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“Extra bacon?” Context Effects in Purchases of Additional Items*

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Abstract

A common and seemingly innocuous practice involves offering optional extra items during the purchasing process. We study such a market with consumers whose preferences for the extra are sensitive to the context of the more expensive base product, making the extra offer appear more attractive than it actually is. The presence of context-sensitive consumers can soften competition in the market for the base product, making the base product more expensive than in a standard economy. This not only jeopardizes their own surplus but also creates a negative externality on the surplus of the other consumers who have standard preferences.

JEL *classification*: D40, D90, L10, L50

Keywords: Context effects, Relative Thinking, Salience, Extra items, Additional products and services

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1 Introduction

Selling extras is popular: airlines charge for optional services like extra legroom, hotels offer room upgrades at check-in, and new cars come with hundreds of options like park assist or heated mirrors. More recently, self-service kiosks have appeared in restaurants. Similar to ordering food and drinks on your phone, these kiosks offer a variety of extra items during the purchase process and have reportedly been successful in increasing sales.[1]

In this paper, we study such optional extras offered at the point of sale that all consumers can decline (at no cost). Empirically, this practice has been shown to be profitable for firms by generating excess demand for the extra item (Morwitz, Greenleaf, and Johnson, 1998; Rasch, Thöne, and Wenzel, 2020; Blake, Moshary, Sweeney, and Tadelis, 2021), often attributed to consumers' insensitivity to its price (Hossain and Morgan, 2006; Chetty, Looney, and Kroft, 2009).[2] Our model novelly combines the observation that purchase decisions are sensitive to the immediate environment with the common practice of offering optional extras to analyze firms' optimal pricing and the impact on consumer surplus.

To set the scene, consider a consumer who chooses a restaurant based on the price and taste of the differentiated main product—the main course. Upon ordering the meal at the chosen restaurant, the consumer is presented with additional options, such as extra bacon, additional sides, or size upgrades. In this situation, consumer preferences for the extra item may change because its price is considered in the context of the more expensive main course purchase: Spending a dollar on extra bacon arguably feels less significant if the price of the burger is \$15 rather than \$5. In the former case, many of us may perceive that opting for extra bacon won't put a dent in our wallets. In the latter case, the expense appears non-negligible, consistent with the notion that "\$50 will appear larger by itself than in the context of a much larger bill" (Thaler, 1999, p.193). As a result, some consumers may perceive the extra item as more attractive than it actually is, temporarily increasing their demand. Such context effects are well-known, and our model explains these consumer preferences with relative thinking, salience, diminishing sensitivity, and reference dependence (Thaler, 1980; Tversky and Kahneman, 1981; Bushong et al., 2021;

[1] For example, Taco Bell announced that the average digital order was 20 percent higher than traditional orders, due in large part to increased sales of additional items (Wong, 2015; Luna, 2023). McDonald's saw a 30 percent increase in the average order, and Chili's reported a 20 percent increase in dessert sales from tablet orders (Garber, 2014).

[2] See also Savage (1954); Thaler (1980); Tversky and Kahneman (1981); Bordalo, Gennaioli, and Shleifer (2012); Kőszegi and Szeidl (2013); Bushong, Rabin, and Schwartzstein (2021).

Somerville, 2022; Bordalo, Gennaioli, and Shleifer, 2022).

To preview the results, we find that the seemingly innocuous practice of offering optional extras during the ordering process can actually jeopardize consumer surplus—it can not only reduce the surplus of the context-dependent consumer who ends up buying the extra item, but more surprisingly, even harm the classical consumer whose preferences are not subject to context effects and who declines the additional offer. This is because the presence of context-dependent consumers can soften competition in the base good market: their demand for the extra item becomes a function of the price of the base good, which reduces the incentives for firms to compete on base good prices. This mechanism can make the base good more expensive than in a benchmark economy with classical consumers only. However, as the share of context-dependent consumers increases, the negative externality on classical consumers disappears and eventually reverses. Our analysis generates unexplored non-monotonic distributional effects among consumers and highlights the challenges of regulating such a market.

Our analysis builds on a model in which firms compete in prices with horizontally differentiated base products. Consumers first choose from which seller to purchase the base good. Consumers are then presented with the seller's offer for an optional extra product.[3] Hence, the seller enjoys monopoly power in the market for the extra item. Consumers can reject the extra at zero cost, and we focus on situations where the extra costs less than the base good.

Classical consumers coexist with context-dependent *behavioral consumers* in our economy. As sketched earlier, context-dependent preferences make the decision for the extra a function of the previous purchase of the base good: the price of the extra looms smaller in the context of a more expensive base good, leading to a temporary increase in demand for the extra item.[4] Faced with a heterogeneous consumer population, firms must decide on their pricing strategy. While they know the distribution of consumer types, they cannot identify an individual's type.

In equilibrium, firms price the extra product so that they make either classical or behavioral consumers indifferent. Firms either set a low extra item price to serve all consumers, or set a higher price that only behavioral consumers accept. Crucially, the

[3] This assumption of a sequential timing aligns with canonical models of add-on pricing (Diamond, 1971; Shapiro, 1994; Lal and Matutes, 1994; Ellison, 2005).

[4] Indeed, there is causal evidence that consumers are more likely to buy a queue-skipping voucher because the price of the ski pass was higher (Erat and Bhaskaran, 2012) and that they will put more effort into redeeming a $5 discount for a $25 radio than for a $500 TV (Thaler, 1980; Bushong et al., 2021; Somerville, 2022).

presence of behavioral consumers can also affect the base good price. The context-dependent preferences provide firms an incentive to make the base good more expensive: a higher base good price amplifies context effects and makes the behavioral consumer even less sensitive to the extra item price. This creates an endogenous price floor on the base good as firms have an incentive to make the base good more expensive. However, at the same time, a more expensive base good lowers demand in the primary market (and with it, also in the market for the extra item). This demand effect creates an incentive to decrease the base good price. Thus, firms face a trade-off between higher demand or further exploiting the effect of context-dependent preferences. Together with the share of behavioral consumers in the market, this trade-off determines the optimal base good price and resulting from this, the distributional effects between the two types of consumers.

If the share of behavioral consumers is small, firms do not adapt their pricing strategy and price as if all consumers were classical, yielding the same outcome as in the benchmark economy. Thus, few behavioral consumers do not affect the market outcome.

When the share of behavioral consumers is sufficiently large, firms' optimal strategy is to sell the extra item to only those consumers at a higher price. Whether this leads to a more expensive or cheaper base good in equilibrium than in the benchmark is governed by the previously mentioned trade-off.

For an intermediate share of behavioral consumers, the base good is more expensive in equilibrium compared to the benchmark. Despite the loss of demand, it is optimal for firms to raise the base good price. This increases the insensitivity of behavioral consumers to additional costs, allowing firms to increase prices of the extra item. Firms earn higher markups in the aftermarket, which overcompensates the loss of demand in both markets. In this case, classical consumers are worse off as they have to pay more for the base good than in the benchmark economy, and total consumer surplus is reduced.

For a large share of behavioral consumers, however, the demand effect dominates and pushes the base good price below the benchmark. While the extra is still sold only to behavioral consumers, it is now more profitable for firms to attract more consumers by reducing the base good price than increasing the markups on the extra item. Therefore, behavioral consumers subsidize classical consumers who benefit from a cheaper base good than in the benchmark economy.

Our non-monotonicity result holds as long as firms have some market power in the base good market. Thus, we obtain the same findings in a simpler setup with a monopolist in the base good market. Only perfectly identical products, and therefore perfect price competition in the base good market, provides complete protection for the classical consumer. Due to the competitive pressure, firms cannot increase the price of the base good and the mark-ups from the extra item market must be completely passed on to the base good. As a result, classical consumers are always weakly better off, benefiting from the cross-subsidization of behavioral consumers who purchase the overpriced extra items.

Our findings provide new insights for regulators and policymakers. Because the literature usually finds that the behavioral consumer subsidizes the classical consumer, the discussion has centered on whether to protect behavioral consumers from their own mistakes (for a review, see Heidhues and Kőszegi, 2018). Our results, however, raise the question of whether one should (attempt to) protect the perfectly acting classical consumer from the mistakes and biases of others. We consider several regulations aimed at protecting consumer surplus and find that the implementation is not trivial. Specifically, policy interventions may have unintended consequences, as they can either increase or decrease consumer surplus, depending on the pre-existing equilibrium in the economy. This makes it exceptionally challenging to predict the effects of policy measures in practice as well-intended regulations may cause even more harm. Our analysis underscores the complexity of regulating extra item markets with heterogeneous consumers.

We first analyze the implications of a price cap on the extra product, which was recently proposed by President Biden in the 2024 State of the Union speech (The White House, 2024).[5] The effect of such a policy is not straightforward. A binding price cap reduces the price for the extra item, and with it the profitability of selling to only behavioral consumers. This may prevent firms from choosing this strategy and the benchmark economy emerges due to the regulation, which makes behavioral consumers always better off. The effect on classical consumers, however, is ambiguous. Depending on the base good price in the ex-ante equilibrium, they are either better or worse off by the regulation. When both consumer types benefit, then a price cap clearly increases total consumer surplus. However, the price cap can also be insufficient and firms still sell the extra only to behavioral consumers. In this case, firms react by raising the price of the base good, and classical consumers are clearly worse off. For behavioral consumers, it depends on whether the effect of a cheaper extra item or a more expensive base good dominates.

Further, many governments enacted exogenous price floors on base goods to prevent

[5]For example, a $8 cap on credit card late fees was proposed (The White House, 2024).

loss leading, often also referred to as predatory pricing (Lal and Matutes, 1994).[6] This may harm both consumer types: a binding price floor makes the base good more expensive, and with it also the extra item due to context-dependent preferences. This clearly harms any consumer staying in the market.

The types of additional items we consider differ from those studied in Gabaix and Laibson (2006), leading to distinct results. In their model, base products feature a hidden price that some consumers ignore when purchasing, but have to pay once they consumed the base product, while other consumers can exert costly effort to substitute away. Examples include ATM fees, hotel service fees, or any other hidden feature of base products. Our type of additional item is an optional extra offered during the ordering process that can always be declined by all consumers (and at no cost), and thus, the setting we study cannot be accommodated by the model assumptions in Gabaix and Laibson (2006). Thus, our model of extra items yields different market outcomes regarding firms' optimal pricing, consumer surplus, and its distribution among consumer types.

Closely related is also Ellison (2005)'s model, in which consumers differ exogenously in their valuation of the add-on. Consumers with higher valuation are more likely to "unintentionally buy overpriced add-ons" (Ellison, 2005, p. 587). Consistent with this notion, we endogenize such heterogeneous preferences for the add-on, which leads to the distinct non-monotonic distributional effects between the two consumer types.

A more comprehensive overview of the related literature and how we differentiate is discussed in Section 7. Before that, Section 2 defines the model set-up. Section 3 provides the equilibrium analysis. Section 4 analyzes policy implications. Section 5 provides further results. All proofs, detailed derivations and microfoundations are presented in appendices.

2 The Model

We consider a market with products that feature add-on components. After purchasing a base product, the consumer is subsequently confronted with the offer for an ancillary product (or service). Consumers observe the add-on price only after the base good purchase. Formally, we suppose that two firms $j \in \{1, 2\}$ compete in prices with differentiated base goods, which are imperfect substitutes. Each firm offers a base good at price

[6] Loss leading is seen as anti-competitive due to asymmetric competition: larger rivals are thought of being able to push smaller firms out of the market.

$p_{1,j}$. There is a continuum of consumers. Firm j faces a weakly concave demand function $D_j(p_{1,j}, p_{1,-j})$, which is twice continuously differentiable, strictly decreasing in its own price and $\lim_{p_{1,j}\to\infty} D_j(\cdot) = 0$. We suppose that the base good demand is (i) supermodular, (ii) the own-price elasticity is stronger than the cross-price elasticity, and (iii) satisfies $\left|\frac{\partial D_j^2(\cdot)}{\partial p_{1,j}^2}\right| \geq \frac{\partial D_j^2(\cdot)}{\partial p_{1,j}\partial p_{1,-j}}$. The third assumption implies that the decrease (increase) of demand is higher when only one firm increases (decreases) prices than when both change prices.[7] To ease notation, we will suppress the firm index j when not necessary.

Once a consumer purchased the base good(s), firms offer one unit of an additional good (or service) per base good sold at price $p_{2,j}$. The add-on demand for firm j is thus bounded from above by $D_j(p_{1,j}, p_{1,-j})$. Consumers are locked-in in the aftermarket, which implies monopolistic power for firms. For simplicity, we suppose that add-ons are homogeneous across firms and marginal costs of production for both goods are zero.

We assume consumers' (perceived) utility from the add-on purchase is given by the function

$$U_i(v_2, p_2, \tilde{\Delta}), \text{ where } \tilde{\Delta} = \beta_i \Delta(p_1, p_2).$$

The utility function is strictly increasing in the add-on valuation v_2 and strictly decreasing in the price p_2, non-negative, weakly concave, and twice continuously differentiable.

The main feature of our model is the argument $\tilde{\Delta} = \beta_i \Delta(p_1, p_2)$ with $\beta_i \in [0, 1)$, which captures context effects. Some consumers may exhibit context-dependent preferences by considering the price of the add-on in the context of the price of the base good. We suppose that this positively affects the perceived utility (given that the base good is more expensive than the add-on), and that this positive effect increases in the range of the two prices. Formally, $\Delta(p_1, p_2) = 0$ for $p_1 = p_2$ with $\frac{\partial \Delta(p_1,p_2)}{\partial p_1} > 0$ and $\frac{\partial \Delta(p_1,p_2)}{\partial p_2} < 0$, where $\Delta(p_1, p_2)$ captures the (relative) difference in prices. Consequently, behavioral consumers with context-dependent preferences exhibit a perceived add-on utility that is strictly increasing in $\tilde{\Delta}$. In the following, we refer to $\tilde{\Delta}$ as the context effects affecting the perceived add-on utility. In Section 6, we show formally that we can apply our general framework with $\tilde{\Delta}$ to relative thinking, salience, proportional thinking, mental accounting, and anchoring & adjustment.[8] Our reduced-form approach allows us to

[7] For example, the linear demand function derived in Singh and Vives (1984) satisfies these assumptions. In Section 5.2, we show that our results also hold for unit demand à la Hotelling (1929). The assumptions (i)-(iii) are merely used for the traceability of asymmetric strategies and are not needed when focusing on symmetric equilibria only. In Section 3.7, we consider the simpler case of a monopolist, which yields similar results with much less structure on the demand function.

[8] We discuss in Section 7.2, why focusing (Kőszegi and Szeidl, 2013), another theory of context-dependent preferences, is not suitable in our setup.

accommodate this set of related behavioral theories in one model, which is also practical and convenient for empirical applications.

The parameter β_i determines whether a consumer exhibits context-dependent preferences and represents the strength of context effects. A $\beta_i = 0$ characterizes a classical consumer who is not subject to any context effects. They evaluate the add-on offer independent of the base good price. A $\beta_i > 0$ characterizes a behavioral consumer with context-dependent preferences, who has a larger perceived utility for the add-on than a classical consumer, given that $p_1 > p_2$. For the moment, we remain agnostic about whether the perceived utility of behavioral consumers is the true utility when consuming the add-on, that is whether context effects $\tilde{\Delta}$ generate utility or not. Our main results, Proposition 1 and 2, do not depend on such a specification.

