the convention that the manufacturer imposes a vertical restraint if and only if it *strictly* increases his profits.

4.1 | A direct ban on online sales

In our benchmark with rational consumers (i.e., $\delta = 1$) the manufacturer never imposes a ban on online sales. When consumers are salient thinkers, however, a ban on online sales eliminates the salience distortions described in Proposition 1 and allows the manufacturer to restore the benchmark equilibrium.

Proposition 2. *The manufacturer imposes a ban on online sales if and only if* $\alpha \in (0, \alpha_R)$.

The manufacturer enables online sales if and only if there are enough online consumers, so that in a world with rational consumers, he would induce retailers to serve *only* online consumers. When banning online sales, the manufacturer can—just like in the rational benchmark—charge a wholesale price of $w = v(q) - r$ and serve all consumers. Since the manufacturer's profit in an online equilibrium is not affected by salience, the claim follows from Lemma 1.

The welfare effect of a ban on online sales again depends on the share of online consumers. On the one hand, a ban on online sales prevents prices from being salient in equilibrium, and it ensures that the manufacturer produces the efficient quality, q^*. In this sense, we provide a rationale for the claim that a ban on online sales allows manufacturers to protect their brand's image, without any inefficient quality adjustments, as would be the case in an excessive branding equilibrium. Moreover, for any $\alpha \in \left[\alpha_S'', \alpha_R\right)$, a ban on online sales prevents the participation distortion that otherwise arises due to salience effects. On the other hand, because online consumers are forced to buy via their local brick-and-mortar store, retail costs are inefficiently high under a ban on online sales. The welfare implication of a ban depends on which of these effects prevails, with both effects varying in strength with the share of online consumers. We obtain:

Proposition 3. *There is some $\bar{\delta} < 1$ such that, for any $\delta > \bar{\delta}$, the manufacturer's ban on online sales strictly decreases social welfare for $\alpha \in \left(0, \alpha_S''\right)$, while it strictly increases social welfare for $\alpha \in \left[\alpha_S'', \alpha_R\right)$. Consumer welfare decreases due to the ban, and strictly so for any $\alpha \in \left[\alpha_S', \alpha_S''\right)$.*

Since the quality distortion vanishes as the salience parameter δ approaches one, a weak salience bias implies that a ban on online sales decreases social welfare for small shares of online consumers. For any $\alpha \in \left[\alpha_S'', \alpha_R\right)$, however, a ban on online sales strictly increases social welfare. In this latter case, retailer profits and consumer surplus are zero, both with and without the ban, so that the manufacturer is the residual claimant to social welfare. The result then follows by revealed preferences. But, for any $\alpha \in \left[\alpha_S', \alpha_S''\right)$, a ban on online sales also prevents low retail prices in an otherwise price salient equilibrium, thereby strictly decreasing consumer welfare.

4.2 | Resale price maintenance

Under resale price maintenance (RPM) the manufacturer determines the retail prices charged in either channel. Absent salience effects, a manufacturer has no incentive to control retail prices in our model. If consumers are salient thinkers, however, RPM eliminates any price variation and is, thus, attractive to the manufacturer whenever one of the salience distortions otherwise arises.

Proposition 4. *The manufacturer aligns retail prices via RPM if and only if $\alpha \in (0, \alpha_R)$.*

As aligning on- and offline prices via RPM rules out adverse salience effects, without preventing efficient online sales, it is desirable not only for the manufacturer, but also from a social welfare point of view. Similar to the case of a ban on online sales, however, RPM prevents low retail prices in an otherwise price salient equilibrium, thereby reducing consumer welfare.

Proposition 5. *The manufacturer's use of RPM strictly increases social welfare, but it also strictly lowers consumer welfare for any $\alpha \in \left[\alpha_S', \alpha_S''\right)$.*

4.3 | Dual pricing

Dual pricing enables the manufacturer to charge a different wholesale price for units to be resold on- and offline. On the one hand, dual pricing allows the manufacturer to extract the online consumers' willingness-to-pay for online sales via a high wholesale price for units to be resold online. On the other hand, it allows him to charge a lower wholesale price for units that are resold offline, so that retailers can cover offline retail costs and serve offline consumers. Hence, even in the rational benchmark the manufacturer always adopts a dual pricing system. With salient thinkers, dual pricing further eliminates both types of salience distortions, so clearly:

Proposition 6. *For any $\alpha \in (0, 1)$, the manufacturer adopts a dual pricing system.*

Because a dual pricing system ensures not only the supply of the efficient quality, but also that all consumers are served efficiently in equilibrium, it maximizes social welfare. Just like with the other vertical restraints, however, dual pricing prevents low retail prices in an otherwise price salient equilibrium and can therefore hurt consumers.

Proposition 7. *The manufacturer's dual pricing system strictly increases, and indeed maximizes, social welfare, but it also strictly decreases consumer welfare for any* $\alpha \in \left[\alpha_S', \alpha_S''\right)$.

5 | ROBUSTNESS OF OUR FINDINGS

Our qualitative findings are robust to several extensions (e.g., regarding the contract space and the market structure). We provide detailed analyses of these extensions in the online appendix.

Uniform two-part tariff. Consider the exact same game as before, with the one exception that the manufacturer can offer a uniform two-part tariff. The equilibrium outcome without vertical restraints is basically the same as in the baseline, with two exceptions: For a very small share of online consumers, the manufacturer can enforce equal prices across channels through the linear component of the tariff, and extract all profits through the fixed part. For a large share of online consumers, the manufacturer sets a fixed fee that allows only a single retailer to break even, so that instead of an online equilibrium we obtain an equilibrium where one retailer serves all online consumers and, depending on the strength of the offline competition, some or all offline consumers. The only difference in the equilibrium with vertical restraints is that resale price maintenance combined with a two-part tariff enables the manufacturer to extract, for any $\alpha \in (0, 1)$, the maximum industry profit, so that under RPM also social welfare is maximized.

Retailer-specific contracts. Keeping everything else constant, suppose that the manufacturer can offer observable retailer-specific contracts. In addition, let transportation costs be large enough so that the manufacturer does not want to rely on a single retailer to serve offline consumers. The equilibrium without vertical restraints has the same structure as before, with the one exception that for intermediate shares of online consumers the manufacturer could have a strict incentive to exclude some retailers from the market. In this case, what arises is either an excessive branding equilibrium in which only a subset of retailers are active in the market or a price salient equilibrium in which all retailers are active. The effects of vertical restraints remain basically the same, unless the manufacturer can selectively ban the online sales of specific retailers. A selective ban on online sales—where only one retailer is allowed to sell online—has the potential to increase not only the manufacturer's profit but also social welfare.

Manufacturer-owned online store. The baseline equilibrium outcome, delineated in Proposition 1, carries over to the case where the manufacturer runs an own online store, except for the fact that the manufacturer directly serves some of the online consumers. With vertical restraints, the only difference compared to our baseline model is that operating an own online store makes a ban on online sales even more attractive to the manufacturer. If the manufacturer prohibits online sales by the retailers, he can serve all online consumers via his own online store, and avoid price salience by matching the price that the retailers charge at their brick-and-mortar stores. Here, a ban on online sales maximizes not only the manufacturer's profit but also social welfare.

Online retailer. If we allow for an online retailer that has no brick-and-mortar store, the equilibrium absent vertical restraints changes in one regard: an excessive branding equilibrium no longer exists. At any wholesale price that induces the remaining retailers to charge equal prices across channels, the online retailer has a strict incentive to charge a lower price to attract all online consumers, because she does not internalize the negative externality of such a price cut on offline profits. In this sense, the manufacturers' claim that online sales harm their brand image by creating a price-salient environment is particularly plausible in the presence of online retailers. Although the equilibrium structure absent vertical restraints changes slightly, the implications of vertical restraints, as derived in Section 4, remain qualitatively the same.

Inter-brand competition. So far, by assuming a monopolistic manufacturer, we completely abstract from inter-brand competition. Our results are robust, however, to introducing a second manufacturer producing a horizontally differentiated product of the same quality. For the sake of the argument, we assume that half of the consumers have a strict preference for each of the two products, which are now characterized along *three* dimensions: quality, price, and additional "brand features." Retailers can stock both products at no additional cost, and retail costs are the same across products. For sufficiently strong brand preferences, all three parts of the equilibrium characterized in Proposition 1 survive. Although we do not prove the uniqueness of the subgame-perfect equilibrium outcome, our analysis suggests that the incentives to impose a vertical restraint also remain basically the same as in our baseline model with a single manufacturer.