To illustrate the predictions of context effects in add-on markets and to keep our model traceable, we assume that

$$U_i(v_2, p_2, \tilde{\Delta}) = W(v_2, \tilde{\Delta}) - p_2,$$

where the value function $W(v_2, \tilde{\Delta})$ captures all elements affecting the (perceived) add-on utility positively. We show in Section 6 that this specific utility function can be microfounded by any of the above-mentioned theories. Since classical consumers are not subject to context effects, we suppose $W(v_2, 0) = W(v_2)$. Further, we restrict our attention to the setting where the base good is more expensive than the add-on, such that $\Delta > 0$ in any equilibrium.[9]

We analyze an economy that potentially consists of both types, classical and behavioral consumers, i.e., $\beta_i \in \{0, \beta\}$ with $i = \{c, b\}$ and $\beta \in (0, 1]$. The share of behavioral consumers in the population is denoted with $\alpha \in [0, 1]$. Firms know the distribution of the types but cannot identify an individual's type. It follows that firms cannot price discriminate. The timing of the game is as follows:[10]

- Period 0: Firms choose the prices p_1 and p_2 simultaneously.

- Period 1: Demand for the base good realizes.

[9] We rule out the corner solution $p_1 = p_2$, which implies $\Delta = 0$ and thus, $W(v_2) = W(v_2, \tilde{\Delta})$. Therefore, we focus on interior solutions and consider only equilibria with $p_1 > p_2$.

[10] Sequential price setting of p_1 and p_2 does not change the results qualitatively. As we show in Section 3.2, firms choose p_1 given p_2 also in the simultaneous case. Thus, if it is profitable to change p_2 after selling the base good, then p_1 was not optimally chosen.

- Period 2: Each firm offers an add-on to its base good consumers. Consumers observe the add-on offer and either accept or reject it at zero costs.

We assume that the add-on does not affect consumer choice in the base good market. Consumers select a firm solely because of the surplus provided by the base good. This assumption aligns with traditional models of add-on pricing and is reasonable in many settings, as the literature points out (Shapiro, 1994). For example, the add-on price may be truly unobservable at the time of the base good purchase: while the headline price is advertised, firms may offer the add-on or reveal its price only after the (tentative) base good purchase, a practice known as drip pricing (Competition Market Authority, 2022; Rasch et al., 2020). Thus, add-on prices cannot be learned. Closely related, search costs to learn the add-on prices may simply be too high (Heidhues, Johnen, and Kőszegi, 2021). Firms may not need to commit to the add-on price ex-ante and consumers thus anticipate monopolistic prices (see Spiegler, 2006; Gamp, 2015; Spiegler, 2016). Consumer could also anticipate the add-on offer. In this case and in line with previous literature (Ellison, 2005; Gabaix and Laibson, 2006), we suppose that consumers form rational expectations about the add-on: since firms have monopolistic power in the aftermarket, consumers expect to obtain zero surplus from the add-on and thus, do not consider it in their decision problem. Moreover, similar to Apffelstaedt and Mechtenberg (2021), we suppose that preferences are context-sensitive only at the final point of sale but not affecting expectations.

3 Equilibrium Analysis

We solve the game for Nash equilibria in pure strategies.

3.1 Aftermarket

In period 2, after the purchase of the base good, consumers face the decision of whether to purchase an add-on at price p_2. Classical consumers ($\beta_c = 0$) buy the add-on when $W(v_2) \geq p_2$. Behavioral consumers ($\beta_b \in (0, 1]$) buy when $W(v_2, \tilde{\Delta}) \geq p_2$. Therefore, the demand for the add-on of firm j is given by

$$Q_j(p_{2,j}, D_j(p_{1,j}, p_{1,-j})) = \begin{cases} D_j(p_{1,j}, p_{1,-j}) & \text{if } p_{2,j} \leq W(v_2), \\ \alpha D_j(p_{1,j}, p_{1,-j}) & \text{if } W(v_2) < p_{2,j} \leq W(v_2, \tilde{\Delta}), \\ 0 & \text{if } p_{2,j} > W(v_2, \tilde{\Delta}). \end{cases}$$

Note that the add-on demand also depends indirectly on p_1, because only base good buyers proceed to the aftermarket and can purchase the add-on.

3.2 Firms' strategies

The profit function of firm j is given by

$$\pi_j(p_{1,j}, p_{1,-j}, p_{2,j}) = p_{1,j} D_j(p_{1,j}, p_{1,-j}) + p_{2,j} Q_j(p_{2,j}, D_j(\cdot)). \tag{1}$$

Since firms have monopolistic power in the aftermarket, they extract the entire rent and make either of the two consumer types indifferent. Two possible add-on prices emerge in equilibrium, implicitly defined by $p_2^* \in \{W(v_2), W(v_2, \tilde{\Delta})\}$.

If $p_2^* = W(v_2)$, firms do not exploit behavioral consumers' context-dependent preferences. All consumers accept the additional offer. We refer to this as the *non-exploiting strategy*. If $p_2^* = W(v_2, \tilde{\Delta})$, however, firms set a larger add-on price to exploit behavioral consumers. As a consequence, classical consumers do not accept the add-on offer anymore. We refer to this as the *exploiting strategy*.

Selecting one strategy determines $p_{2,j}$ and $Q_j(p_{2,j}, D_j(\cdot))$ in Expression (1). Given a chosen strategy, firm j maximizes its profits by choosing the base good price $p_{1,j}$, which yields the implicitly defined best response functions for any $p_{1,-j}$. Depending on the rival's actions, we obtain either (i) symmetric non-exploiting prices p_1^n and profits π^n, (ii) symmetric exploiting prices $p_1^e(\alpha)$ and profits π^e or (iii) an asymmetric outcome, where the non-exploiting firm sets $\tilde{p}_1^n(\alpha)$ and gets $\tilde{\pi}^n$, and the exploiting firm sets $\tilde{p}_1^e(\alpha)$ and receives $\tilde{\pi}^e$, where

$$\begin{aligned}
\pi^n &= \pi(p_1^n, p_1^n, W(v_2)) \\
\pi^e &= \pi(p_1^e(\alpha), p_1^e(\alpha), W(v_2, \tilde{\Delta})) \\
\tilde{\pi}^n &= \pi(\tilde{p}_1^n(\alpha), \tilde{p}_1^e(\alpha), W(v_2)) \\
\tilde{\pi}^e &= \pi(\tilde{p}_1^e(\alpha), \tilde{p}_1^n(\alpha), W(v_2, \tilde{\Delta})).
\end{aligned}$$

The full derivation of all prices and profits are characterized in Appendix A. Lemma A.1 in Appendix A.3 shows that the exploiting profits π^e and $\tilde{\pi}^e$ are strictly increasing in α. This is because behavioral consumers become more frequent when α increases, meaning firms can exploit more consumers in the add-on market. The symmetric non-exploiting profit π^n is independent of the share of behavioral consumers because firms price such that all consumers accept the add-on offer. The asymmetric non-exploiting profit $\tilde{\pi}^n$ is either increasing or decreasing in α. See Appendix A for details and explanation.

3.3 Equilibrium

The emerging equilibrium depends on the share of behavioral consumers α in the market. In the following, we provide the intuition, while the formal equilibrium derivation is provided in Appendix A.4.

When the share of behavioral consumers is low, then neither firm exploits and both set $p_1^* = p_1^n$, $p_2^* = W(v_2)$ in equilibrium. When behavioral consumers are frequent, then both firms exploit in equilibrium by choosing $p_1^* = p_1^e(\alpha)$, $p_2^* = W(v_2, \tilde{\Delta})$. For a wide range of α, the *symmetric non-exploiting equilibrium* and the *symmetric exploiting equilibrium*, respectively, are unique. Only for an intermediate share of behavioral consumers, multiple equilibria exist. Either the best response implies to do the same as the rival and both, the symmetric non-exploiting and symmetric exploiting equilibrium exist, or the best response is to do the opposite and multiple asymmetric equilibria arise.

The equilibrium structure is intuitive. In the add-on market, firms face a trade-off between a higher demand or a larger mark-up. When the share of behavioral consumers is low, the demand effect dominates. The income from selling a high-priced add-on to only a few behavioral consumers cannot compensate for the demand loss arising from classical consumers who decline the additional offer. Accordingly, firms do not exploit and sell the add-on to all consumers. When the share of behavioral consumers is large, both firms exploit behavioral consumers by setting $p_2^* = W(v_2, \tilde{\Delta})$. In this case, the demand loss from not serving classical consumers in the aftermarket is (over)compensated by the higher add-on mark-up because sufficiently many behavioral consumers are in the population.

3.4 The base good price

An important consequence of consumers with context-dependent preferences in the market is that it gives firms an incentive to increase the *base good price*. A more expensive base good increases the preference distortion of behavioral consumers, and with it, increases the perceived add-on utility. This allows firms to extract a higher mark-up in the add-on market, increasing the value of the aftermarket. Consequently, firms do not want to price the base good too low, creating an endogenous price floor. Yet, a higher base good price leads to lower demand in the base good market, which, in turn, implies lower demand in the add-on market. Hence, firms that exploit in the aftermarket face a trade-off when setting the optimal base good price $p_1^e(\alpha)$ or $\tilde{p}_1^e(\alpha)$, and consequently also $\tilde{p}_1^n(\alpha)$, since base good prices are strategic complements. This trade-off is captured by the relationship between the two semi-elasticities

$$\epsilon_D = \frac{-\partial D(\cdot)/\partial p_{1,j}}{D(\cdot)} \quad \text{and} \quad \epsilon_W = \frac{\partial W(v_2, \tilde{\Delta})/\partial p_{1,j}}{W(v_2, \tilde{\Delta})}.$$

The base good demand semi-elasticity, ϵ_D, denotes the demand effect of a price change in the base good market and, thus, the amount of consumers in the add-on market. The second semi-elasticity, ϵ_W, captures how strongly a change in the reference price p_1 affects the context effects $\tilde{\Delta}$ and with it the perceived add-on utility. Depending on which effect dominates, the optimal base good price is either a decreasing or increasing function in the share of behavioral consumers α.

When $\epsilon_D > \epsilon_W$, the demand effect is stronger and the optimal prices $p_1^e(\alpha)$, $\tilde{p}_1^e(\alpha)$ and $\tilde{p}_1^n(\alpha)$ are decreasing in α. In this case, it is profitable to attract and lock-in more consumers by lowering the base good price. In other words, the demand effect pushes down the endogenous price floor.

In contrast, when $\epsilon_D < \epsilon_W$, the optimal base good prices are increasing in the share of behavioral consumers. This is the case when the base good demand is relatively inelastic and a price change has little effect on the sold quantity of base goods. Then firms rather intensify the context effects by making the base good more expensive as α increases. We show in Lemma A.2 in Appendix A that the order of the semi-elasticities, ϵ_D and ϵ_W, is monotonic in α and thus, also the price functions.[11]

Crucially, this implies that the base good price in the symmetric exploiting equilibrium and asymmetric equilibrium depends on the share of behavioral consumers in the population. To analyze the effects of context-dependent consumers on the economy, we consider a benchmark economy consisting of classical consumers only ($\alpha = 0$). The benchmark base good price is given by p_1^{BM}. In equilibrium, firms sell the add-on to all consumers at $p_2 = W(v_2)$. Observe that a firm's maximization problem in the benchmark is identical to when a firm selects the non-exploiting strategy in our baseline model. Hence, the benchmark outcome is identical to the symmetric non-exploiting equilibrium, implying $p_1^{BM} = p_1^n$. We infer that in any symmetric non-exploiting equilibrium, firms price as if

[11] That is for specific functions $D(\cdot)$ and $W(\cdot)$, it is either $\epsilon_D \geq \epsilon_W$ for all α or $\epsilon_D \leq \epsilon_W$ for all α.

there were only classical consumers. Thus, a low share of behavioral consumers does not alter the market outcome or the surplus of classical consumers.

Whether the base good in a symmetric exploiting or asymmetric equilibrium is cheaper or more expensive than in the benchmark depends crucially on α and whether ϵ_D or ϵ_W is stronger. We define the implicit price threshold

$$\bar{\alpha}_p = \begin{cases} \dfrac{W(v_2)}{W(v_2,\tilde{\Delta}) + \dfrac{\frac{\partial W(v_2,\tilde{\Delta})}{\partial p_1} D(p_1^*, p_1^*)}{\frac{\partial D(p_1^*,p_1^*)}{\partial p_1}}}, & \text{for } \epsilon_D \neq \epsilon_W \\ \infty, & \text{for } \epsilon_D = \epsilon_W, \end{cases}$$

where $p_1^* \in \{p_1^n, p_1^e(\bar{\alpha}_p), \tilde{p}_1^n(\bar{\alpha}_p), \tilde{p}_1^e(\bar{\alpha}_p)\}$. When $\alpha = \bar{\alpha}_p$, then the base good costs the same in any equilibrium, $p_1^n = p_1^{BM} = p_1^e(\bar{\alpha}_p) = \tilde{p}_1^n(\bar{\alpha}_p) = \tilde{p}_1^e(\bar{\alpha}_p)$. Observe that, since $D(p_{1,j}, p_{1,-j})$ is decreasing in $p_{1,j}$, the denominator of $\bar{\alpha}_p$ is not necessarily positive, but depends on the relationship of the semi-elasticities. The price threshold $\bar{\alpha}_p$ is positive when $\epsilon_D > \epsilon_W$ and negative when $\epsilon_D < \epsilon_W$. Lemma 1 captures whether and when the base good is cheaper or more expensive than in the benchmark economy.

Lemma 1.

(i) Suppose $\epsilon_D > \epsilon_W$. If $\alpha \in (\min\{\bar{\alpha}, \hat{\alpha}\}, \bar{\alpha}_p)$, then the base good is more expensive in any symmetric exploiting or asymmetric equilibrium than in the benchmark. If $\alpha > \bar{\alpha}_p$, then the base good is cheaper in any symmetric exploiting equilibrium.

(ii) Suppose $\epsilon_D < \epsilon_W$. The base good is more expensive in any symmetric exploiting or asymmetric equilibrium than in the benchmark.

In the benchmark (and non-exploiting) case, firms redistribute all add-on earnings by lowering the base good price to attract more consumers. This does not occur when exploitation is optimal, which causes the endogenous price floor. For that reason, the base good can be more expensive than in the benchmark economy even when the demand effect dominates like in Lemma 1 (i), where prices are decreasing in α. When the share of behavioral consumers is sufficiently low ($\alpha < \bar{\alpha}_p$), then the endogenous price floor is still above the base good price in the benchmark, leading to a more expensive base good. Note that symmetric exploiting and asymmetric equilibria exist only when $\alpha > \min\{\bar{\alpha}, \hat{\alpha}\}$, where $\bar{\alpha}$ and $\hat{\alpha}$ are profit thresholds characterizing the equilibrium structure.[12]

[12] We define the profit thresholds $\bar{\alpha}$ and $\hat{\alpha}$ in Appendix A.4. They are necessary to formalize the equilibrium characterization.

When the share of behavioral consumers is large, $\alpha > \bar{\alpha}_p$, the demand effect pushes the endogenous price floor below the benchmark price and the base good is cheaper in any symmetric exploiting equilibrium.[13] In this case, firms rather exploit many behavioral consumers by a little than only some by a lot. For $\epsilon_D < \epsilon_W$, the price functions are increasing in α, and the price threshold $\bar{\alpha}_p$ is negative. Hence, for any share of behavioral consumers, the base good of an exploiting firm (and of the non-exploiting firm in the asymmetric case) is more expensive than in the benchmark economy.