Asymmetric offline markets. Consider a variant of our baseline model in which the offline consumers in some, but not all, regions have a higher valuation of quality than the remaining consumers (i.e., all online consumers and the offline consumers in the other regions). This changes the equilibrium structure absent vertical restraints only in one regard: for a relatively high share of online consumers, a price salient equilibrium arises in which only the high-value offline consumers and all online consumers are served. With many high-value offline consumers, however, the manufacturer might now use vertical restraints—in combination with a high wholesale price—to exclude the online and low-value offline consumers from the market, at the same time tailoring the product to the high-value offline consumers. Otherwise, the incentives to impose, and the consequences of, restraints on online sales are similar as in our baseline model.

Other context effects and quality salient equilibria. Besides the contrast effect, there are other ways in which the choice context could affect the perception of quality (e.g., highlighting quality via expensive interior, background music, scents, or colors). Absent vertical restraints, such context effects imply two changes compared to our baseline model: If the share of online consumers is very small, a *quality salient equilibrium* arises, where the weight that a consumer attaches to the product's quality is larger than the weight she attaches to its price. Second, also if in equilibrium prices vary across channels, retailers inflate the perceived quality in their offline stores, so that the product's price is not necessarily salient for all consumers; that is, in equilibrium, offline consumers might attach a higher weight to quality, while online consumers always attach a higher weight to price. Despite these two changes, the manufacturer's incentives to impose a vertical restraint remain basically the same. Also the qualitative welfare implications of imposing different vertical restraints do not change compared to our baseline model.

6 | ALTERNATIVE EXPLANATIONS FOR VERTICAL RESTRAINTS ON ONLINE SALES

Economists have put forward several justifications for vertical restraints (on online sales), such as ensuring high service quality (e.g., Mathewson & Winter, 1984; Telser, 1960), signaling and exclusivity concerns (e.g., Inderst, 2019; Marvel & McCafferty, 1984; Pesendorfer, 1995), different forms of commitment problems (e.g., Coase, 1972; Hart & Tirole, 1990; Nava & Schiraldi, 2019; Stokey, 1981), facilitating collusion (e.g., Jullien & Rey, 2007), informational advantages of retailers (e.g., Rey & Tirole, 1986), preventing certain types of price discrimination (e.g., Chen, 1999), exploiting context effects other than the contrast effect (e.g., Helfrich & Herweg, 2020; Inderst & Obradovits, 2020a), or simply responding to channel characteristics (e.g., Dertwinkel-Kalt et al., 2016; Miklós-Thal & Shaffer, forthcoming). We discuss the explanations that are most relevant for thinking about online sales and brand image concerns in more detail.

Service externalities. Online retailers may "free ride" on services provided in brick-and-mortar stores, which in turn reduces the incentives for offline retailers to provide high-quality services in the first place. Hence, by reducing the number of service-providing retailers, online discounts might harm brand image in the long run, and this "service externality" can explain why manufacturers want to restrain online sales by their retailers (e.g., Mathewson & Winter, 1984; Telser, 1960).[13] Our approach, in contrast, predicts a more direct negative effect of online discounts on a brand's image, which applies independent of whether product-related services are important or not. This allows us to make sense of the observation that vertical restraints are also applied to a broad range of products for which the service-based justification for vertical restraints is not plausible (see Ippolito, 1991; MacKay & Smith, 2017; Pitofsky, 1982).[14] We therefore regard these two arguments in favor of restraints on online sales as complementary.

Signaling and exclusivity. In other occurrences, vertical restraints have been justified by a more direct need to protect brand image, but only if the product's quality is (at least partially) unobservable ex ante and the product's price thus serves as a signal of its quality (Inderst, 2019). Unobservable quality, however, plays a role only for specific goods, and also for these goods it is questionable whether nowadays—with plenty of customer reviews being easily accessible online—a product's price still serves as an important signal of quality. Moreover, the marketing literature suggests that, especially for brand products, a manufacturer's reputation (as a high-quality producer) rather than a product's price signals its quality (Aaker, 2014, chapter 5).[15] And, even if price serves as a signal of quality, the contrast effect makes testable predictions that go beyond any signaling concerns: according to the contrast effect, online discounts can harm a brand's image also in repeat purchases; making the two stories empirically distinguishable.

Relatedly, when consumers care about exclusivity, high prices can—by effectively excluding low-value consumers—promote sales and even boost willingness-to-pay (e.g., Imas & Madarász, 2021; Pesendorfer, 1995; Taussig, 1916). Vertical restraints like RPM can maintain such high prices and, unlike high wholesale prices, can also prevent the use of "status goods" as loss leaders, thereby protecting a brand's image (for an extensive discussion of vertical restraints in the context of status goods, see Orbach, 2008). Exclusivity concerns are not specific to online sales, however, and many (if not most) instances of restraints on online sales regard products for which exclusivity is arguably no concern at all (see the examples in Footnote 2).[16]

Commitment problems. Vertical restraints can also solve various commitment problems a manufacturer might face. As shown by Hart and Tirole (1990), with secret contracting and without vertical restraints, a manufacturer cannot commit to high input prices, and an opportunism problem arises. With RPM, on the other hand, the manufacturer can soften intra-brand competition, which in turn allows him to sustain high input prices in equilibrium. Pricing restraints such as RPM can further solve commitment problems related to intertemporal price discrimination in selling durable goods (Coase, 1972; Nava & Schiraldi, 2019; Stokey, 1981). While neither of these commitment problems directly relates to brand image concerns, they can give rise to equilibria with a structure similar to our price salient equilibrium: absent vertical restraints, low input prices in combination with fierce downstream competition lead to low retail prices, which could attract—if consumers were heterogeneous in their valuation of quality—low-value consumers and thus incentivize the manufacturer to lower the actual quality. Importantly, however, such a classical model cannot account for the externality at the heart of our results: price discounts in one distribution channel affect the willingness-to-pay of consumers served via another channel; again making these alternative stories empirically distinguishable from ours.

Context effects.[17] A relatively small literature applies salience models to study questions related to vertical contracting and brand image concerns. The two papers most closely related to ours, Helfrich and Herweg (2020) and Inderst and Obradovits (2020a), have in common that they leverage a different, secondary property of Bordalo et al.'s (2013) salience theory, so-called, *diminishing sensitivity*. According to diminishing sensitivity, price is salient when—fixing the contrast in prices—the price level is sufficiently low. Helfrich and Herweg (2020) argue that, because online sales exert downward pressure on offline prices and, thus, lower the overall price level, manufacturers may have an incentive to ban online sales. Other than in our model, however, their analysis suggests that a ban on online sales always lowers consumer *and* social welfare.[18] Inderst and Obradovits (2020a) delineate a model of one-stop shopping, where consumers require several goods, but compare retailers based only on one prominent good. To attract consumers, retailers may offer the prominent product below cost, inducing a low price level and salient prices, and in turn provide a low-quality rather than a high-quality "loss leader." Thus, also in Inderst and Obradovits (2020a) salience effects can deteriorate quality provision, although, other than in our model, this is driven by the retailers and not by the manufacturer.

7 | CONCLUDING REMARKS

We propose a salience-based justification for vertical restraints on online sales that takes seriously the claim put forward by brand manufacturers that online discounts harm brand image. The exact same salience mechanism can help us to make sense of other restrictions imposed on retailers. In recent years, the interest in MAP policies that restrain advertised, but not actual, prices has "skyrocketed" (Amarante & Banks, 2013). Under the plausible assumption that offline (online) consumers are aware of advertised, but not actual online (offline) prices, eliminating variation in advertised prices through MAP can prevent salience distortions through online discounts, while at the same time allowing for optimal discriminatory pricing across channels. In this sense, models building on the contrast effect can add to our understanding of why "US manufacturers use MAP to protect brand image."[19]

We can further contribute to the recent debate on geoblocking in the European Union.[20] For the sake of the argument, consider an extension of our baseline model with two countries that have the same mass of consumers and the same share of online consumers. Under geoblocking, consumers can only buy the product from retailers located in the same country. If geoblocking is prohibited, however, consumers can also buy online from retailers in a different country. Thus, a ban on geoblocking increases the size of the online market from a single retailer's perspective, and increases her incentive to charge a low online price. As a consequence, an excessive branding equilibrium is *less* likely to occur (in the sense of set inclusion). In addition, because the actual size of the online market does not change, the online equilibrium remains equally attractive from the manufacturer's perspective, so that a price salient equilibrium is *more* likely to occur. This yields further testable predictions—a ban on geoblocking reduces retail prices, increases price dispersion, and, thus, lowers the perceived as well as actual quality of products—and it fits neatly into the paper's common theme—manufacturers may want to restrain retailers to prevent price salience and the corresponding harm to their brand image.