3.5 The surplus of classical consumers

We turn now to the central part of our analysis and main result. Combining the results from Lemma 1 and the equilibrium characterization (Lemma A.3) identifies that the presence of behavioral consumers has non-monotonic effects on classical consumers. Importantly, when $\epsilon_D > \epsilon_W$, then the price threshold is always larger than the profit thresholds. That is $\bar{\alpha}_p > \max\{\bar{\alpha}, \hat{\alpha}\}$. Hence, there exists an interval in which α is such that a symmetric exploiting or an asymmetric equilibrium exists, and the base good price in these equilibria is larger than in the benchmark economy.[14] When $\epsilon_D < \epsilon_W$, then the base good is always more expensive in a symmetric exploiting or asymmetric equilibrium. Proposition 1 states the conditions when classical consumers benefit or are harmed by the presence of behavioral consumers.

Proposition 1 (The effect on the surplus of classical consumers)**.**

(a) Behavioral consumers do not affect the market in any symmetric non-exploiting equilibrium.

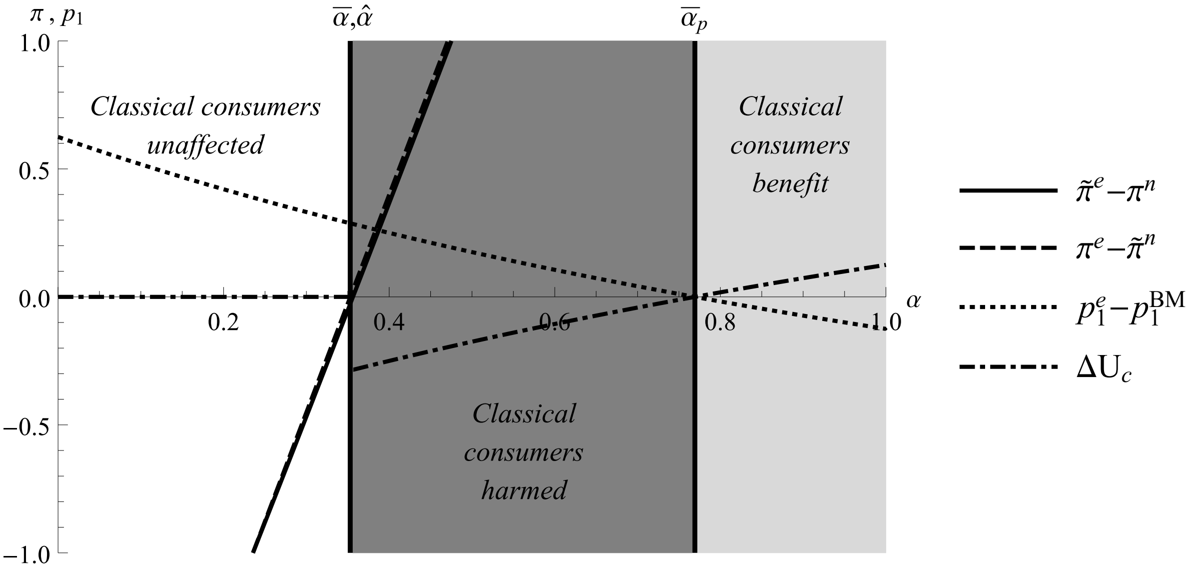
(b) Suppose $\epsilon_D > \epsilon_W$. Then the presence of behavioral consumers:
(i) harms classical consumers in any symmetric exploiting equilibrium if $\alpha < \bar{\alpha}_p$ and benefits them otherwise, (ii) harms classical consumers in any asymmetric equilibrium.

(c) Suppose $\epsilon_D < \epsilon_W$. Then the presence of behavioral consumers harms classical consumers in any symmetric exploiting or asymmetric equilibrium.

[13] Asymmetric equilibria do not exist when $\alpha > \bar{\alpha}_p$.

[14] When $\alpha > \max\{\bar{\alpha}, \hat{\alpha}\}$, then the unique symmetric exploiting equilibrium exists. When $\hat{\alpha} < \alpha < \bar{\alpha}$, then the asymmetric equilibria exist. When $\bar{\alpha} < \alpha < \hat{\alpha}$, then the multiple symmetric equilibria exist.

Figure 1: Proposition 1 (a) with symmetric prices.



Note: The figure depicts Proposition 1 (a) with $\epsilon_D > \epsilon_W$ and $\bar{\alpha} < \hat{\alpha}$, using $W(v_2, \tilde{\Delta}) = v_2\beta(1 + p_1 - p_2)$ with $\beta = 1$. The base good demand function is adopted from Singh and Vives (1984): $D_j(p_{1,j}, p_{1,-j}) = \frac{v_1}{1+d} - \frac{p_{1,j}}{1-d^2} + \frac{dp_{1,-j}}{1-d^2}$. The parameter specifications are $v_1 = 9$, $v_2 = 1$, $d = 0.4$ and marginal costs $c = 2.6$.
Notation: π^n, π^e: symmetric non-exploiting and exploiting profits;
$\tilde{\pi}^n, \tilde{\pi}^e$: profits in asymmetric outcomes;
p_1^e, p_1^{BM}: symmetric exploiting and benchmark economy prices;
$\hat{\alpha}$: profit threshold such that $\pi^n = \tilde{\pi}^e$; $\bar{\alpha}$: profit threshold such that $\tilde{\pi}^n = \pi^e$;
ΔU_c: classical consumer total surplus change.

When the share of behavioral consumers is low, such as in case (a), firms behave like in the benchmark economy. Thus, classical consumers are unaffected when only a few consumers are subject to context effects. This result is independent of the semi-elasticities.

Once there are sufficiently many behavioral consumers in the economy, however, they do change the market outcome. In this case, firms adopt the exploiting strategy and price the add-on beyond the valuation of classical consumers. If the base good demand is relatively elastic ($\epsilon_D > \epsilon_W$) such as in case (b), then for an intermediate share of behavioral consumers, $\alpha < \bar{\alpha}_p$, the base good is more expensive than in the benchmark economy. As a result, the presence of behavioral consumers harms classical consumers because they need to pay more for the base good, resulting in a lower surplus.[15] However, when the share of behavioral consumers is large enough that it surpasses the critical threshold $\alpha > \bar{\alpha}_p$, such as in case (ii), classical consumers are better off because then the base good is cheaper than in the benchmark economy. This non-monotonicity occurs because

[15]It is sufficient to look only at the base good price because the add-on surplus of classical consumers is zero in any case.

the optimal base good price is a decreasing function when the demand effect dominates ($\epsilon_D > \epsilon_W$), which pushes the endogenous price floor down. These three different outcomes of Proposition 1 (a) and (b) are depicted in Figure 1.

If the base good demand is relatively inelastic ($\epsilon_D < \epsilon_W$) like in case (c), classical consumers are always harmed when at least one firm exploits in equilibrium because the base good is more expensive than in the benchmark economy.

These findings imply that classical consumers, who behave perfectly in line with canonical economic theory, do not always benefit from the presence of behavioral or "naive" consumers in the market. In our model, classical consumers can be harmed because base good prices may go up. This has major implications for designing policies, which we will discuss in more detail in Section 4.

3.6 Total consumer surplus

So far, we focused on the surplus of classical consumers. We now consider total consumer surplus.

Proposition 2 (Consumer surplus)**.**

(a) Behavioral consumers are worse off when firms apply the exploiting strategy.

(b) The exploiting strategy strictly lowers total consumer surplus except when $\epsilon_D > \epsilon_W$ and $\alpha > \bar{\alpha}_p$. Then, the effect on total consumer surplus is ambiguous.

Behavioral consumers always prefer the non-exploiting outcome. This is because even in the case when the exploiting strategy leads to lower base good prices, the negative surplus consumed in the add-on market— due to their distorted context-dependent purchase decision—is larger than the positive surplus in the base good market. The result is independent of the welfare specification of behavioral consumers. That is whether context effects generate utility or not, which is convenient for empirical exercises and for policymakers as we show in Section 4. For a rather inelastic base good demand, $\epsilon_D < \epsilon_W$, or an intermediate share of behavioral consumers, $\epsilon_D > \epsilon_W$ and $\alpha < \bar{\alpha}_p$, both consumer types are worse off when at least one firm exploits in equilibrium. Hence, the total consumer surplus must be unambiguously lower in this case. When $\epsilon_D > \epsilon_W$ and $\alpha > \bar{\alpha}_p$, classical consumers benefit from the exploitation as they enjoy a cheaper base good. In this case, the impact on total consumer surplus depends on whether the positive effect on classical consumers or the negative effect on behavioral consumers dominates. To quantitatively pin down this effect, one would need to assume an explicit functional form of demand and preferences.

3.7 Monopoly and perfect competition

In this section, we discuss the outcomes of the two extreme cases of competition in the base good market, monopoly and perfect competition. We defer the formal analysis and results to Appendix C.1.

The findings in Proposition 1 and 2 are robust if a firm is a monopolist in the base good market. With only one firm, the analysis is identical to the case of imperfect competition, but we need to impose fewer assumptions on the demand function.[16] The findings are similar to the two-firm case, except that asymmetric equilibria do not exist. This result is not obvious since the cross-subsidization result usually vanishes with monopolistic competition in the existing literature (Heidhues and Kőszegi, 2018).

Perfect competition in the base good market, on the other hand, eliminates the harmful effect of behavioral consumers on the classical consumer. Yet, market outcomes may still be different than in the benchmark economy. Under perfect price competition, that is when base goods are perfect substitutes, the cross-subsidization from behavioral consumers to classical consumers survives. The intuitive reason is that due to competitive pressure, firms cannot increase the base good price above the benchmark level. Otherwise, firms would face zero demand. Thus, when firms exploit in equilibrium, the base good price must be strictly lower than in the benchmark economy, which benefits classical consumers' surplus. Hence, under perfect competition, all add-on revenues are redistributed to the base good market. Classical consumers can never be negatively affected by the presence of behavioral consumers, which resembles the findings of Gabaix and Laibson (2006).

3.8 Comparative statics

Next, we examine how a shock in the share of behavioral consumers affects the equilibrium outcome and consumer surplus. Various reasons could account for such a shock. For

[16] When base goods are perfectly differentiated, then each firm is a monopolist in its respective base good market. Compared to the imperfect competition case, we need much less structure on the base good demand function. We simply impose that $D(p_1)$ is strictly decreasing, twice continuously differentiable, $\lim_{p_1 \to \infty} D(p_1) = 0$ and satisfies $D(p_1)D''(p_1) < 2D'(p_1)^2$, which, for instance, holds for log-concave but also CES demand functions.

example, a new wave or generation of consumers may enter the market, behavioral consumers may learn over time and become classical consumers, or policymakers (or firms) have an instrument to affect the share of behavioral consumers directly. The impact on consumer surplus depends on how large the shock is and whether the base good price is an increasing or decreasing function in the share of behavioral consumers.

First, we define a *small* shock in α such that it does not change a firm's optimal strategy and the equilibrium outcome. A *large* shock, in contrast, changes firms' strategies, such that it makes an ex-ante (non-)exploiting suboptimal, and firms switch strategies. We focus our analysis on the case of symmetric exploitation in the ex-ante equilibrium, $\alpha_0 > \max\{\bar{\alpha}, \hat{\alpha}\}$.[17]

Proposition 3.

(a) Suppose $\epsilon_D > \epsilon_W$ and $\alpha_0 > \max\{\bar{\alpha}, \hat{\alpha}\}$.

(i) A small negative shock makes behavioral and classical consumers worse off.

(ii) A large negative shock benefits behavioral consumers. Classical consumers benefit when $\alpha_0 < \bar{\alpha}_p$. Otherwise, they are harmed.

(iii) Any positive shock benefits consumers.

(b) Suppose $\epsilon_D < \epsilon_W$ and at least one firm exploits ex-ante. Any negative shock benefits and any positive shock harms consumers.

In the case of $\epsilon_D > \epsilon_W$, the base good price $p_1^e(\alpha)$ is a decreasing function in α. Hence, after a small shock, firms still exploit ex-post, but base good prices are strictly higher than before, harming both consumer types. A large reduction leads firms to change their strategy and they do not exploit anymore ex-post. This benefits behavioral consumers by Proposition 2. The effect on classical consumers depends on the ex-ante equilibrium, that is, whether they benefited or were harmed by the presence of behavioral consumers ex-ante. Thus, fewer behavioral consumers in the market are not necessarily better for consumers. Since $p_1^e(\alpha)$ decreases in α, a positive shock implies a cheaper base good, and, in turn, also a cheaper add-on, which benefits both consumer types. Intuitively, since

[17] The effects in an ex-ante symmetric non-exploiting equilibrium are straightforward. A small shock has zero impact on consumer surplus as there are no price effects. A large positive shock leads to symmetric exploitation, which is harmful to behavioral consumers by Proposition 2. Classical consumers are harmed by a large positive shock except when $\epsilon_D > \epsilon_W$ and $\alpha' > \bar{\alpha}_p$, where α' denotes the share ex-post.

more behavioral consumers are in the market, each individual is exploited less. Firms rather exploit many behavioral consumers by a little than only some by a lot.

In the case of $\epsilon_D < \epsilon_W$, the base good price increases in α. Hence, any reduction in the share of behavioral consumers leads to lower prices, while any increase in α causes more expensive products.

4 Policy Implications

We apply our main results stated in Proposition 1 and 2, and analyze how different policies affect consumer welfare. First, we consider a price cap on the add-on, limiting the amount a firm can earn from exploitation in the aftermarket. Second, we analyze the effect of a price floor regulation on the base good, which is a common tool used by policymakers to prevent loss-leading and predatory pricing.

4.1 Add-on price cap

In his 2023 State of the Union speech, Biden called for a \$8 cap on credit card late fees (The White House, 2023), with the intention of extending such a policy to other additional services and goods commonly offered by firms. A price cap tackles the revenue firms can make from exploitation in the add-on market and thus, the profitability of this strategy.

Suppose that the share of behavioral consumers is sufficiently large ($\alpha > \max\{\bar{\alpha}, \hat{\alpha}\}$) such that the unique symmetric exploiting equilibrium exists prior to the regulation. In this case, the add-on price is given by $W(v_2, \tilde{\Delta})$. Consider a price cap

$$\bar{p}_2 \in (W(v_2), W(v_2, \tilde{\Delta})),$$

which affects the symmetric exploiting equilibrium but not the symmetric non-exploiting outcome (or benchmark economy). To characterize the policy impact, we need to distinguish between effective and ineffective regulations. An *effective* policy limits the add-on revenue from exploitation sufficiently strong such that it is not optimal anymore after the intervention. Hence, the measure results in the unique symmetric non-exploiting equilibrium. In contrast, a policy is *ineffective*, when the price cap is too soft such that both firms still exploit in equilibrium.

Definition 1.

(i) An effective policy induces the symmetric non-exploiting equilibrium ex-post.

(ii) An ineffective policy does not affect the equilibrium structure ex-post.

Whether a policy is effective and prevents the exploitation of behavioral consumers has a crucial impact on the surplus of consumers. When a firm still exploits ex-post, then it sets a base good price $\bar{p}_1^e$. Further, let us suppose that context effects do not generate utility, and behavioral consumers obtain $W(v_2)$ when consuming the add-on. This affects only the findings in Proposition 4 (b) when the policy is inefficient. The result for an efficient regulation is independent of this welfare specification.

Proposition 4 (Add-on price cap)**.**

(a) The add-on price cap reduces the region of exploitation, but makes the base good more expensive under exploitation.

(b) Any ineffective price cap harms classical consumers. Behavioral consumers benefit if $W(v_2, \tilde{\Delta}) - \bar{p}_2 > \bar{p}_1^e - p_1^e(\alpha)$. Otherwise, they are harmed.