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ENDNOTES

[1]Online sales are steadily increasing, amounting in 2020 to $4.3 trillion (18% of total retail spending) worldwide (see https://t1p.de/huvz and https://t1p.de/fhzw, both downloaded on Jul. 16, 2021).

[2]The report is available online at https://t1p.de/2zil (downloaded on Jan. 28, 2021).

[3]Upon investigation by the German Federal Cartel Office, *adidas* lifted the ban shortly after its implementation (https://t1p.de/jdni, downloaded on Jan. 28, 2021). Other examples include *Samsonite*'s ban on online sales (https://t1p.de/tlxm, downloaded on Jan. 28, 2021), dual pricing systems implemented by *Bosch* and *Gardena* (https://t1p.de/7eek, downloaded on Jan. 28, 2021), various restrictions on online sales of licensed merchandise by *Nike*, *Sanrio*, and *Universal Studios* (https://t1p.de/k09o, downloaded on Jan. 28, 2021), or resale price maintenance implemented by *Recticel Schlafkomfort* (https://t1p.de/qztx, downloaded on Jan. 28, 2021).

[4]See, for instance, https://t1p.de/hhp0 (downloaded on Jan. 28, 2021).

[5]Notably, our results only rely on offline consumers being aware of online prices, which is motivated by survey evidence suggesting that before offline shopping consumers often browse the respective goods online (see, e.g., the *Retail Dive Consumer Survey* available at https://t1p.de/d6mo, downloaded on Jan. 28, 2021).

[6]Our results generalize to the case of retailer-region-specific transportation cost: a consumer in area j incurs cost $t_{ij} > 0$ when buying at retailer i's brick-and-mortar store. Hence, our model in principle allows for competition being stronger among certain retailers (e.g., those located close to each other) than among others.

[7]Our qualitative welfare results are robust, however, to assuming (in the spirit of Bernheim & Rangel, 2007) that consumer surplus is determined by a convex combination of consumption and salience-weighted utility.

[8]While Harsanyi and Selten (1988) define their concept of risk-dominance only for two-player games with a binary action space, we adopt their intuition that the retail equilibrium in which retailers lose most in case of a (optimal) deviation are particularly stable. It turns out that in all relevant subgames the payoff-dominant retail equilibrium is also the one in which retailers have "most to lose," so that both criteria select the same equilibrium.

[9]Relatedly, Bodur et al. (2015) provide experimental support for the idea that prices seen on price comparison websites affect a consumer's willingness-to-pay at offline stores. Consistent with our mechanism, they find that less price dispersion on the comparison sites is associated with a higher willingness-to-pay in the offline environment.

[10]See, for instance, the *Retail Dive Consumer Survey* (https://t1p.de/d6mo, downloaded on Jan. 28, 2021).

[11]Following the IO literature on the role of salience effects (e.g., Apffelstaedt & Mechtenberg, 2021; Bordalo et al., 2016; Inderst & Obradovits, 2020a, 2020b, 2021a, 2021b), we further assume that the outside option of not buying the product is *not* included in the consideration set. It seems plausible to assume that a consumer perceives the posted prices at which the product is offered in a different way than the "zero price" associated with not buying the product. In this sense, the fictitious price of the outside option is unlikely to contribute to the salience of prices in the same way as posted prices of regular offers do. Going further, it is not even clear whether the outside option is perceived as having different attributes such as a "quality" and a "price." We are not aware of any experimental or empirical study indicating that the outside option affects salience.

[12]There are also shops that present products of very different qualities next to each other. These shops, however, often directly indicate the different target groups that should consider the respective product. Sportswear seller *Decathlon*, for instance, clearly indicates whether a running shoe is suitable for an amateur or a professional runner. This could be interpreted as a method to prevent professionals from actively considering the purchase of the cheap, amateur shoe, and vice versa. We thank an anonymous referee for suggesting this example.

[13]In particular with respect to hygiene or pharmaceutical products, manufacturers banned online sales on the grounds that some services (e.g., personal expert guidance or specific sale methods) cannot be replicated over the internet. In the prominent case of *Pierre Fabre*, the ECJ regarded this ban as an infringement by object of Article 101(1) TFEU, as the court did not agree on the importance of these services (Haucap & Stühmeier, 2016).

[14]Hunold and Muthers (2017) challenge the service argument in favor of RPM: in a classical model with two manufacturers that share common retailers RPM can actually result in lower service quality.

[15]Along these lines, a manufacturer might fear that online platforms (such as *Amazon Marketplace*) foster the supply of counterfeit products and competition from used items. Different from what we address in this paper, here brand image concerns do not originate from the price-setting behavior of trusted retailers, but from the qualities offered by unauthorized sellers. Going further, because there is no contractual relationship between manufacturers and unauthorized sellers, the manufacturer cannot interfere by implementing vertical restraints.

[16]Notably, in the landmark case of *Pierre Fabre*, the European Commission rejected an "exclusivity defense" for restraining online sales of status goods stating that "maintaining a prestigious image is not a legitimate aim for restricting competition" (see https://t1p.de/x0un, downloaded on Jan. 28, 2021).

[17]More generally, we contribute to growing literatures on the implications of context-dependent preferences (see also Chen & Turut, 2013; Helfrich & Herweg, 2020; Narasimhan & Turut, 2013; Zhu & Dukes, 2017), consumer (in)attention (Grubb, 2015; Heidhues et al., 2021, 2018), and in particular salience and focusing (e.g., Apffelstaedt & Mechtenberg, 2021; Bordalo et al., 2016; Dertwinkel-Kalt et al., 2019; Herweg et al., 2017; Inderst & Obradovits, 2020a, 2020b, 2021a, 2021b) for industrial organization.

[18]While asking a similar question, the approach taken in Helfrich and Herweg (2020) is fundamentally different from ours. Precisely, Helfrich and Herweg (2020) assume that the salience of a product's price does not depend on the *difference* in its on- and offline prices, thereby assuming away the kind of contrast effect that drives our results *and* that is at the heart of Bordalo et al.'s (2013) salience theory. When applying the original salience theory to their setup, some of their predictions flip, but it is unclear what exactly the equilibrium would look like.

[19]See https://t1p.de/vgei (downloaded on Jan. 28, 2021).

[20]See, for instance, https://t1p.de/sqy1 (downloaded on Jan. 28, 2021).

[21]For a formal definition of irrelevant subgames see Blume and Heidhues (2006).

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APPENDIX A: PROOFS

A.1 | Baseline equilibrium with rank-based salience distortions

In Proposition 1′, as stated below, we completely characterize the set of subgame-perfect equilibria with salient thinkers absent vertical restraints (under the selection assumption stated in Section 2). Proposition 1′ not only implies Proposition 1 stated in the main text, but will be extremely useful in interpreting the robustness checks analyzed in detail in the Online Appendix. We further prove Corollary 1, on the existence of a price salient equilibrium, in this subsection.

Proposition 1′ (Full characterization of the equilibrium with salient thinkers). *There exist threshold values* $0 < \alpha_S^{'} \leq \alpha_S^{''} < 1$, *such that the following three statements hold:*

(i) *Suppose the share of online consumers is small (i.e.,* $\alpha < \alpha_S^{'}$*). Then, in the unique subgame-perfect equilibrium all consumers are served efficiently, price is nonsalient, the manufacturer sets an inefficiently high quality* $q = q_{\text{ex}}^S(\alpha, \delta) > q^*$ *and a wholesale price*

$$w = w_{\text{ex}}^S(\alpha, \delta) := v\left(q_{\text{ex}}^S(\alpha, \delta)\right) \cdot \left(\frac{1 - \alpha\delta N}{1 - \alpha N}\right) - r \cdot \left(\frac{1 - \alpha}{1 - \alpha N}\right).$$

Moreover, on the path of play, each retailer i operates both distribution channels at retail prices $p_{i,k} = v\left(q_{\text{ex}}^S(\alpha, \delta)\right)$, $k \in \{\text{on}, \text{off}\}$, *and earns strictly positive profits.*

(ii) *Suppose the share of online consumers is at an intermediate level (i.e.,* $\alpha_S^{'} \leq \alpha < \alpha_S^{''}$*). Then, in any subgame-perfect equilibrium all consumers are served efficiently, price is salient, the manufacturer sets an inefficiently low quality* $q = q_{\text{ps}}^S(\delta) < q^*$ *and a wholesale price* $w = w_{\text{ps}}^S(\alpha, \delta) := \delta v\left(q_{\text{ps}}^S(\delta)\right) - r$. *Moreover, on the path of play, each retailer i operates her offline store at a retail price* $p_{i,\text{off}} = \delta v\left(q_{\text{ps}}^S(\delta)\right)$, *and at least two retailers offer the product also online at a retail price equal to cost* $w_{\text{ps}}^S(\alpha, \delta)$. *Retailers earn zero profits.*

(iii) *Suppose the share of online consumers is large (i.e.,* $\alpha \geq \alpha_S^{''}$*). Then, in any subgame-perfect equilibrium only online consumers are served, price is nonsalient, the manufacturer sets the efficient quality* $q = q^*$ *and a wholesale price* $w = w_{\text{on}}^S := v(q^*)$. *Moreover, on the path of play, at least one retailer offers the product online at a retail price equal to cost* w_{on}^S, *but no retailer offers the product in her offline store. Retailers earn zero profits.*

Proof. We solve the game backwards.

STAGE 2: Fix some quality level $q \in [\underline{q}, \bar{q}\,]$ and some wholesale price $w \geq 0$.

Roadmap for the second stage: In a first step, we analyze pure-strategy retail equilibria that are *symmetric* in the following sense: *if in equilibrium a strictly positive share of consumers buy the product via distribution channel* $k \in \{\text{on}, \text{off}\}$, *then each retailer i operates channel k and charges the same retail price,* $p_{i,k} = p_k$. Given this restriction, three types of retail equilibria with sales can exist; these are, retail equilibria in which (1) only online consumers are served (i.e., an *online retail equilibrium* or short on), or (2) all consumers are served efficiently and price is salient (i.e., a *price salient retail equilibrium* or short ps), or (3) all consumers are served efficiently and price is nonsalient (i.e., a *distortion-free retail equilibrium* or short df).

As online consumers have a weakly higher valuation of the product than offline consumers—namely, the same valuation for offline purchases and a strictly higher valuation for online purchases—we cannot have a symmetric retail equilibrium in which only offline consumers buy. Moreover, as online retail costs are lower than offline retail costs, there cannot exist a symmetric retail equilibrium in which all consumers are served offline. This holds both with and without salience effects, because in the case in which no consumer buys online while some consumers buy offline, retailer *i* could simply match the offline price in her online store, thereby making online consumers buy online without creating any (additional) price dispersion that could adversely affect profits from offline consumers. Note, however, that (4) symmetric retail equilibria without any sales (i.e., a *no-sales retail equilibrium*) can exist. But, as we discuss below, these no-sales retail equilibria do not affect the subgame-perfect equilibrium of our game.

We proceed as follows: For each type of symmetric retail equilibrium $l \in \{\text{on}, \text{ps}, \text{df}\}$, we determine the *maximal wholesale price* w_l^S, which is defined as the highest wholesale price under which retail equilibrium l can be sustained. Moreover, we determine the subgames in which a no-sales retail equilibrium exists. Notice that a full characterization of retail equilibria requires a large number of tedious case distinctions (particularly regarding online retail equilibria). For the sake of brevity, we focus on the relevant subgames, but a full proof is available upon request.

In a second step, we apply our equilibrium selection criterion to make sure that for any wholesale price w_l^S—or at least in an ϵ-neighborhood below w_l^S—a unique symmetric retail equilibrium in pure strategies exists. Afterwards, we argue that any selected retail equilibrium yields the same payoffs as one of the symmetric pure-strategy retail equilibria. Given this fact, the wholesale price w_l^S pins down the maximum profit the manufacturer can earn given retail equilibrium l and suffices to determine the subgame-perfect equilibrium of our game. Notably, when solving for the subgame-perfect equilibrium, we do not characterize retail equilibria in irrelevant subgames; that is, we neglect subgames which do not affect the incentives on the path of play.[21]

(1) *Online retail equilibrium.*

Without loss of generality, we only consider subgames with $w \le v(q)$. We further assume that retailers do not operate their offline stores, which implies that price is nonsalient in any symmetric online retail equilibrium. While in certain subgames there also exist online retail equilibria in which price is salient, these retail equilibria do not affect the subgame-perfect equilibrium of our game and are therefore omitted in the following analysis.

First, suppose $\delta v(q) < w \le v(q)$. In this case, any $p_{\text{on}} \in [w, v(q)]$ constitutes a symmetric retail equilibrium price. To see why, assume that all retailers charge $p_{i,\text{on}} = p_{\text{on}} \in [w, v(q)]$ and serve an equal share of online consumers. Obviously, charging a higher online price is not a profitable deviation, as in this case demand drops to zero. As charging a lower online price renders prices salient, any deviation implies that the consumers' willingness-to-pay falls below the wholesale price. Finally, retailer i cannot profitably deviate by serving consumers via her offline store since $w > v(q) - r$ (under the first part of Assumption 1). Hence, for any $w \in (\delta v(q), v(q)]$, there is a symmetric retail equilibrium with $C_i = \{\text{on}\}$ and $p_{i,\text{on}} = p_{\text{on}} \in [w, v(q)]$.

Second, suppose $v(q)(\delta N - 1)/(N - 1) \le w \le \delta v(q)$. In this case, any symmetric retail price $p_{\text{on}} \in [N \cdot (\delta v(q) - w) + w, v(q)] \cup \{w\}$ is an equilibrium price. Since $v(q)(\delta N - 1)/(N - 1) > v(q) - r$ (according to the first part of Assumption 1), the only potentially profitable deviation is charging a lower online price, and serving all online consumers (indeed, for $p_{\text{on}} = w$, even this is not profitable). Obviously, retailer i has an incentive to deviate from any symmetric price $p_{\text{on}} \in (w, \delta v(q)]$, since an arbitrarily small price cut allows her to serve all online consumers. Hence, consider only prices $p_{\text{on}} \in (\delta v(q), v(q)]$. For these symmetric online prices, retailer i has no incentive to deviate to a lower online price if and only if $\frac{\alpha}{N} \cdot (p_{\text{on}} - w) \ge \alpha \cdot (\delta v(q) - w)$, or, equivalently, $p_{\text{on}} \ge N \cdot (\delta v(q) - w) + w$. Hence, for any $w \in [v(q)(\delta N - 1)/(N - 1), \delta v(q)]$, there is a symmetric retail equilibrium with $C_i = \{\text{on}\}$ and $p_{i,\text{on}} = p_{\text{on}} \in [N \cdot (\delta v(q) - w) + w, v(q)] \cup \{w\}$.

Third, suppose $\delta v(q) - r \le w < v(q)(\delta N - 1)/(N - 1)$, which is a nonempty set of wholesale prices according to Assumption 1. In this case, the unique equilibrium candidate price is $p_{\text{on}} = w$. According to the previous step, we know that for wholesale prices $w < v(q)(\delta N - 1)/(N - 1)$ no online retail equilibrium with $p_{\text{on}} > w$ exists. In addition, since $w \ge \delta v(q) - r$, no profitable deviation from a symmetric price $p_{\text{on}} = w$ exists. Hence, for any $w \in [\delta v(q) - r, v(q)(\delta N - 1)/(N - 1))$, there is a symmetric retail equilibrium with $C_i = \{\text{on}\}$ and $p_{i,\text{on}} = w$.

Fourth, suppose $0 < w < \delta v(q) - r$. Again, using the same arguments as in the third step, we conclude that the unique equilibrium candidate price is $p_{\text{on}} = w$. Here, each retailer could profitably deviate by offering the product also offline (at a retail price of $\min\{\delta v(q), w + l\}$), so that no symmetric retail equilibrium with $C_i = \{\text{on}\}$ exists.

In conclusion, an online retail equilibrium exists if and only if $w \in [\delta v(q) - r, v(q)]$. Thus, the maximal wholesale price for this type of retail equilibrium is given by $w_{\text{on}}^S(q) := v(q)$.

(2) *Distortion-free retail equilibrium.*

Without loss of generality, we consider only subgames with $w \leq v(q) - r$. By definition, in a distortion-free retail equilibrium, given it exists, we have $C_i = \{\text{on, off}\}$ and $p_{i,\text{off}} = p^* = p_{i,\text{on}}$ for any retailer i. As retail costs are lower online than offline, this immediately implies that retailers earn positive profits. Thus, as retailers equally share the online market, a necessary condition for such a retail equilibrium to exist is $p^* > \delta v(q)$, as otherwise even a marginal price cut would yield a discrete increase in demand, so that each retailer could profitably deviate.