(c) Any effective price cap benefits behavioral consumers. Classical consumers are better off except when $\epsilon_D > \epsilon_W$ and $\alpha > \bar{\alpha}_p$.

The price cap distorts the profits under exploitation $(\pi^e, \tilde{\pi}^e)$, but not the non-exploiting profits $(\pi^n, \tilde{\pi}^n)$. Hence, both profit thresholds $(\bar{\alpha}, \hat{\alpha})$ increase, making it harder to sustain exploitation as a larger share of behavioral consumers is required. Simultaneously, the price threshold $(\bar{\alpha}_p)$ increases as well. Graphically, the vertical lines in Figure 1 move to the right. In particular, it increases the white region of the symmetric non-exploiting equilibrium.

Further, firms that still exploit after the regulation, compensate the add-on price cap by increasing the price for the base good, $\bar{p}_1^e > p_1^e(\alpha)$. For this reason, classical consumers are worse off by any inefficient policy. Even if the base good is cheaper than in the benchmark economy ex-post $(\bar{p}_1^e < p_1^{BM})$, it is still more expensive than in the ex-ante exploiting equilibrium. This is also true for behavioral consumers, but they benefit from a lower add-on price. Depending on which price effect dominates, behavioral consumers can be better off by an inefficient regulation.

In the case of an efficient policy, no firm exploits ex-post. By Proposition 2, this is always better for behavioral consumers. For classical consumers, it depends on whether they enjoyed cross-subsidization or not before the regulation. Overall, a cap on the add-on price has the potential to improve total consumer surplus. But, in particular when inefficient, it may harm all consumers in the market.

4.2 Price floor

Loss-leading is a controversial practice that raises concerns over anti-competitive effects. For that reason, predatory pricing is banned in many US States and some European countries.[18] Policymakers impose a price floor on goods by prohibiting pricing below costs with the aim of protecting consumers. The literature finds mixed results on the effectiveness of this policy (e.g., Chen and Rey, 2012; Johnson, 2017). In our model, a binding price floor yields negative effects for most consumers, while it is ambiguous whether consumers who could benefit really do so.

We first focus on a price floor on the base good that does not affect the benchmark economy but potentially the symmetric exploiting equilibrium, $\underline{p}_1 \leq p_1^{BM}$. This price floor is only binding when the base good is cheaper than in the benchmark economy, which requires $\epsilon_D > \epsilon_W$ and a large share of behavioral consumers, $\alpha > \bar{\alpha}_p$.[19] In this case, firms want to set a low base good price to attract more behavioral consumers who are willing to buy the overpriced add-on and, thus, can be exploited.

Proposition 5 (Price floor)**.**

(a) A price floor $\underline{p}_1 \leq p_1^{BM}$ does not prevent exploitation.

(b) A binding price floor $\underline{p}_1 \leq p_1^{BM}$ (i) increases the add-on price and (ii) reduces the base good demand. Classical and remaining behavioral consumers in the market are strictly worse off by a binding regulation. The effect on behavioral consumers who left the market is ambiguous.

(c) Any price floor affecting the benchmark economy, $\underline{p}_1 > p_1^{BM}$ facilitates exploitation.

Although profits under symmetric exploitation decrease when a price floor $\underline{p}_1 \leq p_1^{BM}$ binds, exploiting is still optimal. Since the perceived utility of behavioral consumers increases because of the price floor, firms can absorb some of the profit distortions by

[18] See for example `https://www.aeaweb.org/research/loss-leading-bans-retail-competition`.

[19] When $\epsilon_D < \epsilon_W$, the base good price in an exploiting equilibrium is always larger than in the benchmark and a price floor is never binding. Further, when an asymmetric equilibrium exists, then the base good must be more expensive than in the benchmark equilibrium.

increasing the add-on price. This is because an exploiting firm sets $p_2 = W(v_2, \tilde{\Delta})$ and $W(v_2, \tilde{\Delta})$ is strictly increasing in p_1. Further, because firms must offer the base good at a higher price than in equilibrium, the demand for the base good declines. This clearly harms consumers that remain in the market as the prices for both goods increase. Additionally, classical consumers who drop out of the market are worse off. Without a price floor, they would buy the base good and obtain a positive surplus. The only potential positive effect is that some behavioral consumers leave the market and do not buy the overpriced add-on. But, similar to classical consumers, they also lose a positive surplus from the base good. Thus, the overall effect is ambiguous.

Lastly, a price floor affecting the benchmark economy, $\underline{p}_1 > p_1^{BM}$, lowers non-exploiting profits more than exploiting profits. Thus, a lower share of behavioral consumers is required for exploitation to be profitable. Therefore, regulators should be careful with prohibiting predatory pricing in markets, which are likely to have behavioral consumers.

5 Further Results

Our setting comes with some modeling choices, which can be relaxed without affecting the results. First, our results are unchanged if we allow for imperfect competition in the aftermarket. Further, some models in the add-on literature use unit demand for the base good. We choose a general downward-sloping demand function because it allows us to display the crucial trade-off firms face more elegantly and intuitively. The main results are qualitatively unchanged in a model with unit demand. Thus, our new findings do not simply arise because of the different demand structures from other models. The formal analyses are in Appendix C.

5.1 After-sales competition

We relax the lock-in assumption and allow for competition in the after-sales market. We suppose the same setup as in the baseline model, but a fraction $\rho \in (0, 1)$ of base good buyers search for the cheapest add-on, while the fraction $(1 - \rho)$ stays loyal and purchases the add-on from the same company. The analysis and equilibrium characterization is similar to the baseline model except that firms mix over the choice of add-on prices. However, this does not affect the outcome qualitatively. Thus, if some consumers search for the cheapest add-on, our results are unchanged and our central finding of non-monotonic effects on classical consumer surplus does not rely on the lock-in assumption. The detailed analysis is provided in Appendix C.5.

5.2 Unit demand

We apply our framework to a model with unit demand in the base good market and horizontal differentiation, which is commonly used in the literature (e.g., Ellison, 2005; Gabaix and Laibson, 2006; Armstrong and Vickers, 2012; Heidhues and Kőszegi, 2017). The full analysis is provided in Appendix C.6.

We find similar results as in the baseline model with imperfect competition. We show that the equilibrium is alike as characterized in Lemma A.3 and the optimal base good price p_1 behaves similarly to Lemma 1. Crucially, the main findings stated in Proposition 1 and 2 hold and are not affected by the different demand structure. When firms exploit behavioral consumers, this can benefit or harm classical consumers.

6 Microfoundations

In this section, we discuss several mechanisms that can microfound the context-dependent preferences of behavioral consumers, captured in our reduced-form model through the function $W(v_2, \tilde{\Delta})$.

Relative thinking. Relative thinking has been shown to be an important determinant in individual decision-making (Thaler, 1980; Jacowitz and Kahneman, 1995). In Bushong et al. (2021), 48% of participants are willing to accept a 30-minute drive to save \$25 for a \$1000 laptop, while 73% of participants are willing to do so to save the same monetary amount when shopping for \$100 headphones. Somerville (2022) experimentally shows that more than two-thirds of the participants are better characterized as relative thinkers than as standard utility maximizers.

In Bushong et al. (2021), consumers put a relative weight $w(\Delta_k)$ on each consumption dimension $k = v, p$; where $\Delta_k = \max k_s - \min k_s$ for $s = 1, 2$ and $w(\Delta_k)$ is a differentiable and decreasing function on $(0, \infty)$. Adapting the model to our setting, the behavioral consumer is a relative thinker regarding the price dimension. To focus on this channel, we set $w(\Delta_v) = 1$.[20] Relative thinkers put the relative weight $w(\Delta_p)$ on the add-on price, which, given that $p_1 > p_2$, decreases if the price range expands. Hence, when the base good is more expensive than the add-on, an increase in $\Delta_p = p_1 - p_2$ lowers the weight $w(\Delta_p)$ on the add-on price, and the negative effect of the price on the perceived utility is lower. Thus, the relative thinking model of Bushong et al. (2021) satisfies our assumptions on $U_i(v_2, p_2, \tilde{\Delta})$ when $w(\Delta_p)$ is weakly concave.[21]

The non-negative assumptions implies $U_i(v_2, p_2, \tilde{\Delta}) \geq 0$ and suppose $U_i(v_2, p_2, \tilde{\Delta}) = v_2 - w(\Delta_p)p_2$. Rearranging leads to $\frac{v_2}{w(\Delta_p)} - p_2 = W(v_2, \tilde{\Delta}) - p_2$. Observe that $\frac{\partial W(v_2,\tilde{\Delta})}{\partial p_1} > 0$ and $\frac{\partial^2 W(v_2,\tilde{\Delta})}{\partial p_1^2} < 0$ when $p_1 > p_2$, since $w(\Delta_p)$ is decreasing in p_1, and $\frac{\partial W(v_2,\tilde{\Delta})}{\partial v_2} > 0$ and $\frac{\partial^2 W(v_2,\tilde{\Delta})}{\partial v_2^2} = 0$. Hence, our assumptions on $U_i(v_2, p_2, \tilde{\Delta}) = W(v_2, \tilde{\Delta}) - p_2 = v_2 - w(\Delta_p)p_2$ are satisfied.

Somerville (2022) provides a similar function: $U_i(v_2, p_2, \tilde{\Delta}) = g(\Delta_v; y)v_2 - g(\Delta_p; y)p_2$, where $g(\Delta_k, y)$ is the weighting function, which is strictly increasing in Δ_k and y is a parameter governing context effects. For relative thinking, he employs $g(\Delta_k, y) = (\Delta_k)^y$, where $y \in (-1, \infty)$. Setting $g(\Delta_v; y) = 1$ and performing similar steps to before, $W(v_2, \tilde{\Delta}) = \frac{v_2}{(\Delta_p)^y}$ satisfies our assumption on consumer behavior.[22]

Closely related is proportional thinking (Thaler, 1980; Tversky and Kahneman, 1981).[23] Several vignette studies show that people are willing to exert more effort to save a fixed amount on a cheap product than on an expensive product because the relative saving is larger (see also the replications by Mowen and Mowen, 1986; Frisch, 1993; Ranyard and Abdel-Nabi, 1993). Azar (2011a) shows that consumers are willing to pay more for the same constant improvement in quality when the good's price is higher and Blake et al. (2021) document a lower proportional price boosts add-on sales. We suggest formalizing proportional thinking in a similar fashion to relative thinking but without the

[20] As Bushong et al. (2021) note, models with context-dependent preferences must have a conception of what the dimensions are and how consumers treat them. We assume that consumers treat money as one dimension for all products, but quality (or valuation) as a distinct dimension for each of the two separate products. Thus, we suppose that context effects happen only in the money dimension as prices are directly observable and readily comparable, while the different anticipated consumption utilities may not be straight forward to relate.

[21] Concavity in $w(\Delta_p)$ is needed for tractability of our reduced-form model. Bushong et al. (2021) provide the parameterized example of $w(\Delta_p) = (1 - \rho) + \frac{\rho}{\Delta_p + \xi}$ where $\rho \in [0, 1)$ and $\xi \in (0, \infty)$, which is concave in Δ_p.

[22] Azar (2007) also provides a model of add-on pricing in which all consumers are relative thinkers. Thus, distributional effects among the (homogeneous) consumers are impossible. Our reduced-form function can also accommodate his specification of relative thinking.

[23] "An old selling trick is to quote a low price for a stripped-down model and then coax the consumer into a more expensive version in a series of increments each of which seems small relative to the entire purchase" (Thaler, 1980, p. 51).

range-dependent aspect: $U_i(v_2, p_2, \tilde{\Delta}) = v_2 - \frac{p_2}{p_1}$.

Salience. Consumers may devote more attention to product attributes that are more salient. For example, it is documented that consumers underreact to taxes when those are not salient (Chetty et al., 2009; Feldman and Ruffle, 2015; Taubinsky and Rees-Jones, 2018). Also, when prices become less salient, demand substantially increases (Finkelstein, 2009; Sexton, 2015). In a large field experiment on StubHub.com, Blake et al. (2021) show that drip pricing strategies increase demand due to the additional fee appearing less salient for consumers (see also Brown, Hossain, and Morgan, 2010; Hossain and Morgan, 2006; Dertwinkel-Kalt, Köster, and Sutter, 2020).

Bordalo et al. (2022) formalize salience theory. In their model, the surplus function for behavioral consumers is $\hat{V} = \sum_k w_k \pi_k a_k$ for a good with k attributes, where w_k is the weighting function capturing bottom-up attention to salient attributes, π_k is the decision weight attached to attribute k, and a_k denotes the attribute's value (see also Bordalo et al., 2012; Bordalo, Gennaioli, and Shleifer, 2013, 2020). In our case, four attributes exist, $k = \{p_1, p_2, v_1, v_2\}$. We suppose that salience happens through contrast effects, namely between the prices of the base good and add-on. To accommodate our model, salient thinking does not affect the attention weight to quality, $w_{v_1} = w_{v_2} = 1$. This deviates from the traditional theory, which typically considers the purchase between two substitutes when either a product's quality or price is salient. Thus, we encourage future research to study how salience on quality affects add-on selling. In our setup, it is the choice of buying the add-on or not, given the (tentative) purchase of the base good. We suppose that a more expensive base good captures the attention of consumers, who then underweight the add-on's price.[24] For the ease of exposition, we assume $\pi_{v_2} = 1$ and $\pi_{p_2} = -1$.

Contrast between the prices is measured by the salience function $\sigma(a_k, \bar{p}) = \frac{|a_k - \bar{p}|}{|a_k + \bar{p}|}$, where $a_k \in \{p_1, p_2\}$ and $\bar{p} = \frac{p_1 + p_2}{2}$, satisfying ordering and diminishing sensitivity properties. Observe that $p_1 > p_2 \Leftrightarrow \sigma(p_1, \bar{p}) > \sigma(p_2, \bar{p})$, implying that p_1 is more salient when the base good is more expensive. This distorts the weighting function accordingly to $w_k = w(\sigma_k; \sigma_{-k})$. Importantly, according to Bordalo et al. (2022), w_k is increasing in the salience of attribute k, σ_k, and decreases in other attribute's salience, σ_{-k}. Thus, increasing p_1 makes the base good price more salient, with the consequence of p_2 becoming less salient. This, in turn, decreases $w_{p_2} = w(\sigma_{p_2}; \sigma_{p_1})$ and thus, behavioral consumers

[24] Given that consumers observe the add-on offer only after the (tentative) purchase, we suppose that salience does not affect the base good market.

put less weight on the add-on price. Since $w_{v_2} = 1$, $\pi_{v_2} = 1$ and $\pi_{p_2} = -1$, we can write the perceived add-on utility as $U_i(v_2, p_2, \tilde{\Delta}) = v_2 - w(\sigma_{p_2}; \sigma_{p_1})p_2 \geq 0$. Rearranging leads to $U_i(v_2, p_2, \tilde{\Delta}) = W(v_2, \tilde{\Delta}) - p_2 = \frac{v_2}{w(\sigma_{p_2};\sigma_{p_1})} - p_2 \geq 0$ with $\tilde{\Delta} = w(\sigma_{p_2}; \sigma_{p_1})$. Given the properties of $w(\sigma_{p_2}; \sigma_{p_1})$, the assumptions on $U_i(v_2, p_2, \tilde{\Delta})$ are satisfied. The diminishing sensitivity property of the salience function $\sigma(a_k, \bar{p})$ corresponds to our concavity assumption.