The remaining proof of this part proceeds in two steps: in Step 1, we consider only sufficiently small values of α and derive a necessary and sufficient condition for the existence of a retail equilibrium in which $C_i = \{\text{on, off}\}$ and $p_{i,\text{off}} = v(q) = p_{i,\text{on}}$ for any $i \in \{1, ..., N\}$. Precisely, we show that *for any* $\alpha \leq \tilde{\alpha}(q) := \frac{(1-\delta)v(q)}{(N-1)r}$ *there exists a critical wholesale price* $\tilde{w}(\alpha) \in [\delta v(q) - r, v(q) - r)$ *such that this type of retail equilibrium exists if* $\delta v(q) - r \leq w \leq \tilde{w}(\alpha)$. *Moreover, we show that for any* $\alpha \leq \tilde{\alpha}(q)$ *and any* $w > \tilde{w}(\alpha)$ *such a retail equilibrium does not exist*. In Step 2, we argue that *for any* $\alpha > \tilde{\alpha}(q)$ *a retail equilibrium in which* $C_i = \{\text{on, off}\}$ *and* $p_{i,\text{off}} = p^* = p_{i,\text{on}}$, $i \in \{1, ..., N\}$, *does not exist.*

Step 1: Let $\delta v(q) - r \leq w \leq v(q) - r$, which implies that the only deviation that could be optimal for retailer i is setting $C_i = \{\text{on}\}$ and $p_{i,\text{on}} = \delta v(q)$. Thereby, retailer i attracts all online consumers. Thus, given a wholesale price $\delta v(q) - r \leq w \leq v(q) - r$, serving all consumers efficiently at a symmetric retail price $p^* = v(q)$ is a retail equilibrium if and only if

$$\frac{1-\alpha}{N} \cdot [v(q) - r - w] + \frac{\alpha}{N} \cdot [v(q) - w] \geq \alpha \cdot [\delta v(q) - w], \tag{A1}$$

or, equivalently,

$$(1 - \alpha N) \cdot w \leq (1 - \alpha\delta N) \cdot v(q) - (1 - \alpha) \cdot r. \tag{A2}$$

It is easy to see that, due to Assumption 1, Inequality (A2) is violated for any $\alpha \geq \frac{1}{N}$. Hence, from now on, let $\alpha < \frac{1}{N}$. Then, Inequality (A2) is equivalent to

$$w \leq \frac{(1 - \alpha\delta N)v(q) - (1 - \alpha)r}{1 - \alpha N} =: w_{\text{df}}^S(q; \alpha, \delta). \tag{A3}$$

It remains to be verified that $w_{\text{df}}^S(q; \alpha, \delta) \in \left[\delta v(q) - r, v(q) - r\right)$. Here, the upper bound is slack due to the first part of Assumption 1. In contrast, the lower bound is met if and only if

$$\alpha \leq \frac{(1-\delta)v(q)}{(N-1)r} =: \tilde{\alpha}(q). \tag{A4}$$

Thus, for any $w \in [\delta v(q) - r, w_{\text{df}}^S(q; \alpha, \delta)]$, a symmetric retail equilibrium with $C_i = \{\text{on, off}\}$ and $p_{i,k} = v(q)$ exists if and only if $\alpha \leq \tilde{\alpha}(q)$, while for $w > w_{\text{df}}^S(q; \alpha, \delta)$ no such equilibrium exists.

Step 2: Suppose that the share of online consumers satisfies $\alpha > \tilde{\alpha}(q)$. It immediately follows from Step 1 that for wholesale prices $w > w_{\text{df}}^S(q; \alpha, \delta)$ no distortion-free retail equilibrium exists. As $\alpha > \tilde{\alpha}(q)$ gives $w_{\text{df}}^S(q; \alpha, \delta) < \delta v(q) - r$, it is sufficient to show that for any $\alpha > \tilde{\alpha}(q)$ and any wholesale price $w < \delta v(q) - r$ no distortion-free retail equilibrium exists.

Consider a candidate equilbrium in which $C_i = \{\text{on, off}\}$ and $p_{i,k} = p^* > \delta v(q)$ for any retailer $i \in \{1, ..., N\}$ and any channel $k \in \{\text{on, off}\}$. In the following, we consider the deviation of operating both channels at a uniformly lower price of $\delta v(q)$.

Since $p^* \leq v(q)$ and $w < \delta v(q) - r$, retailer i actually has an incentive to deviate if

$$\frac{1-\alpha}{N} \cdot [\delta v(q) - r - w] + \alpha \cdot [\delta v(q) - w] > \frac{1-\alpha}{N} \cdot [v(q) - r - w] + \frac{\alpha}{N} \cdot [v(q) - w],$$

which holds if and only if the wholesale price satisfies

$$w < \frac{v(q)[\alpha\delta(N-1)-(1-\delta)]}{\alpha(N-1)}.$$

It is straightforward to check that for any $\alpha > \tilde{\alpha}(q)$, the right-hand side of the preceding inequality exceeds $\delta v(q) - r$. Thus, if $\alpha > \tilde{\alpha}(q)$, retailer i has an incentive to deviate at any wholesale price $w < \delta v(q) - r$. Hence, for $\alpha > \tilde{\alpha}(q)$ there does not exist a symmetric retail equilibrium with $C_i = \{\text{on, off}\}$ and $p_{i,k} = p^*$, which completes the proof of the second step.

Altogether, a distortion-free retail equilibrium exists if and only if $\alpha \le \tilde{\alpha}$ and $w \le w_{\text{df}}^S(q;\alpha,\delta)$, where the maximal wholesale price, $w_{\text{df}}^S(q;\alpha,\delta)$, is defined in (A3).

(3) *Price salient retail equilibrium.*

As in equilibrium—given it exists—the product's price is salient, the wholesale price cannot exceed $\delta v(q) - r$; otherwise, the retailers could not profitably serve consumers via their brick-and-mortar stores. As the product's price is salient irrespective of whether retailer i deviates or not, standard arguments yield the unique symmetric equilibrium candidate prices

$$p_{\text{on}} = w \quad \text{and} \quad p_{\text{off}} = \min\left\{\delta v(q), w + r + t\cdot\left(\frac{N}{N-1}\right), w + l\right\}. \tag{A5}$$

If the product's price is salient anyhow and if the symmetric online price lies above cost, retailer i could marginally decrease both her online price and her offline price by the same amount, which discretely increases her demand, as now all online consumers buy via her online store, and at the same time ensures that the offline consumers located in area i still buy offline. Hence, whenever price is salient and $p_{\text{on}} > w$, a profitable deviation exists. In equilibrium, the symmetric offline price is chosen such that offline consumers buy at their local store—yielding retailers positive profits whenever $w < \delta v(q) - r$—given that competition drives down the online price to cost.

For these candidate prices, it is straightforward to see that charging neither a higher or lower online price nor a higher or lower offline price would increase retailer i's profit given that any other retailer j charges $p_{j,\text{on}} = p_{\text{on}}$ and $p_{j,\text{off}} = p_{\text{off}}$ as delineated in (A5). As a consequence, a price salient retail equilibrium exists if and only if $w \le \delta v(q) - r$ and the maximal wholesale price for this type of retail equilibrium is given by $w_{\text{ps}}^S := \delta v(q) - r$.

(4) *No-sales retail equilibrium.*

Without loss of generality, suppose that retailers operate only their online stores and charge a symmetric, deterministic online price that exceeds the consumers' maximum willingness-to-pay (i.e., $p_{i,\text{on}} = p_{\text{on}} > v(q)$). It is easy to check that retailers have no incentive to deviate if and only if $\delta v(q) \le w \le v(q)$. Hence, for any $w \in [\delta v(q), v(q)]$, a no-sales retail equilibrium exists.

Selection among symmetric pure-strategy retail equilibria.

We have derived the set of maximal wholesale prices $\left\{w_{\text{ps}}^S, w_{\text{df}}^S, w_{\text{on}}^S\right\}$. Now, we want to verify that our selection criterion yields a unique symmetric retail equilibrium in pure strategies for a wholesale price of $w = w_{\text{df}}^S$ as well as for any wholesale price that lies either in an ϵ-environment below w_{on}^S or in an ϵ-environment below w_{ps}^S. Remember that our selection criterion says that retailers choose the retail equilibrium that yields the highest retailer profits; in particular, for a given type of retail equilibrium the one with the highest feasible retail price.

First, we observe that for any wholesale price below w_{ps}^S—that is, also for a wholesale price of $w = w_{\text{df}}^S$ if $\alpha > \tilde{\alpha}(q)$—only a price salient retail equilibrium exists, so that we already have a unique symmetric retail equilibrium.

Second, we can show that *there exists some* $\epsilon > 0$ *such that for any* $w \in \left(w_{\text{on}}^S - \epsilon, w_{\text{on}}^S\right)$ *the unique retail equilibrium under selection is the online retail equilibrium with a retail price of* $v(q)$. We have seen above that there exists some $\epsilon' > 0$ such that for any $w \in \left(w_{\text{on}}^S - \epsilon', w_{\text{on}}^S\right)$ both an online and a no-sales retail equilibrium exist. Moreover, we know that there exists some $\epsilon'' > 0$ such that for any $w \in \left(w_{\text{on}}^S - \epsilon'', w_{\text{on}}^S\right)$ there is an online retail equilibrium in which retailers earn strictly positive profits. Combining these observations yields the claim, as retailers earn zero profits in any no-sales retail equilibrium. Finally, observe that for any $w \in \left(w_{\text{on}}^S - \epsilon'', w_{\text{on}}^S\right)$ and any retail equilibrium the highest deviation profit is always zero, which implies that retailers have the most to lose in the payoff-dominant retail equilibrium. Consequently, using risk-instead of payoff-dominance would not change the selected retail equilibrium.

Third, we will show that *for any* $\alpha \le \tilde{\alpha}$ *and* $w = w_{\text{df}}^S$ *the unique retail equilibrium under selection is a distortion-free retail equilibrium*. Note that, at a wholesale price of $w = w_{\text{df}}^S$, there exist both a distortion-free and an online retail equilibrium. As for any $\alpha \le \tilde{\alpha}$ we have $w_{\text{df}}^S < v(q) - r$, it follows immediately from our characterization of online retail equilibria that retailers earn zero profit in this type of retail equilibrium. As retailers earn positive profits in a distortion-free equilibrium, our selection criterion implies that for any $\alpha \le \tilde{\alpha}$ and $w = w_{\text{df}}^S$ retailers select the distortion-free retail equilibrium with the highest feasible retail price of $v(q)$. Finally, observe that the highest deviation profit given an online retail equilibrium is zero, while the highest deviation profit given a distortion-free retail equilibrium does not depend on the retail price. Hence, retailers have the most to lose in the payoff-dominant retail equilibrium, so that using risk-instead of payoff-dominance would not change the selected retail equilibrium.

Irrelevance of mixed-strategy and asymmetric pure-strategy retail equilibria.

As an illustration, we consider the subgame following a wholesale price of $w = w_{\text{df}}^S$, where among the symmetric retail equilibria the distortion-free retail equilibrium with a retail price of $v(q)$ is selected. We observe that in this subgame the retailers' equilibrium profits are necessarily maximized in this distortion-free retail equilibrium, as mixed strategies or asymmetric pure strategies—even if they can be supported as equilibrium strategies—imply price salience (at least) with positive probability and, in addition, *either* assign probability one to (weakly) lower prices without increasing demand *or* assign positive probability to prices that exceed $v(q)$, thereby inducing zero demand. Altogether, we conclude that neither a mixed-strategy retail equilibrium nor an asymmetric pure-strategy retail equilibrium can increase the retailers' profits relative to the distortion-free retail equilibrium with a retail price of $v(q)$. It is also easy to check that retailers still have the most to lose in the payoff-dominant retail equilibrium, so that applying risk-instead of payoff-dominance would not change the selected retail equilibrium.

The arguments for the other symmetric retail equilibria to be selected in the respective subgames go along the same lines, with one (irrelevant) exception: in these other subgames, it might be the case that an asymmetric retail equilibrium, in which all players earn the exact same payoffs as in the corresponding symmetric retail equilibrium (e.g., only a subset of retailers offer the product online at cost), is selected.

TABLE A1 Essentially unique retail equilibrium under selection

	$0 < \alpha \le \tilde{\alpha}$	$\tilde{\alpha} < \alpha < 1$
$w \in \left(w_{\text{ps}}^S - \epsilon, w_{\text{ps}}^S\right)$	$C_i = \{\text{on, off}\}$ and $p_{i,\text{off}} > p_{i,\text{on}}$	$C_i = \{\text{on, off}\}$ and $p_{i,\text{off}} > p_{i,\text{on}}$
$w = w_{\text{df}}^S$	$C_i = \{\text{on, off}\}$ and $p_{i,\text{off}} = p_{i,\text{on}} = v(q)$	$C_i = \{\text{on, off}\}$ and $p_{i,\text{off}} > p_{i,\text{on}}$
$w \in \left(w_{\text{on}}^S - \epsilon, w_{\text{on}}^S\right)$	$C_i = \{\text{on}\}$ and $p_{i,\text{on}} = v(q)$	$C_i = \{\text{on}\}$ and $p_{i,\text{on}} = v(q)$

Since this fact does not change the manufacturer's incentives to induce a certain type of retail equilibrium, it is without loss of generality to assume for the remaining analysis that also in these subgames the symmetric retail equilibrium is selected.

Summary of the Second Stage.

Table A1 summarizes the selected retail equilibria in the relevant subgames.

STAGE 1: $q = [\underline{q}, \bar{q}]$, *and we show that* the manufacturer charges $w = w_l^S$ if he wants to induce the retail equilibrium $l \in \{\text{on}, \text{df}, \text{ps}\}$. *Obviously, if the manufacturer wants to induce a distortion-free retail equilibrium, he charges a wholesale price* $w = w_{\text{df}}^S$. *Now consider the optimal way to induce an online retail equilibrium. For the sake of a contradiction, suppose that the manufacturer wants to induce such a retail equilibrium—i.e.,* $\alpha \cdot \left[w_{\text{on}}^S - c(q)\right] > \max\left\{w_{\text{ps}}^S - c(q), w_{\text{df}}^S - c(q)\right\}$*—and sets a wholesale price* $w < w_{\text{on}}^S$. *Then, as delineated in Table A1, there exists some* $\epsilon > 0$ *so that he can induce the retailers to sell the product only online by charging a wholesale price* $w \in \left(w_{\text{on}}^S - \epsilon, w_{\text{on}}^S\right)$. *Hence, the manufacturer can earn profits arbitrarily close to* $\alpha \cdot \left[w_{\text{on}}^S - c(q)\right]$, *so that our assumption toward a contradiction yields a profitable deviation; a contradiction. The argument for optimally inducing a price salient retail equilibrium follows the same lines. Finally, note that, with similar arguments as above, (i) consumers, who are indifferent between buying or not, indeed purchase the product in equilibrium, and (ii) offline (online) consumers, who are indifferent between buying in either channel, buy offline (online) in equilibrium.*

Second, we determine *the manufacturer's optimal quality choice for any potential retail equilibrium* $l \in \{\text{on}, \text{df}, \text{ps}\}$. The optimal quality level in the case of inducing either a price salient retail equilibrium or an online retail equilibrium is given by

$$q_l^S := \underset{q \in [\underline{q}, \bar{q}]}{\arg\max} \left[w_l^S(q) - c(q)\right] \quad \text{for } l \in \{\text{on}, \text{ps}\}, \tag{A6}$$

while in the case of inducing a distortion-free retail equilibrium the optimal quality level is given by the solution to the following constrained maximization problem

$$q_{\text{df}}^S := \underset{q \in [\underline{q}, \bar{q}] \text{ s.t. } \tilde{\alpha}(q) \geq \alpha}{\arg\max} \left[w_{\text{df}}^S(q) - c(q)\right]. \tag{A7}$$

Here, we make three immediate observations: First, *if the manufacturer induces a retail equilibrium in which all consumers are served and prices are nonsalient, he produces an excessive quality* (*i.e., a quality above* q^*). Since $\tilde{\alpha}'(q) > 0$, any solution to problem (A7) has to satisfy

$$\frac{\partial}{\partial q} w_{\text{df}}^S(q; \alpha, \delta) \leq c'(q) \quad \text{and} \quad \tilde{\alpha}(q) \geq \alpha \quad \text{and} \quad \left(\frac{\partial}{\partial q} w_{\text{df}}^S(q; \alpha, \delta) - c'(q)\right) \cdot (\alpha - \tilde{\alpha}(q)) = 0.$$

Again since $\tilde{\alpha}'(q) > 0$, the Inada conditions on the cost function ensure a unique solution also to the constrained problem in (A7). Now, because the cost function is convex, it is sufficient to verify

$$\frac{\partial}{\partial q} w_{\text{df}}^S(q; \alpha, \delta) = \left(\frac{1 - \alpha\delta N}{1 - \alpha N}\right) \cdot v'(q) > v'(q),$$

which holds for any $\delta \in (0, 1)$. As the manufacturer optimally distorts the product's quality upwards whenever he induces a distortion-free retail equilibrium, we denote this an *excessive branding (subgame-perfect) equilibrium*, and we relabel the provided quality as $q_{\text{ex}}^S := q_{\text{df}}^S$ and the corresponding wholesale price as $w_{\text{ex}}^S := w_{\text{df}}^S$.