Reference point dependence and anchoring-and-adjustment. A large amount of experimental evidence documents the importance of reference points in individual decision-making, starting with Kahneman and Tversky (1979); Tversky and Kahneman (1974); Jacowitz and Kahneman (1995); Tversky and Kahneman (1981). Arbitrary high anchors have been shown to increase the WTP for a variety of goods (Ariely, Loewenstein, and Prelec, 2003; Bergman, Ellingsen, Johannesson, and Svensson, 2010; Fudenberg, Levine, and Maniadis, 2012; Maniadis, Tufano, and List, 2014; Alevy, Landry, and List, 2015; Yoon, Fong, and Dimoka, 2019; Ioannidis, Offerman, and Sloof, 2020). The British regulator argues "For example, consumers may use a heuristic called 'anchoring and adjustment', in which case consumers will anchor on the base price and insufficiently adjust for the surcharge" (Office of Fair Trading, 2013, p. 8). See Furnham and Boo (2011) for a literature review on the heuristic. It is also documented that the price observed in previous market periods affects subsequent bids of market participants (Tufano, 2010; Beggs and Graddy, 2009; Ferraro, Messer, Shukla, and Weigel, 2021). Therefore, we argue that anchoring and adjustment is a suitable explanation for our reduced form function $W(v_2, \tilde{\Delta})$. Formally, we incorporate the distance between p_2 and the reference price p_1 as the context effects into the incentive constraint, $u - p_i + \gamma(\tilde{p} - p_i) \geq 0$, where $\gamma(\cdot)$ captures loss aversion (Wenner, 2015). Setting $u = v_2$, $p_i = p_2$ and $\tilde{p} = p_1$ yields immediately $W(v_2, \tilde{\Delta}) = v_2 + \gamma(\Delta) \geq p_2$ with $\Delta = p_1 - p_2$.

Diminishing sensitivity. Closely related is diminishing sensitivity, a feature of prospect theory, and a now well-established concept. Diminishing sensitivity goes back to Kahneman and Tversky (1979); Thaler (1980) who suggest that consumers evaluate an outcome x with the function $v(x)$, which is defined over gains and losses with respect to some reference point (see Barberis, 2013, for a review). $v(x)$ is concave for gains and convex for losses. When evaluating the additional offer, behavioral consumers put the add-on purchase in context of the previous base good purchase. Intuitively, some fixed additional costs appear small in the context of an expensive base good purchase. In contrast, classical consumers evaluate the extra purchase independently.

That is, behavioral consumers consider an increase in the total costs. Given the properties of $v(x)$, it follows that $v(0)-v(-p_2) > v(-p_1)-v(-p_1-p_2)$. Thus, behavioral consumers value the additional costs (spending p_1+p_2 instead of p_1) less than classical consumers (spending p_2 instead of 0), implying that they accept a larger price for the add-on. Behavioral consumers accept the additional offer when $v_2+v(-p_1-p_2)-v(-p_1) > 0$, where $v(-x) < 0$. Due to the convexity of v(-x), we have $\frac{\partial v(-p_1-p_2)}{\partial p_1} < \frac{\partial v(-p_1)}{\partial p_1}$. Thus, an increase in p_1 makes behavioral consumers less sensitive to the add-on price p_2. Therefore, diminishing sensitivity satisfies the properties of the perceived add-on utility $U_i(v_2, p_2, \tilde{\Delta})$. Note that one needs to assume a specific functional form for $v(x)$ to obtain $U_i(v_2, p_2, \tilde{\Delta}) = W(v_2, \tilde{\Delta}) - p_2$.

Mental accounting. Because consumers are mental accountants " [...] sellers have a distinct advantage in selling something if its cost can be added on to another larger purchase" (Thaler, 1985, p. 209). Intuitively, in the context of a big expenditure, adding a relatively small cost fells insignificant. See also Ranyard and Abdel-Nabi (1993); Moon, Keasey, and Duxbury (1999); Erat and Bhaskaran (2012).

The transaction utility theory from Thaler (1985) is a two-stage process. First, there is a judgment process, where consumers evaluate potential transactions. The total utility is defined as $w(z,p,p^*) = v(\bar{p}-p) + v(-p : -p^*)$, where $\bar{p}$ is the valuation for a good z with price p, reference price p^*, and $v(\cdot)$ is a concave function. The term $v(\bar{p}-p)$ captures the acquisition utility, which is simply the net utility accrued by the trade and corresponds to the add-on net utility of classical consumers.[25] The transaction utility (or reference outcome) is captured by $v(-p : -p^*)$, which depends on the add-on price and the reference price. Note that $v(-p : -p) = 0$, $v(-p : -p^*) > 0$ when $p < p^*$, and $v(-p : -p^*)$ is increasing in p^*. Intuitively, when the reference price exceeds the market price, then it affects the value of good z positively. The size of the effect depends on the difference between p and p^*. Second, there is a decision process, where consumers (dis-)approve each potential transaction. A behavioral consumer will buy a good z if $\frac{w(z,p,p^*)}{p} > k$, where k is a constant. We interpret $k = 0$ as the outside option of not buying the add-on. Supposing $v(\bar{p}-p) = W(\bar{p}) - p$ and setting $\bar{p} = v_2$, $p = p_2$, and $p^* = p_1$ leads to the incentive constraint $\frac{W(v_2)-p_2+v(-p_2:-p_1)}{p_2} \geq 0$. Assuming $p_1 > p_2$, then $W(v_2, v(-p_2 : -p_1)) = W(v_2) + v(-p_2 : -p_1) \geq p_2$ implies $\frac{\partial v(-p_2:-p_1)}{\partial p_1} > 0$, and, since $v(\cdot)$ is concave, the assumptions on $W(v_2, \tilde{\Delta})$ with $\Delta = v(-p_2 : -p_1)$ are satisfied. Therefore,

[25] We use directly the notation $v(\bar{p}-p)$ instead of $v(\bar{p}, -p)$, since Thaler (1985) argues that acquisition utility will generally be coded as integrated outcome.

consumers subject to mental thinking can be characterized as behavioral consumers in our model.[26]

7 Related Literature and Discussion

7.1 Related literature

The key feature of our model relies on well-documented empirical patterns. For example, add-on purchases are more frequent if base good prices are higher (Xia and Monroe, 2004). Erat and Bhaskaran (2012) experimentally show that the valuation for the add-on increases with the price of the base product. Similarly, consumers value the upgrade to a better product (i.e., the add-on) more if the base good's price is higher (Azar, 2011b). Chetty et al. (2009) show that consumers under-react to non-salient additional costs such as taxes. Indeed, pass-through rates of tax changes are often larger than one, suggesting that consumers underweight those additional costs (Barzel, 1976; Besley and Rosen, 1999; Young and Bielińska-Kwapisz, 2002; Kenkel, 2005). A decoupled good consisting of a base and add-on product reliably increases demand, consistent with consumers underweighting the add-on price (Ellison and Ellison, 2009; Santana, Dallas, and Morwitz, 2020). Hossain and Morgan (2006) show that consumers are too insensitive to shipping charges on eBay, and propose a model of context effects including mental accounting and salience. Field and natural experiments show that increasing the add-on price comes along with higher profits for firms since consumers seem to underact to the add-on price (Brown et al., 2010). In sequential buying, the willingness-to-pay for the product under consideration increases with the price of the previously purchased product (Ariely et al., 2003). As such, this paper contributes to the recent debate around drip pricing in economics (Kosfeld and Schüwer, 2016), marketing science (see Ahmetoglu, Furnham, and Fagan, 2014, for a review) and antitrust (see Greenleaf, Johnson, Morwitz, and Shalev, 2016, for a review). Drip pricing is the strategy to reveal add-on prices only after the (tentative) purchase of

[26] Our reduced-form model also accommodates Erat and Bhaskaran (2012), who provide a mental accounting model in the context of add-on selling. Context effects are defined as a mental book value $BV = p - V$, where p is the paid base good price and V is the cumulative benefit a consumer has obtained so far from using the base good, which increases over time. Thus, BV is maximal just after the base good purchase occurred. Further, a consumer buys the add-on if and only if $p_A \leq u_A + \gamma u_A BV$. Setting $p = p_1$, $p_A = p_2$ and $u_A = v_2$ translates immediately to our reduced form incentive constraint $W(v_2, BV(p_1)) = v_2(1 + \gamma BV(p_1)) \geq p_2$, where $BV(p_1)$ is strictly increasing in p_1.

the base good[27] and has been shown to increase demand and reduce consumer surplus in natural environments and experimental markets (Huck and Wallace, 2015; Dertwinkel-Kalt et al., 2020; Rasch et al., 2020; Blake et al., 2021). We show that even if all consumers can turn down the add-on at no cost, some may still purchase it because of underweighting the add-on price. Such consumer behavior can jeopardize their own surplus, but also the surplus of the classical consumer who doesn't fall prey to purchasing the add-on.

We closely relate to the literature on context effects in the broader sense (Azar, 2007; Bordalo et al., 2012, 2013; Dertwinkel-Kalt, Köhler, Lange, and Wenzel, 2017; Bushong et al., 2021; Somerville, 2022). Context effects occur if preferences are malleable and dependent on the immediate environment. In this paper, we inject consumers with context-dependent preferences into a multi-good model that follows otherwise canonical assumptions (Holton, 1957; Diamond, 1971; Coppi, 2007; Verboven, 1999). Karle, Kerzenmacher, Schumacher, and Verboven (2023) provide experimental evidence suggesting that consumers tend to search sub-optimally less when product prices are high and behave, due to relative thinking, as if they were less price sensitive. This finding is closely related to our assumption that consumers have a temporarily higher demand for add-ons when the price of the base product is higher. Choices sensitive to the context may also arise from rational inferences from information that products carry (Kamenica, 2008). Salant and Siegel (2018) studies the optimal design of product menus of a monopolist that can influence the "frame" of a product, for example through highlighting specific characteristics such as nutrition labels. The frame makes a product more attractive than it actually is. In equilibrium, the monopolist may use the frame to sell products to a consumer that contain a base good and an expensive add-on, while rational consumers do not purchase the add-on. Our model is distinct in that it allows for competition, and in that we endogeneize the "frame", while also analyzing distributional effects as a function of the share of context-dependent consumers in the population. Related is also Inderst and Obradovits (2023)'s model of drip pricing in which consumers have context-dependent preferences, resulting in competition to increase the welfare loss due to a distortion in product choice. Further, Apffelstaedt and Mechtenberg (2021) analyze how firms compete for context-sensitive consumers in retail markets, providing an explanation for common marketing strategies such as decoy products or upselling techniques.

[27] Drip pricing is the sequential presentation of prices and is defined as "[...] a pricing technique in which firms advertise only part of a product's price and reveal other charges later as the customer goes through the buying process. The additional charges can be mandatory charges [...] or fees for optional upgrades and add-ons" (Federal Trade Commission, 2012).

In this paper, we show that context-sensitive consumers can cause lower competition in the base good market, leading to higher base good prices. We thus add to the literature documenting endogenous price floors. Michel (2017) analyzes extend warranties for electronic goods. Naive consumers underestimate the cost of returning a faulty base product under an extended warranty, and thus, overestimate the value of the add-on, which can be exploited by firms. A crucial difference to our model is that preferences for the add-on are not context-dependent, and excess demand for the add-on is not a function of base good prices, but exogenously given. In Michel (2017), an endogenous price floor might emerge in equilibrium because consumers can substitute an extended warranty with buying multiple base goods. In our model, the endogenous price floor arises due to the preference distortion from context effects. Similarly, in Miao (2010), some consumers buy the overpriced add-on due to myopia, while others can avoid the add-on. An endogenous base good price floor can emerge if consumers can substitute the add-on with a new base good purchase. For example, if cartridges are too highly priced, consumers would be better of buying a new printer, creating incentives for firms to sell printers not too cheaply. In a Hotelling model with a population consisting only of relative thinkers, Azar (2008) assumes that transportation costs are an increasing function of the good's price, leading to higher prices in equilibrium. Cunningham (2013) expands the model, relaxes assumptions, and provides empirical evidence that add-on mark-ups are positively related with the base good's cost. We differentiate because we allow for a heterogeneous population and examine distributional effects between the two consumer types, as well as welfare impacts.

Such price floors on the base good can also arise exogenously, for example through government intervention. In typical models of multi-goods, firms enjoy ex-post monopoly power over the add-on, allowing them to extract high margins from those after-sales products. Competition forces firms to redistribute those rents to the base good, which must be sold as a loss-leader to attract consumers ex ante (Shapiro, 1994; Lal and Matutes, 1994; Verboven, 1999). Because loss-leading is often seen as a predatory practice that exploits consumers and reduces welfare (Chen and Rey, 2012), the issue has gauged the interest of researchers and antitrust agencies alike. For example, 22 U.S. states prohibit the sale of goods below costs, and loss-leading is banned in several countries in the European Union. In our model, a law that enacts an exogenous price floor on the base good harms most consumers, and whether it has positive effects on at least some consumers is unclear. Thus, banning loss-leading may actually be detrimental for consumers. This result contributes to recent evidence that points towards the potential negative effects of such bans due to other reasons, such as for example a smaller product choice (Johnson, 2017). Price floors, however, can also emerge without regulation, for example because negative prices are infeasible, or because of consumer suspicion that "there must be a catch" (Armstrong and Vickers, 2012; Heidhues, Kőszegi, and Murooka, 2016; Heidhues and Kőszegi, 2017). Both would lead to weakly lower consumer surplus in our model.

Finally, our work contributes to the literature on models of add-on sales with boundedly rational consumers, initiated by Ellison (2005) and Gabaix and Laibson (2006) (see Spiegler, 2011; Armstrong and Vickers, 2012; Grubb, 2015, for a review). Armstrong (2015) reviews several models with a heterogeneous consumer population similar to our setup. In contrast to our model, behavioral consumers are either unaware of extra costs or wrongly believe they will not demand an extra item when choosing a firm. He shows that one of two distinct externalities can be present in the market, which depends on the type of add-on and what kind of mistake naive consumers make. When all consumers are better off with an increasing proportion of classical consumers, search externalities are present. Having more classical consumers in the market benefits everyone. In contrast, ripoff externalities exist when individual consumers benefit from having fewer classical consumers in the market. These two effects are also occurring in our model: Depending on the demand elasticity in the base good market, prices are increasing or decreasing in the share of classical consumers. For a relatively elastic demand, the ripoff externalities are present, while in the inelastic case, classical consumers provide search externalities. Note that Armstrong (2015) needs different models and assumptions on consumer behavior to induce the different externalities, while we obtain this result within one framework.

Heidhues and Kőszegi (2018) survey the literature and develop a reduced-form framework, which captures many popular models of add-on selling with heterogeneous consumers. Some consumers are naive (or behavioral) and misperceive the additional offer or ignore additional costs initially, while sophisticated consumers can avoid the extra costs. When firms exploit consumers' naivety, this always benefits sophisticated consumers. Crucially, their reduced-form model does not consider context effects, which gives firms an important strategic element in our setup and leads to novel non-monotonic distributional results.

7.2 Discussion

Our model comes with some limitations. Certainly, our model (intentionally) does not apply to all types of add-ons. If there is a substantial time lag between the purchase of the base good and the the add-on, as in the case of printers and cartridges, it is unlikely that consumers' demand for the add-on is still distorted by the context of the base good purchase. Second, our model likely does not apply when add-ons are a significant part of the total price, such as for example full collision damage waiver insurance, which often costs twice as much as the rental car itself. This is because the behavioral mechanism may break down or even reverse in this setting, and moreover, consumers may choose the seller based on the total price rather than the base good only. Third, our model does not trivially generalize to mandatory add-ons such as hotel resort fees, taxes, or other surcharges, because these settings are inconsistent with our assumption that add-ons can be rejected at zero costs.