Second, *if the manufacturer induces a retail equilibrium in which all consumers are served and prices are salient, he produces an insufficient quality* (*i.e., a quality below* q^*). Again, since the cost function is convex, the claim follows as $\frac{\partial}{\partial q} w_{\text{ps}}^S(q;\delta) = \delta v'(q) < v'(q)$ holds for $\delta \in (0,1)$.

Third, *if the manufacturer induces a retail equilibrium in which only online consumers are served, he produces the efficient quality level*. This follows immediately from $\frac{\partial}{\partial q} w_{\text{on}}^S(q) = v'(q)$.

Next, given the characterization of optimal quality, we show that *there exists some* $\alpha_S' \in \left(0, \tilde{\alpha}\right]$ *such that for any* $\alpha < \alpha_S'$ *the manufacturer induces the retailers to serve all consumers efficiently while keeping prices nonsalient*. By definition, for any $\alpha \le \tilde{\alpha}$, the manufacturer definitely wants to avoid a price-salient environment in case all consumers are served in equilibrium, as $w_{\text{ex}}^S(q;\alpha,\delta) \ge w_{\text{ps}}^S(q;\delta)$ for any $q \in [\underline{q}, \bar{q}\,]$. Anyway, given such a share of online consumers, the manufacturer could not even induce a price salient equilibrium at a wholesale price $w = w_{\text{ps}}^S(q;\delta)$ due to our selection criterion (see Table A1). Thus, for $\alpha \le \tilde{\alpha}$, the manufacturer induces a retail equilibrium in which all consumers are served efficiently and prices are nonsalient if and only if

$$w_{\text{ex}}^S\left(q_{\text{ex}}^S(\alpha,\delta);\alpha,\delta\right) - c\left(q_{\text{ex}}^S(\alpha,\delta)\right) > \alpha \cdot [v(q^*) - c(q^*)]. \tag{A8}$$

The left-hand side of the preceding inequality monotonically decreases in α as

$$\begin{aligned}\frac{\partial}{\partial \alpha}\left(w_{\text{ex}}^S\left(q_{\text{ex}}^S(\alpha,\delta);\alpha,\delta\right) - c\left(q_{\text{ex}}^S(\alpha,\delta)\right)\right) &= \frac{\partial}{\partial \alpha} w_{\text{ex}}^S(q;\alpha,\delta)\Big|_{q=q_{\text{ex}}^S(\alpha,\delta)} \\ &= \frac{(1-\delta)v\left(q_{\text{ex}}^S(\alpha,\delta)\right) - r}{(1-\alpha N)^2} \\ &< 0,\end{aligned}$$

where the first equality follows according to the Envelope Theorem, and the inequality by the first part of Assumption 1. In addition, we observe that the right-hand side of Inequality (A8) monotonically increases in α and approaches zero for $\alpha \to 0$. Hence, our claim follows from the fact that

$$\lim_{\alpha \to 0}\left[w_{\text{ex}}^S\left(q_{\text{ex}}^S(\alpha,\delta);\alpha,\delta\right) - c\left(q_{\text{ex}}^S(\alpha,\delta)\right)\right] = v(q^*) - c(q^*) > 0.$$

Finally, we show that *there exists some* $\alpha_S'' \in \left[\alpha_S', 1\right)$ *such that for any* $\alpha \ge \alpha_S''$ *the manufacturer induces the retailers to serve only the online consumers* (via the online channel). Since for α sufficiently large there does not exist a retail equilibrium in which all consumers are served efficiently and price is nonsalient, the claim follows from the observation that

$$\lim_{\alpha \to 1} \alpha \cdot [v(q^*) - c(q^*)] = v(q^*) - c(q^*) \ge \delta v\left(q_{\text{ps}}^S\right) - r - c\left(q_{\text{ps}}^S\right).$$

This completes the proof. □

Proof of Corollary 1. According to Proposition 1, a retail equilibrium in which all consumers are served efficiently, but price is nonsalient exists only if $\alpha \le \tilde{\alpha}$, where the threshold value $\tilde{\alpha}$—as defined in Equation (A4)—depends on the strength of the salience bias, δ. Specifically, $\tilde{\alpha}$ approaches zero for $\delta \to 1$, which in turn implies that also α_S' approaches zero for $\delta \to 1$. In addition, since $\lim_{\delta \to 1} w_{\text{ps}}^S(q;\delta) = v(q) - r$, we conclude that

$$\lim_{\delta \to 1}\left[w_{\text{ps}}^S\left(q_{\text{ps}}^S;\delta\right) - c\left(q_{\text{ps}}^S\right)\right] = v(q^*) - r - c(q^*) > \alpha \cdot [v(q^*) - c(q^*)]$$

holds if and only if

$$\alpha < \frac{v(q^*) - r - c(q^*)}{v(q^*) - c(q^*)} = \alpha_R.$$

Thus, as the threshold value α_R is bounded away from zero, we obtain

$$\lim_{\delta \to 1} \alpha_S''(\delta) = \alpha_R > 0 = \lim_{\delta \to 1} \alpha_S'(\delta),$$

which was to be proven. □

A.2 | Robustness to continuous salience weights

In this subsection, we provide a proof to Lemma 2 stated in Section 3.3 as well as an additional result on continuous salience weights (Lemma 3) referenced in the main text.

Proof of Lemma 2. First, since we assume $g'(0) > \frac{1}{v(\underline{q})}$, it has to hold that

$$\begin{aligned}\lim_{p \to v(q)} \frac{\partial}{\partial p}\left(\frac{v(q)}{g(v(q) - p)} - p\right) &= \lim_{p \to v(q)}\left(v(q) \cdot \frac{g'(v(q) - p)}{g(v(q) - p)^2} - 1\right)\\ &= v(q) \cdot g'(0) - 1\\ &> 0.\end{aligned}$$

Second, given $g(0) = 1$, it immediately follows that

$$\begin{aligned}\lim_{p \to 0}\left(\frac{v(q)}{g(v(q) - p)} - p\right) &= \frac{v(q)}{g(v(q))}\\ &> 0 = \lim_{p \to v(q)}\left(\frac{v(q)}{g(v(q) - p)} - p\right).\end{aligned}$$

Third, since $g(\cdot)$ is strictly increasing and concave, we obtain

$$\frac{\partial^2}{\partial p^2}\left(\frac{v(q)}{g(v(q) - p)} - p\right) = v(q)\frac{-g''(v(q) - p)g(v(q) - p)^2 + 2g'(v(q) - p)^2}{g(v(q) - p)^4} > 0.$$

Using the first and second observation and applying the Intermediate Value Theorem, we conclude that there exists some retail price $\hat{p}(q) \in (0, v(q))$ such that $\hat{p}(q) = \frac{v(q)}{g(v(q) - \hat{p}(q))}$. The second and third observations ensure uniqueness, as a convex function has at most two roots. Moreover, we immediately obtain $p > \frac{v(q)}{g(v(q) - p)}$ for any price $p > \hat{p}$ and $p < \frac{v(q)}{g(v(q) - p)}$ for any price $p < \hat{p}$. □

Lemma 3. *For any given quality $q \in [\underline{q}, \bar{q}]$, we have $\delta'(q) < 0$.*

Proof of Lemma 3. We start by proving the following result: □

Lemma 4. *For any $q \in [\underline{q}, \bar{q}]$, we have $\hat{p}'(q) < v'(q)$.*

Proof. Applying the Implicit Function Theorem to Equation (2) yields

$$\hat{p}'(q) = v'(q) \cdot \left(\frac{1 - g'(v(q) - \hat{p}(q))\hat{p}(q)}{g(v(q) - \hat{p}(q)) - g'(v(q) - \hat{p}(q))\hat{p}(q)} \right).$$

To prove the statement, we have to verify that the fraction on the right-hand side is strictly less than one. As $\hat{p}(q) < v(q)$, as $g(0) = 1$ and as $g(\cdot)$ is strictly increasing, we immediately conclude that the denominator is strictly larger than the numerator. Hence, it remains to show that the denominator is strictly positive.