Further, we presume that firms offer a base good and an extra item, but the option to offer a bundle product is absent. Our assumption relies on empirical evidence documenting that decoupling a bundle product into a base good and extra item increases demand and firms' profits (Morwitz et al., 1998; Blake et al., 2021). Variations of our model, however, could investigate firms' optimal pricing strategies and its consequences on welfare in product design, such as in Apffelstaedt and Mechtenberg (2021).

Moreover, our model cannot accommodate context effects arising from focusing (Kőszegi and Szeidl, 2013). Consumers subject to focusing overweight attributes in the dimension in which alternatives differ more. Intuitively, in our framework, consumers would weigh the add-on price more the larger the difference to the base good price, implying that the perceived utility decreases as the base good becomes more expensive. This is inconsistent with our model assumptions derived from other well-known context effects.

Lastly, another limitation is that we assume that the perceived utility of context-dependent consumers for the add-on is monotonously increasing in the price of the base good. A disproportionately high-priced add-on, however, may be perceived as unfair (Rabin, 1993; Robbert and Roth, 2014; Herz and Taubinsky, 2017). Hence, fairness effects may impose an upper limit for the add-on price that behavioral consumers are willing to accept. This would essentially create an endogenous cap on the add-on price. We analyzed the effects of an exogenously imposed add-on price cap in Section 4: such a cap—whether exogenously imposed or endogenously emerging—can lead to higher base good prices and lower consumer surplus.

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Online Appendices

A Auxiliary Results

To ease notation, we denote $\frac{\partial D_j(p_{1,j},p_{1,-j})}{\partial p_{1,j}} = D_j'(p_{1,j}, p_{1,-j})$ and $\frac{\partial^2 D_j(p_{1,j},p_{1,-j})}{\partial p_{1,j}^2} = D_j''(p_{1,j}, p_{1,-j})$.

A.1 Non-exploiting strategy

Suppose firm j does not exploit and sets $p_{2,j} = W(v_2)$. This implies $Q_j(p_{2,j}, D_j(\cdot)) = D_j(p_{1,j}, p_{1,-j})$ and the profit function (1) reduces to

$$\pi_j(p_{1,j}, p_{1,-j}, W(v_2)) = \big[p_{1,j} + W(v_2)\big] D_j(p_{1,j}, p_{1,-j}). \tag{2}$$

Note that the optimization problem in the benchmark economy ($\alpha = 0$) is identical to (2). Maximizing this expression with respect to $p_{1,j}$ yields the first-order condition

$$\begin{aligned} D_j(p_{1,j}, p_{1,-j}) + D_j'(p_{1,j}, p_{1,-j})[p_{1,j} + W(v_2)] = 0 \\ \Leftrightarrow \quad p_{1,j} = \frac{-D_j(p_{1,j}, p_{1,-j})}{D_j'(p_{1,j}, p_{1,-j})} - W(v_2). \end{aligned}$$

Substituting $p_{1,j}$ in expression (2) leads to

$$\pi_j(p_{1,j}, p_{1,-j}, W(v_2)) = \frac{-D_j(p_{1,j}, p_{1,-j})^2}{D_j'(p_{1,j}, p_{1,-j})}.$$

Whether firm j sets p_1^n or $\tilde{p}_1^n(\alpha)$ depends on the action of firm $-j$. First, suppose firm $-j$ does not exploit. Then, both firms set

$$p_1^n = \frac{-D(p_1^n, p_1^n)}{D'(p_1^n, p_1^n)} - W(v_2)$$

and obtain

$$\pi^n = \pi(p_1^n, p_1^n, W(v_2)) = \frac{-D(p_1^n, p_1^n)^2}{D'(p_1^n, p_1^n)}.$$

Observe that neither p_1^n nor π^n depend on α. Therefore, the symmetric non-exploiting outcome is independent of the share of behavioral consumers. Further, the benchmark outcome ($\alpha = 0$) is identical since it has the same maximization problem. That is $p_1^n = p_1^{BM}$ and $\pi^n = \pi^b$. Now suppose firm $-j$ exploits and sets $\tilde{p}_1^e(\alpha)$. Then, firm j sets

$$\tilde{p}_1^n(\alpha) = \frac{-D(\tilde{p}_1^n(\alpha), \tilde{p}_1^e(\alpha))}{D'(\tilde{p}_1^n(\alpha), \tilde{p}_1^e(\alpha))} - W(v_2)$$

and obtains

$$\tilde{\pi}^n = \pi\left(\tilde{p}_1^n(\alpha), \tilde{p}_1^e(\alpha), W(v_2)\right) = \frac{-D(\tilde{p}_1^n(\alpha), \tilde{p}_1^e(\alpha))^2}{D'(\tilde{p}_1^n(\alpha), \tilde{p}_1^e(\alpha))}.$$

As we show later, $\tilde{p}_1^n(\alpha)$ and thus, $\tilde{\pi}^n$, depend on α because $\tilde{p}_1^e(\alpha)$ does and base good prices are strategic complements.

A.2 Exploiting strategy

Suppose firm j exploits and sets $p_{2,j} = W(v_2, \tilde{\Delta})$. This implies $Q_j(p_{2,j}, D_j(\cdot)) = \alpha D_j(p_{1,j}, p_{1,-j})$ and the profit function (1) reduces to

$$\pi_j(p_{1,j}, p_{1,-j}, W(v_2, \tilde{\Delta})) = \left[p_{1,j} + \alpha W(v_2, \tilde{\Delta})\right] D_j(p_{1,j}, p_{1,-j}). \tag{3}$$

Maximizing this expression with respect to $p_{1,j}$ yields the first-order condition

$$\begin{aligned} &[1 + \alpha W'(v_2, \tilde{\Delta})]D_j(p_{1,j}, p_{1,-j}) + D'_j(p_{1,j}, p_{1,-j})[p_{1,j} + \alpha W(v_2, \tilde{\Delta})] = 0 \\ \Leftrightarrow \quad & p_{1,j} = \frac{-[1 + \alpha W'(v_2, \tilde{\Delta})]D_j(p_{1,j}, p_{1,-j})}{D'_j(p_{1,j}, p_{1,-j})} - \alpha W(v_2, \tilde{\Delta}), \end{aligned}$$

where $W'(v_2, \tilde{\Delta}) = \frac{\partial W(v_2, \tilde{\Delta})}{\partial p_{1,j}}$. Substituting $p_{1,j}$ in expression (3) leads to

$$\pi_j(p_{1,j}, p_{1,-j}, W(v_2, \tilde{\Delta})) = \frac{-[1 + \alpha W'(v_2, \tilde{\Delta})]D_j(p_{1,j}, p_{1,-j})^2}{D'_j(p_{1,j}, p_{1,-j})}.$$

Whether firm j sets $p_1^e(\alpha)$ or $\tilde{p}_1^e(\alpha)$ depends on the action of firm $-j$. First, suppose firm $-j$ exploits. Then, both firms set

$$p_1^e(\alpha) = \frac{-[1 + \alpha W'(v_2, \tilde{\Delta})]D(p_1^e(\alpha), p_1^e(\alpha))}{D'(p_1^e(\alpha), p_1^e(\alpha))} - \alpha W(v_2, \tilde{\Delta})$$

and obtain

$$\pi^e = \pi(p_1^e(\alpha), p_1^e(\alpha), W(v_2, \tilde{\Delta})) = \frac{-[1 + \alpha W'(v_2, \tilde{\Delta})]D(p_1^e(\alpha), p_1^e(\alpha))^2}{D'(p_1^e(\alpha), p_1^e(\alpha))}.$$

Now suppose firm $-j$ does not exploit and sets $\tilde{p}_1^n(\alpha)$. Then, firm j sets

$$\tilde{p}_1^e(\alpha) = \frac{-[1 + \alpha W'(v_2, \tilde{\Delta})]D(\tilde{p}_1^e(\alpha), \tilde{p}_1^n(\alpha))}{D'(\tilde{p}_1^e(\alpha), \tilde{p}_1^n(\alpha))} - \alpha W(v_2, \tilde{\Delta})$$

and obtains

$$\tilde{\pi}^e = \pi\left(\tilde{p}_1^e(\alpha), \tilde{p}_1^n(\alpha), W(v_2, \tilde{\Delta})\right) = \frac{-[1 + \alpha W'(v_2, \tilde{\Delta})]D(\tilde{p}_1^e(\alpha), \tilde{p}_1^n(\alpha))^2}{D'(\tilde{p}_1^e(\alpha), \tilde{p}_1^n(\alpha))}.$$

A.3 Derivatives

It is crucial for our analysis to understand how the base-good prices and profits react to changes in α. Recall that $D_j(p_{1,j}, p_{1,-j})$ is a concave function and is strictly decreasing in $p_{1,j}$, which implies $D'(\cdot) < 0$ and $D''(\cdot) \leq 0$. Further, we have $\frac{\partial D_j(p_{1,j}, p_{1,-j})}{\partial p_{1,-j}} \geq 0$ and $\frac{\partial^2 D_j(p_{1,j}, p_{1,-j})}{\partial p_{1,j} \partial p_{1,-j}} \geq 0$, since base goods are strategic complements and demand is supermodular. Further, a stronger own price elasticity implies $\left|D'_j(p_{1,j}, p_{1,-j})\right| > \frac{\partial D_j(p_{1,j}, p_{1,-j})}{\partial p_{1,-j}}$. Finally, since $W(v_2, \tilde{\Delta})$ is strictly increasing in all arguments and concave, we have $W'(v_2, \tilde{\Delta}) = \frac{\partial W(v_2, \tilde{\Delta})}{\partial p_{1,j}} > 0$ and $W''(v_2, \tilde{\Delta}) = \frac{\partial^2 W(v_2, \tilde{\Delta})}{\partial p_{1,j}^2} \leq 0$. Given the assumptions on $D(\cdot)$ and $W(v_2, \tilde{\Delta})$, Lemma A.1 characterizes how profits and prices react to a change of α.

Lemma A.1.

(a) p_1^n *and* π^n *are constant in* α.

(b) π^e *and* $\tilde{\pi}^e$ *are strictly increasing in* α.

(c) $p_1^e(\alpha)$, $\tilde{p}_1^e(\alpha)$, $\tilde{p}_1^n(\alpha)$ *and* $\tilde{\pi}^n$ *are (i) strictly decreasing in* α *if* $\epsilon_D > \epsilon_W$, *(ii) strictly increasing in* α *if* $\epsilon_D < \epsilon_W$, *and (iii) constant in* α *if* $\epsilon_D = \epsilon_W$.

Proof. (a)

$$\begin{aligned}
\frac{\partial p_1^n}{\partial \alpha} &= \left[-1 + \frac{D(p_1^n, p_1^n)D''(p_1^n, p_1^n)}{D'(p_1^n, p_1^n)^2}\right] \frac{\partial p_1^n}{\partial \alpha} \\
\Leftrightarrow \quad \frac{\partial p_1^n}{\partial \alpha} &\left[2 - \frac{D(p_1^n, p_1^n)D''(p_1^n, p_1^n)}{D'(p_1^n, p_1^n)^2}\right] = 0
\end{aligned}$$

Since $\frac{D(\cdot)D''(\cdot)}{D'(\cdot)^2} \leq 0$, it must be that $\frac{\partial p_1^n}{\partial \alpha} = 0$.

$$\frac{\partial \pi_1^n}{\partial \alpha} = \frac{-2D(p_1^n, p_1^n)D'(p_1^n, p_1^n)^2 + D(p_1^n, p_1^n)^2 D''(p_1^n, p_1^n)}{D'(p_1^n, p_1^n)^2} \underbrace{\frac{\partial p_1^n}{\partial \alpha}}_{=0} = 0.$$

(b) We characterize first $\frac{\partial p_1^e(\alpha)}{\partial \alpha}$, before we can derive $\frac{\partial \pi_1^e}{\partial \alpha}$.

$$\begin{aligned}
\frac{\partial p_1^e(\alpha)}{\partial \alpha} &= -\left[1 + 2\alpha W'(v_2, \tilde{\Delta}) + \frac{\alpha W''(v_2, \tilde{\Delta})D(p_1^e(\alpha), p_1^e(\alpha))}{D'(p_1^e(\alpha), p_1^e(\alpha))}\right] \frac{\partial p_1^e(\alpha)}{\partial \alpha} \\
&\quad + (1 + \alpha W'(v_2, \tilde{\Delta}))\frac{D(p_1^e(\alpha), p_1^e(\alpha))D''(p_1^e(\alpha), p_1^e(\alpha))}{D'(p_1^e(\alpha), p_1^e(\alpha))^2} \frac{\partial p_1^e(\alpha)}{\partial \alpha} \\
&\quad - W(v_2, \tilde{\Delta}) - \frac{W'(v_2, \tilde{\Delta})D(p_1^e(\alpha), p_1^e(\alpha))}{D'(p_1^e(\alpha), p_1^e(\alpha))} \\
\Leftrightarrow \quad \frac{\partial p_1^e(\alpha)}{\partial \alpha} &= \frac{-W(v_2, \tilde{\Delta}) - \frac{W'(v_2, \tilde{\Delta})D(p_1^e(\alpha), p_1^e(\alpha))}{D'(p_1^e(\alpha), p_1^e(\alpha))}}{(1 + \alpha W'(v_2, \tilde{\Delta}))\left(2 - \frac{D(p_1^e(\alpha), p_1^e(\alpha))D''(p_1^e(\alpha), p_1^e(\alpha))}{D'(p_1^e(\alpha), p_1^e(\alpha))^2}\right) + \frac{\alpha W''(v_2, \tilde{\Delta})D(p_1^e(\alpha), p_1^e(\alpha))}{D'(p_1^e(\alpha), p_1^e(\alpha))}}.
\end{aligned}$$

$$\begin{aligned}
\frac{\partial \pi_1^e}{\partial \alpha} &= D(p_1^e(\alpha), p_1^e(\alpha))\Bigg[-\frac{W'(v_2, \tilde{\Delta})D(p_1^e(\alpha), p_1^e(\alpha))}{D'(p_1^e(\alpha), p_1^e(\alpha))} - \frac{\partial p_1^e(\alpha)}{\partial \alpha}\Bigg[(1 + \alpha W'(v_2, \tilde{\Delta})) \\
&\quad \left(2 - \frac{D(p_1^e(\alpha), p_1^e(\alpha))D''(p_1^e(\alpha), p_1^e(\alpha))}{D'(p_1^e(\alpha), p_1^e(\alpha))^2}\right) + \frac{\alpha W''(v_2, \tilde{\Delta})D(p_1^e(\alpha), p_1^e(\alpha))}{D'(p_1^e(\alpha), p_1^e(\alpha))}\Bigg]\Bigg] \\
&= D(p_1^e(\alpha), p_1^e(\alpha))W(v_2, \tilde{\Delta}) > 0,
\end{aligned}$$

where the second equality follows from substituting $\frac{\partial p_1^e(\alpha)}{\partial \alpha}$. Before we derive $\frac{\partial \tilde{\pi}_1^e}{\partial \alpha}$, we need to characterize $\frac{\partial \tilde{p}_1^n(\alpha)}{\partial \alpha}$ and $\frac{\partial \tilde{p}_1^e(\alpha)}{\partial \alpha}$:

$$\frac{\partial \tilde{p}_1^n(\alpha)}{\partial \alpha} = \underbrace{\left[\frac{\frac{D(\tilde{p}_1^n(\alpha),\tilde{p}_1^e(\alpha))\frac{\partial^2 D(\tilde{p}_1^n(\alpha),\tilde{p}_1^e(\alpha))}{\partial \tilde{p}_1^n(\alpha)\partial \tilde{p}_1^e(\alpha)}}{D'(\tilde{p}_1^n(\alpha),\tilde{p}_1^e(\alpha))^2} - \frac{\frac{\partial D(\tilde{p}_1^n(\alpha),\tilde{p}_1^e(\alpha))}{\partial \tilde{p}_1^e(\alpha)}}{D'(\tilde{p}_1^n(\alpha),\tilde{p}_1^e(\alpha))}}{2 - \frac{D(\tilde{p}_1^n(\alpha),\tilde{p}_1^e(\alpha))D''(\tilde{p}_1^n(\alpha),\tilde{p}_1^e(\alpha))}{D'(\tilde{p}_1^n(\alpha),\tilde{p}_1^e(\alpha))^2}}\right]}_{=A} \frac{\partial \tilde{p}_1^e(\alpha)}{\partial \alpha}.$$