For the sake of a contradiction, suppose the opposite; that is, let us assume that we have $g(v(q) - \hat{p}(q)) \leq g'(v(q) - \hat{p}(q))\hat{p}(q)$. Since $g(\cdot)$ is strictly increasing and concave, we have

$$\frac{\partial}{\partial p}(g(v(q) - p) - g'(v(q) - p)p) = -2 \cdot g'(v(q) - p) + g''(v(q) - p)p < 0 \tag{A9}$$

for any retail price $p \in (0, v(q))$, such that our assumption toward a contradiction implies that $g(v(q) - p) < g'(v(q) - p)p$ for any price $p \in (\hat{p}(q), v(q))$. Then, we obtain

$$\begin{aligned} 0 &= g(v(q) - v(q))v(q) - g(v(q) - \hat{p}(q))\hat{p}(q) \\ &= \int_{\hat{p}(q)}^{v(q)} g(v(q) - p)dp - \left(-[g(v(q) - p)p]_{\hat{p}(q)}^{v(q)} + \int_{\hat{p}(q)}^{v(q)} g(v(q) - p)dp \right) \\ &= \int_{\hat{p}(q)}^{v(q)} g(v(q) - p) - g'(v(q) - p)pdp < 0, \end{aligned}$$

where the first equality follows from (2), the last one by partial integration, and the inequality holds by the assumption toward a contradiction and (A9); a contradiction. □

Since $\delta'(q) = -\delta(q)^2 \cdot g'(v(q) - \hat{p}(q)) \cdot [v'(q) - \hat{p}'(q)]$, the claim follows from Lemma 4. □

A.3 | Vertical restraints on online sales

We provide proofs for our formal results on the use and welfare effects of a ban on online sales (Propositions 2 and 3). The proofs of the remaining propositions stated in Section 4 (on the use and welfare effects of RPM and dual pricing) are straightforward and therefore omitted.

Proof of Proposition 2. If the manufacturer bans online sales and charges a wholesale price in an ϵ-environment below the highest wholesale price that allows retailers to profitably serve consumers via their brick-and-mortar stores (i.e., $w = v(q) - r$), there is a unique retail equilibrium with $p_{i,\text{off}} = v(q)$ for any retailer $i \in \{1, \ldots, N\}$. Thus, by the same arguments as in the proof of Proposition 1, banning online sales and charging a wholesale price of $w = v(q) - r$, induces retailers to serve all consumers offline. Then, using the fact that the manufacturer's profits in an online equilibrium are not affected by salience, the claim follows from Lemma 1. □

Proof of Proposition 3. As the effect on consumer surplus is obvious, we only derive the effect on social welfare. Given a ban on online sales social welfare is equal to $SW_{ban} = v(q^*) - r - c(q^*)$. The remainder of the proof subsequently considers two cases: (i) $\alpha \in \left(0, \alpha_S''\right)$, and (ii) $\alpha \in \left[\alpha_S'', 1\right)$.

Case 1: Let $\alpha \in \left(0, \alpha_S''\right)$. Absent a ban, according to Proposition 1, all consumers are served an inefficient quality $q^S = q^S(\alpha, \delta) \neq q^*$ via their efficient distribution channel, so that equilibrium welfare is given by $SW_S = v(q^S) - (1 - \alpha)r - c(q^S)$. Define $\Delta_q(\alpha, \delta) := [v(q^*) - c(q^*)] - [v(q^S) - c(q^S)]$. Then, we obtain $SW_{ban} \geq SW_S$ if and only if $\Delta_q(\alpha, \delta) \geq \alpha \cdot r$.

We have to show that *there is some* $\bar{\delta} < 1$ *such that for any* $\delta > \bar{\delta}$ *a ban on online sales strictly decreases welfare; that is, we have to verify* $\Delta_q(\alpha, \delta) < \alpha r$ *for any* $\delta > \bar{\delta}$. We proceed in three steps: first, we show that *for any* $\alpha \in \left(0, \alpha_S''\right)$ *there is some* $\check{\delta}(\alpha) \in (0, 1)$ *so that for any* $\delta > \check{\delta}(\alpha)$ *a ban on online sales strictly decreases welfare*. Second, we argue that *there is some* $\underline{\alpha} > 0$ *such that for any* $\alpha < \underline{\alpha}$ *and any* δ *a ban on online sales strictly decreases welfare*. Third, we show that $\sup_{\alpha \in [\underline{\alpha}, \alpha_S'')} \check{\delta}(\alpha) = \max_{\alpha \in [\underline{\alpha}, \alpha_S'')} \check{\delta}(\alpha)$. Defining $\bar{\delta} := \max_{\alpha \in [\underline{\alpha}, \alpha_S'')} \check{\delta}(\alpha)$ completes the proof.

Fix some $\alpha \in \left(0, \alpha_S''\right]$. According to the proof of Proposition 1, it follows that $\frac{\partial}{\partial \delta} | q^* - q^S(\alpha, \delta)| < 0$. Then, since $q^S(\alpha, \delta)$ approaches q^* for $\delta \to 1$ and $\alpha \cdot r > 0$, there exists some $\check{\delta}(\alpha) \in (0, 1)$ such that for any $\delta > \check{\delta}(\alpha)$ we have $\Delta_q(\alpha, \delta) < \alpha \cdot r$. This completes the first step.

Next, we show that *there exists some* $\underline{\alpha} > 0$ *such that for any* $\alpha < \underline{\alpha}$ *and for any* δ *we have* $\Delta_q(\alpha, \delta) < \alpha \cdot r$. First, we observe that $\lim_{\alpha \to 0} \Delta_q(\alpha, \delta) - \alpha \cdot r = 0$. Now, by continuity, it is sufficient to verify that $\lim_{\alpha \to 0} [\frac{\partial}{\partial \alpha} \Delta_q(\alpha, \delta) - r] < 0$ holds. According to Proposition 1, for an α sufficiently close to zero, the manufacturer offers an excessive quality, $q_{\text{ex}}^S(\alpha, \delta)$, implicitly given by

$$\left(\frac{1 - \alpha\delta N}{1 - \alpha N}\right) \cdot v'\left(q_{\text{ex}}^S\right) = c'\left(q_{\text{ex}}^S\right). \tag{A10}$$

This identity follows from the fact that for a sufficiently small α the constraint in (A7) is slack. Hence, for an α sufficiently close to zero, we obtain

$$\frac{\partial}{\partial \alpha} \Delta_q(\alpha, \delta) = -\left(\frac{\partial}{\partial \alpha} q_{\text{ex}}^S(\alpha, \delta)\right)\left[v'\left(q_{\text{ex}}^S\right) - c'\left(q_{\text{ex}}^S\right)\right].$$

Using Equation (A10), we conclude that $q_{\text{ex}}^S(\alpha, \delta)$ approaches q^* for $\alpha \to 0$. By definition, we have $v'(q^*) - c'(q^*) = 0$, and applying the Implicit Function Theorem to (A10) yields

$$\lim_{\alpha \to 0} \frac{\partial}{\partial \alpha} q_{\text{ex}}^S(\alpha, \delta) = N(1 - \delta)\left(\frac{v'(q^*)}{v''(q^*) - c''(q^*)}\right) < \infty.$$

This implies that $\lim_{\alpha \to 0} [\frac{\partial}{\partial \alpha} \Delta_q(\alpha, \delta) - r] < 0$, which was to be proven.

It remains to be shown that $\sup_{\alpha \in [\underline{\alpha}, \alpha_S'')} \check{\delta}(\alpha) = \max_{\alpha \in [\underline{\alpha}, \alpha_S'')} \check{\delta}(\alpha)$. But this equality follows from the fact that for a sufficiently large δ and an α sufficiently close to α_S'' we have $q^S(\alpha, \delta) = q_{\text{ps}}^S(\delta)$.

Case 2: Let $\alpha \in \left[\alpha_S'', 1\right)$. Indeed, it is sufficient to verify that $\alpha_S'' < \alpha_R$. Recall that, according to Proposition 1, the manufacturer earns the same profit as in the case of rational consumers if only online consumers are served in equilibrium. If instead all consumers are served in equilibrium, the manufacturer earns strictly less than in the rational benchmark. Thus, it is straightforward to see that $\alpha_S'' < \alpha_R$ has to hold. Hence, for any $\alpha \in \left[\alpha_S'', 1\right)$, either all consumers are served offline (which is the case if online sales are banned), or only online consumers are served (which is the case if online sales are feasible), so that, according to Proposition 1, social welfare coincides with the manufacturer's profits. But then the claim follows immediately from Proposition 2. □