Note that $A \geq 0$ since $D(\cdot)$ is concave, supermodular, strictly decreasing in the first argument and increasing in the second argument. Taking the derivative of $\tilde{p}_1^e(\alpha)$ with respect to α yields

$$\frac{\partial \tilde{p}_1^e(\alpha)}{\partial \alpha}\left[(1+\alpha W'(v_2,\tilde{\Delta}))\left[2 - \frac{D(\tilde{p}_1^e(\alpha),\tilde{p}_1^n(\alpha))D''(\tilde{p}_1^e(\alpha),\tilde{p}_1^n(\alpha))}{D'(\tilde{p}_1^e(\alpha),\tilde{p}_1^n(\alpha))^2}\right]\right.$$
$$\left. + \frac{\alpha W''(v_2,\tilde{\Delta})D(\tilde{p}_1^e(\alpha),\tilde{p}_1^n(\alpha))}{D'(\tilde{p}_1^e(\alpha),\tilde{p}_1^n(\alpha))}\right] = -W(v_2,\tilde{\Delta}) - \frac{W'(v_2,\tilde{\Delta})D(\tilde{p}_1^e(\alpha),\tilde{p}_1^n(\alpha))}{D'(\tilde{p}_1^e(\alpha),\tilde{p}_1^n(\alpha))}$$
$$+ (1+\alpha W'(v_2,\tilde{\Delta}))\underbrace{\left[\frac{D(\tilde{p}_1^e(\alpha),\tilde{p}_1^n(\alpha))\frac{\partial^2 D(\tilde{p}_1^e(\alpha),\tilde{p}_1^n(\alpha))}{\partial \tilde{p}_1^e(\alpha)\partial \tilde{p}_1^n(\alpha)}}{D'(\tilde{p}_1^e(\alpha),\tilde{p}_1^n(\alpha))^2} - \frac{\frac{\partial D(\tilde{p}_1^e(\alpha),\tilde{p}_1^n(\alpha))}{\partial \tilde{p}_1^n(\alpha)}}{D'(\tilde{p}_1^e(\alpha),\tilde{p}_1^n(\alpha))}\right]}_{=B}\frac{\partial \tilde{p}_1^n(\alpha)}{\partial \alpha}.$$

Note that $B \geq 0$. Substituting $\frac{\partial \tilde{p}_1^n(\alpha)}{\partial \alpha}$ yields

$$\frac{\partial \tilde{p}_1^e(\alpha)}{\partial \alpha} =$$
$$\frac{-W(v_2,\tilde{\Delta}) - \frac{W'(v_2,\tilde{\Delta})D(\tilde{p}_1^e(\alpha),\tilde{p}_1^n(\alpha))}{D'(\tilde{p}_1^e(\alpha),\tilde{p}_1^n(\alpha))}}{(1+\alpha W'(v_2,\tilde{\Delta}))\left[2 - \frac{D(\tilde{p}_1^e(\alpha),\tilde{p}_1^n(\alpha))D''(\tilde{p}_1^e(\alpha),\tilde{p}_1^n(\alpha))}{D'(\tilde{p}_1^e(\alpha),\tilde{p}_1^n(\alpha))^2} - AB\right] + \frac{\alpha W''(v_2,\tilde{\Delta})D(\tilde{p}_1^e(\alpha),\tilde{p}_1^n(\alpha))}{D'(\tilde{p}_1^e(\alpha),\tilde{p}_1^n(\alpha))}}.$$

Now we can take the derivative of $\tilde{\pi}_1^e$ with respect to α.

$$\frac{\partial \tilde{\pi}_1^e}{\partial \alpha} = D(\tilde{p}_1^e(\alpha),\tilde{p}_1^n(\alpha))\left[-\frac{\partial \tilde{p}_1^e(\alpha)}{\partial \alpha}\left[(1+\alpha W'(v_2,\tilde{\Delta}))\right.\right.$$
$$\left.\left[2 - \frac{D(\tilde{p}_1^e(\alpha),\tilde{p}_1^n(\alpha))D''(\tilde{p}_1^e(\alpha),\tilde{p}_1^n(\alpha))}{D'(\tilde{p}_1^e(\alpha),\tilde{p}_1^n(\alpha))^2}\right] + \frac{\alpha W''(v_2,\tilde{\Delta})D(\tilde{p}_1^e(\alpha),\tilde{p}_1^n(\alpha))}{D'(\tilde{p}_1^e(\alpha),\tilde{p}_1^n(\alpha))}\right]$$
$$+ \frac{\partial \tilde{p}_1^n(\alpha)}{\partial \alpha}(1+\alpha W'(v_2,\tilde{\Delta}))\underbrace{\left[\frac{D(\tilde{p}_1^e(\alpha),\tilde{p}_1^n(\alpha))\frac{\partial^2 D(\tilde{p}_1^e(\alpha),\tilde{p}_1^n(\alpha))}{\partial \tilde{p}_1^e(\alpha)\partial \tilde{p}_1^n(\alpha)}}{D'(\tilde{p}_1^e(\alpha),\tilde{p}_1^n(\alpha))^2} - \frac{2\frac{\partial D(\tilde{p}_1^e(\alpha),\tilde{p}_1^n(\alpha))}{\partial \tilde{p}_1^n(\alpha)}}{D'(\tilde{p}_1^e(\alpha),\tilde{p}_1^n(\alpha))}\right]}_{=C}$$
$$\left. - \frac{W'(v_2,\tilde{\Delta})D(\tilde{p}_1^e(\alpha),\tilde{p}_1^n(\alpha))}{D'(\tilde{p}_1^e(\alpha),\tilde{p}_1^n(\alpha))}\right]$$
$$= D(\tilde{p}_1^e(\alpha),\tilde{p}_1^n(\alpha))\left[-\frac{W'(v_2,\tilde{\Delta})D(\tilde{p}_1^e(\alpha),\tilde{p}_1^n(\alpha))}{D'(\tilde{p}_1^e(\alpha),\tilde{p}_1^n(\alpha))} - \frac{\partial \tilde{p}_1^e(\alpha)}{\partial \alpha}\left[(1+\alpha W'(v_2,\tilde{\Delta}))\right.\right.$$

$$\left[2-\frac{D(\tilde{p}_1^e(\alpha),\tilde{p}_1^n(\alpha))D''(\tilde{p}_1^e(\alpha),\tilde{p}_1^n(\alpha))}{D'(\tilde{p}_1^e(\alpha),\tilde{p}_1^n(\alpha))^2}-AC\right]+\frac{\alpha W''(v_2,\tilde{\Delta})D(\tilde{p}_1^e(\alpha),\tilde{p}_1^n(\alpha))}{D'(\tilde{p}_1^e(\alpha),\tilde{p}_1^n(\alpha))}\Bigg]\Bigg]$$

$$= D(\tilde{p}_1^e(\alpha),\tilde{p}_1^n(\alpha))\Bigg[\left(W(v_2,\tilde{\Delta})+\frac{W'(v_2,\tilde{\Delta})D(\tilde{p}_1^e(\alpha),\tilde{p}_1^n(\alpha))}{D'(\tilde{p}_1^e(\alpha),\tilde{p}_1^n(\alpha))}\right)\cdot$$

$$\frac{(1+\alpha W'(v_2,\tilde{\Delta}))\left[2-\frac{D(\tilde{p}_1^e(\alpha),\tilde{p}_1^n(\alpha))D''(\tilde{p}_1^e(\alpha),\tilde{p}_1^n(\alpha))}{D'(\tilde{p}_1^e(\alpha),\tilde{p}_1^n(\alpha))^2}-AC\right]+\frac{\alpha W''(v_2,\tilde{\Delta})D(\tilde{p}_1^e(\alpha),\tilde{p}_1^n(\alpha))}{D'(\tilde{p}_1^e(\alpha),\tilde{p}_1^n(\alpha))}}{(1+\alpha W'(v_2,\tilde{\Delta}))\left[2-\frac{D(\tilde{p}_1^e(\alpha),\tilde{p}_1^n(\alpha))D''(\tilde{p}_1^e(\alpha),\tilde{p}_1^n(\alpha))}{D'(\tilde{p}_1^e(\alpha),\tilde{p}_1^n(\alpha))^2}-AB\right]+\frac{\alpha W''(v_2,\tilde{\Delta})D(\tilde{p}_1^e(\alpha),\tilde{p}_1^n(\alpha))}{D'(\tilde{p}_1^e(\alpha),\tilde{p}_1^n(\alpha))}}$$

$$-\frac{W'(v_2,\tilde{\Delta})D(\tilde{p}_1^e(\alpha),\tilde{p}_1^n(\alpha))}{D'(\tilde{p}_1^e(\alpha),\tilde{p}_1^n(\alpha))}\Bigg]>0$$

The inequality follows since $2-\frac{D(\tilde{p}_1^e(\alpha),\tilde{p}_1^n(\alpha))D''(\tilde{p}_1^e(\alpha),\tilde{p}_1^n(\alpha))}{D'(\tilde{p}_1^e(\alpha),\tilde{p}_1^n(\alpha))^2}-AC>0$ because $\left|\frac{\partial D_j^2(\cdot)}{\partial p_{1,j}^2}\right| \geq \frac{\partial D_j^2(\cdot)}{\partial p_{1,j}\partial p_{1,-j}}$ and $\left|D_j'(p_{1,j},p_{1,-j})\right| > \left|\frac{\partial D_j(p_{1,j},p_{1,-j})}{\partial p_{1,-j}}\right|$, and $B<C$ implies

$$2-\frac{D(\tilde{p}_1^e(\alpha),\tilde{p}_1^n(\alpha))D''(\tilde{p}_1^e(\alpha),\tilde{p}_1^n(\alpha))}{D'(\tilde{p}_1^e(\alpha),\tilde{p}_1^n(\alpha))^2}-AB>0.$$

Thus, the fraction on the second last line is strictly positive. Since $\frac{W'(v_2,\tilde{\Delta})D(\tilde{p}_1^e(\alpha),\tilde{p}_1^n(\alpha))}{D'(\tilde{p}_1^e(\alpha),\tilde{p}_1^n(\alpha))}<0$, the result follows.

(c) First, observe that, given our assumptions, the denominators of $\frac{\partial p_1^e(\alpha)}{\partial\alpha}$ and $\frac{\partial \tilde{p}_1^e(\alpha)}{\partial\alpha}$ are strictly positive. Whether the nominators are positive or negative depends on whether ϵ_D or ϵ_W dominates.

$$\begin{aligned}\frac{\partial p_1^e(\alpha)}{\partial\alpha}&\leq 0\\ -W(v_2,\tilde{\Delta})-\frac{W'(v_2,\tilde{\Delta})D(p_1^e(\alpha),p_1^e(\alpha))}{D'(p_1^e(\alpha),p_1^e(\alpha))}&\leq 0\\ -\frac{D'(p_1^e(\alpha),p_1^e(\alpha))}{D(p_1^e(\alpha),p_1^e(\alpha))}&\geq\frac{W'(v_2,\tilde{\Delta})}{W(v_2,\tilde{\Delta})}\\ \epsilon_D&\geq\epsilon_W.\end{aligned}$$

Hence, it follows $\epsilon_D\geq\epsilon_W \Leftrightarrow \frac{\partial p_1^e(\alpha)}{\partial\alpha}\leq 0$. Thus, $p_1^e(\alpha)$ is strictly decreasing if $\epsilon_D>\epsilon_W$, strictly increasing if $\epsilon_D<\epsilon_W$ and constant if $\epsilon_D=\epsilon_W$.

The argument for $\frac{\partial \tilde{p}_1^e(\alpha)}{\partial\alpha}$ and thus, $\tilde{p}_1^e(\alpha)$, is analogous. Observe that $\frac{\partial \tilde{p}_1^n(\alpha)}{\partial\alpha}\leq 0$ if $\frac{\partial \tilde{p}_1^e(\alpha)}{\partial\alpha}\leq 0$ and strictly positive otherwise. Thus, the result for $\tilde{p}_1^n(\alpha)$ follows immediately.

Finally,

$$\frac{\partial\tilde{\pi}_1^n}{\partial\alpha}=\underbrace{-D(\tilde{p}_1^n(\alpha),\tilde{p}_1^e(\alpha))\frac{\frac{\partial D(\tilde{p}_1^n(\alpha),\tilde{p}_1^e(\alpha))}{\partial\tilde{p}_1^e(\alpha)}}{D'(\tilde{p}_1^n(\alpha),\tilde{p}_1^e(\alpha))}}_{>0}\frac{\partial\tilde{p}_1^e(\alpha)}{\partial\alpha}.$$

Hence, $\tilde{\pi}_1^n$ is strictly decreasing if $\epsilon_D>\epsilon_W$, strictly increasing if $\epsilon_D<\epsilon_W$ and constant if $\epsilon_D=\epsilon_W$.

□

Lemma A.2 shows that the prices $p_1^e(\alpha)$, $\tilde{p}_1^e(\alpha)$ and $\tilde{p}_1^n(\alpha)$, and thus $\tilde{\pi}_1^n$, are monotonic in α. That is, for a given $D(\cdot)$ and $W(v_2, \tilde{\Delta})$, the price functions are either increasing or decreasing for all $\alpha \in [0, 1]$.

Lemma A.2. *Fix $D(\cdot)$ and $W(v_2, \tilde{\Delta})$. The base-good prices $p_1^e(\alpha)$, $\tilde{p}_1^e(\alpha)$ and $\tilde{p}_1^n(\alpha)$ are monotonic in the share of behavioral consumers α.*

Proof. We provide the proof for $p_1^e(\alpha)$. The argument for $\tilde{p}_1^e(\alpha)$ and $\tilde{p}_1^n(\alpha)$ are analogous. Observe that

$$\frac{\partial \epsilon_D}{\partial p_1^e(\alpha)} = \frac{-D''(p_1^e(\alpha), p_1^e(\alpha))D(p_1^e(\alpha), p_1^e(\alpha)) + D'(p_1^e(\alpha), p_1^e(\alpha))^2}{D(p_1^e(\alpha), p_1^e(\alpha))^2} > 0$$

since $D(p_{1,j}, p_{1,-j})$ is concave, and

$$\frac{\partial \epsilon_W}{\partial p_1^e(\alpha)} = \frac{W''(v_2, \tilde{\Delta})W(v_2, \tilde{\Delta}) - W'(v_2, \tilde{\Delta})^2}{W(v_2, \tilde{\Delta})^2} < 0$$

since $W(v_2, \tilde{\Delta})$ is concave.

First, suppose $\epsilon_D > \epsilon_W$ at an initial share of behavioral consumers $\alpha_0 \in [0, 1]$. By Lemma A.1, we have $\frac{\partial p_1^e(\alpha)}{\partial \alpha} < 0$. This implies, since $\frac{\partial \epsilon_D}{\partial p_1^e(\alpha)} > 0$ and $\frac{\partial \epsilon_W}{\partial p_1^e(\alpha)} < 0$, that ϵ_D and ϵ_W are converging for $\alpha > \alpha_0$ and diverging for $\alpha < \alpha_0$.

Since ϵ_D and ϵ_W are converging for an increasing α, there exists a threshold value $\tilde{\alpha} > \alpha_0$ such that $\epsilon_D = \epsilon_W$. Note that $\tilde{\alpha} > 1$ is possible. By Lemma A.1, we have $\frac{\partial p_1^e(\alpha)}{\partial \alpha} = 0$ when $\epsilon_D = \epsilon_W$. Hence, a further increase $\alpha > \tilde{\alpha}$ does not change the optimal base-good price $p_1^e(\alpha)$. But then it must be $\epsilon_D = \epsilon_W$ for all $\alpha \geq \tilde{\alpha}$ and thus, $p_1^e(\alpha)$ is constant in α for all $\alpha \geq \tilde{\alpha}$ and strictly decreasing in α for all $\alpha \in [\alpha_0, \tilde{\alpha})$.

Since ϵ_D and ϵ_W are diverging for a decreasing α, $p_1^e(\alpha)$ is a strictly decreasing function for all $\alpha \in [0, \alpha_0]$. Hence, $p_1^e(\alpha)$ is strictly decreasing in the domain $\alpha \in [0, \tilde{\alpha})$ and constant in α for all $\alpha \geq \tilde{\alpha}$, which implies that $p_1^e(\alpha)$ is monotonic for $\alpha \in [0, 1]$ if $\epsilon_D > \epsilon_W$ at α_0.

Now, suppose that $\epsilon_D < \epsilon_W$ at an initial share of behavioral consumers $\alpha_0 \in [0, 1]$. By Lemma A.1, we have $\frac{\partial p_1^e(\alpha)}{\partial \alpha} > 0$. This implies again that ϵ_D and ϵ_W are converging for $\alpha > \alpha_0$ and diverging for $\alpha < \alpha_0$. Thus, we can apply the same argument as above. This implies that $p_1^e(\alpha)$ is a strictly increasing function for all $\alpha \in [0, \tilde{\alpha})$ and constant in α for all $\alpha \geq \tilde{\alpha}$, which implies that $p_1^e(\alpha)$ is monotonic for $\alpha \in [0, 1]$ if $\epsilon_D < \epsilon_W$ at α_0.

Observe that the argument does not depend on the specific value of α_0 and the statements are true for any $\alpha_0 \in [0, 1]$. Therefore, $p_1^e(\alpha)$ must be monotonic in α. The argument for $\tilde{p}_1^e(\alpha)$ and $\tilde{p}_1^n(\alpha)$ follows immediately by replacing $p_1^e(\alpha)$. □

A.4 Equilibrium

Lemma A.3 characterizes the Nash equilibria in pure strategies. We define the unique, implicit profit threshold $\hat{\alpha}$ such that $\pi^n = \tilde{\pi}^e$ when $\alpha = \hat{\alpha}$. When $\epsilon_D > \epsilon_W$, we can also define the unique, implicit threshold $\bar{\alpha}$ such that $\tilde{\pi}^n = \pi^e$ when $\alpha = \bar{\alpha}$.[28]

Lemma A.3 (Equilibrium)**.**

[28] When $\epsilon_D < \epsilon_W$, then both profits, $\tilde{\pi}^n$ and π^e, are strictly increasing in α.

(a) *Suppose* $\epsilon_D > \epsilon_W$.

(i) *If* $\alpha < \min\{\bar{\alpha}, \hat{\alpha}\}$, *then both firms do not exploit and set* $p_1^* = p_1^n$ *and* $p_2^* = W(v_2)$.

(ii) *If* $\alpha > \max\{\bar{\alpha}, \hat{\alpha}\}$, *then both firms exploit and set* $p_1^* = p_1^e(\alpha)$ *and* $p_2^* = W(v_2, \tilde{\Delta})$.

(iii) *If* $\bar{\alpha} < \alpha < \hat{\alpha}$, *then either both firms do not exploit or both firms exploit.*

(iv) *If* $\hat{\alpha} < \alpha < \bar{\alpha}$, *then firm* j *does not exploit and sets* $p_{1,j}^* = \tilde{p}_1^n(\alpha)$ *and* $p_{2,j}^* = W(v_2)$, *and firm* $-j$ *exploits and sets* $p_{1,-j}^* = \tilde{p}_1^e(\alpha)$ *and* $p_{2,-j}^* = W(v_2, \tilde{\Delta})$.

(b) *Suppose* $\epsilon_D < \epsilon_W$.

(i) *If* $\alpha < \hat{\alpha}$, *then only symmetric equilibria exist.*

(ii) *If* $\alpha > \hat{\alpha}$, *then symmetric exploiting and asymmetric equilibria exist.*

In the case of (a), $\epsilon_D > \epsilon_W$, the symmetric non-exploiting equilibrium in (i) and the symmetric exploiting equilibrium in (ii) are unique.[29] In (iii), the best response of a firm is to do the same as the rival, and in (iv), the best response is to do the opposite.[30] Thus, for intermediate values of α, we observe either multiple symmetric equilibria or multiple asymmetric equilibria.

In part (b), when $\epsilon_D < \epsilon_W$, we observe a similar pattern of equilibria, but we cannot characterize when a unique symmetric equilibrium emerges. For a low share of behavioral consumers, (i), either both firms do not exploit (when $\tilde{\pi}^n > \pi^e$) or there exists multiple symmetric equilibria like in case $(aiii)$. For a large α, (ii), either both firms exploit, or an asymmetric outcome emerges like in case (aiv).

A.5 Proof of Lemma A.3

We will first prove two intermediate results.

Lemma A.4 (Unique thresholds)**.**

(i) *The critical threshold* $\hat{\alpha}$ *is the unique solution to* $\pi^n = \tilde{\pi}^e$ *and* $\alpha < \hat{\alpha} \Leftrightarrow \pi^n > \tilde{\pi}^e$.

(ii) *Suppose* $\epsilon_D > \epsilon_W$. *The critical threshold* $\bar{\alpha}$ *is the unique solution to* $\tilde{\pi}^n = \pi^e$ *and* $\alpha < \bar{\alpha} \Leftrightarrow \tilde{\pi}^n > \pi^e$.

Proof. (i) By Lemma A.1, π^n is constant in α and $\tilde{\pi}^e$ is strictly increasing in α. Thus, there exists a unique solution solved for α such that $\pi^n = \tilde{\pi}^e$ and $\alpha < \hat{\alpha} \Leftrightarrow \pi^n > \tilde{\pi}^e$.

(ii) When $\epsilon_D > \epsilon_W$, then, by Lemma A.1, π^e is strictly increasing in α and $\tilde{\pi}^n$ is decreasing in α. Thus, there exists a unique solution solved for α such that $\tilde{\pi}^n = \pi^e$ and $\alpha < \bar{\alpha} \Leftrightarrow \tilde{\pi}^n > \pi^e$.

□

[29] If $\pi^n > \tilde{\pi}^e$ and $\tilde{\pi}^n > \pi^e$, non-exploiting is the dominant strategy for both firms. Similarly, if $\pi^n < \tilde{\pi}^e$ and $\tilde{\pi}^n < \pi^e$, then exploiting is the dominant strategy.

[30] Lemma A.3 $(a)(iii)$ also applies, when $\bar{\alpha} = \alpha < \hat{\alpha}$ or $\bar{\alpha} < \alpha = \hat{\alpha}$. When $\hat{\alpha} = \alpha < \bar{\alpha}$, then, next to the asymmetrica equilibria, there exist also the symmetric non-exploiting equilibrium. Similarly, when $\hat{\alpha} < \alpha = \bar{\alpha}$, then, next to the asymmetrica equilibria, there exist also the symmetric exploiting equilibrium. In the special case of $\alpha = \hat{\alpha} = \bar{\alpha}$, any strategy is optimal since $\pi^n = \pi^e = \tilde{\pi}^n = \tilde{\pi}^e$.

Lemma A.5 (Dominant strategies)**.**

(i) Non-exploiting is the dominant strategy for both firms if $\pi^n > \tilde{\pi}^e$ *and* $\tilde{\pi}^n > \pi^e$*.*

(ii) Exploiting is the dominant strategy for both firms if $\pi^n < \tilde{\pi}^e$ *and* $\tilde{\pi}^n < \pi^e$*.*

Proof. (i) First, suppose that firm $-j$ does not exploit. The best response of firm j is to not exploit since $\pi^n > \tilde{\pi}^e$. Now suppose that firm $-j$ does exploit. The best response of firm j is to not exploit since $\tilde{\pi}^n > \pi^e$. Hence, in any case, the best response is to not exploit and thus, the dominant strategy. The best response of firm $-j$ is similarly.

(ii) First, suppose that firm $-j$ does not exploit. The best response of firm j is to exploit since $\pi^n < \tilde{\pi}^e$. Now suppose that firm $-j$ does exploit. The best response of firm j is to exploit since $\tilde{\pi}^n < \pi^e$. Hence, in any case, the best response is to exploit and thus the dominant strategy. The best response of firm $-j$ is similarly. □

Now, we can proof the statements in Lemma A.3.

(a) (i) By Lemma A.4, we have $\pi^n > \tilde{\pi}^e$ and $\tilde{\pi}^n > \pi^e$ if $\alpha < \min\{\bar{\alpha}, \hat{\alpha}\}$. Hence, by Lemma A.5, it is optimal for both firms to not exploit behavioral consumers, and set $p_1^* = p_1^n$ and $p_2^* = W(v_2)$.

(ii) By Lemma A.4, we have $\pi^n < \tilde{\pi}^e$ and $\tilde{\pi}^n < \pi^e$ if $\alpha > \max\{\bar{\alpha}, \hat{\alpha}\}$. Hence, by Lemma A.5, it is optimal for both firms to exploit behavioral consumers, and set $p_1^* = p_1^e(\alpha)$ and $p_2^* = W(v_2, \tilde{\Delta})$.

(iii) By Lemma A.4, we have $\pi^n > \tilde{\pi}^e$ and $\tilde{\pi}^n < \pi^e$ if $\bar{\alpha} < \alpha < \hat{\alpha}$. Suppose that firm $-j$ does not exploit. The best response of firm j is to not exploit since $\pi^n > \tilde{\pi}^e$. Now suppose that firm $-j$ does exploit. The best response of firm j is to exploit since $\tilde{\pi}^n < \pi^e$. Hence, the best response of firm j is to do the same as firm $-j$. The best response of firm $-j$ is similarly. Thus, there exists two Nash equilibria in pure strategies {(not exploit, not exploit),(exploit,exploit)}.

(iv) By Lemma A.4, we have $\pi^n < \tilde{\pi}^e$ and $\tilde{\pi}^n > \pi^e$ if $\hat{\alpha} < \alpha < \bar{\alpha}$. Suppose that firm $-j$ does not exploit. The best response of firm j is to exploit since $\pi^n < \tilde{\pi}^e$. Now suppose that firm $-j$ does exploit. The best response of firm j is to not exploit since $\tilde{\pi}^n > \pi^e$. Hence, the best response of firm j is to do the opposite as firm $-j$. The best response of firm $-j$ is similarly. Thus, there exists two Nash equilibria in pure strategies {(not exploit, exploit),(exploit, not exploit)}.

(b) (i) By Lemma A.4, we have $\pi^n > \tilde{\pi}^e$. If $\tilde{\pi}^n > \pi^e$, then by Lemma A.5, it is optimal for both firms to not exploit behavioral consumers. Thus, the unique symmetric non-exploiting equilibrium emerges. Otherwise, if $\tilde{\pi}^n < \pi^e$, case $(a)(iii)$ arises and the best response of firm j is to do the same as firm $-j$. Thus, multiple symmetric equilibria emerge. In either case, only symmetric equilibria exist.

(ii) By Lemma A.4, we have $\pi^n < \tilde{\pi}^e$. If $\tilde{\pi}^n < \pi^e$, then by Lemma A.5, it is optimal for both firms to exploit behavioral consumers. Thus, the unique symmetric exploiting equilibrium emerges. Otherwise, if $\tilde{\pi}^n > \pi^e$, case $(a)(iv)$ arises and the best response of firm j is to do the opposite as firm $-j$. Thus, multiple asymmetric equilibria emerge. The symmetric non-exploiting equilibrium does not exist if $\alpha > \hat{\alpha}$.

$\square$

B Proofs Main Results

B.1 Proof of Lemma 1

By Lemma A.1 and A.2, there exists a unique solution $\bar{\alpha}_{p^k} \in \mathbb{R}$ to $p_1^n = p_1^k(\alpha)$ solved for α, where $p_1^k \in \{p_1^e(\alpha), \tilde{p}_1^n, \tilde{p}_1^e\}$. First, suppose $\alpha = \bar{\alpha}_{\tilde{p}_1^n}$. Then, from Section A,

$$\begin{aligned}
& p_1^n = \tilde{p}_1^n(\bar{\alpha}_{\tilde{p}_1^n}) \\
\Leftrightarrow \quad & \frac{-D(p_1^n, p_1^n)}{D'(p_1^n, p_1^n)} = \frac{-D(\tilde{p}_1^n(\bar{\alpha}_{\tilde{p}_1^n}), \tilde{p}_1^e(\bar{\alpha}_{\tilde{p}_1^n}))}{D'(\tilde{p}_1^n(\bar{\alpha}_{\tilde{p}_1^n}), \tilde{p}_1^e(\bar{\alpha}_{\tilde{p}_1^n}))} \\
\Leftrightarrow \quad & \frac{-D(p_1^n, p_1^n)}{D'(p_1^n, p_1^n)} = \frac{-D(p_1^n, \tilde{p}_1^e(\bar{\alpha}_{\tilde{p}_1^n}))}{D'(p_1^n, \tilde{p}_1^e(\bar{\alpha}_{\tilde{p}_1^n}))}
\end{aligned} \tag{4}$$

Consider the equation $\pi^n = \tilde{\pi}^n$, which must have a solution by Lemma A.1.

$$\begin{aligned}
& \pi^n = \tilde{\pi}^n \\
\Leftrightarrow \quad & \frac{-D(p_1^n, p_1^n)^2}{D'(p_1^n, p_1^n)} = \frac{-D(\tilde{p}_1^n(\bar{\alpha}_{\tilde{p}_1^n}), \tilde{p}_1^e(\bar{\alpha}_{\tilde{p}_1^n}))^2}{D'(\tilde{p}_1^n(\bar{\alpha}_{\tilde{p}_1^n}), \tilde{p}_1^e(\bar{\alpha}_{\tilde{p}_1^n}))} \\
\Leftrightarrow \quad & \frac{-D(p_1^n, p_1^n)^2}{D'(p_1^n, p_1^n)} = \frac{-D(p_1^n, \tilde{p}_1^e(\bar{\alpha}_{\tilde{p}_1^n}))^2}{D'(p_1^n, \tilde{p}_1^e(\bar{\alpha}_{\tilde{p}_1^n}))} \\
\Leftrightarrow \quad & D(p_1^n, p_1^n) = D(p_1^n, \tilde{p}_1^e(\bar{\alpha}_{\tilde{p}_1^n})),
\end{aligned}$$

where the last equality follows from Equation (4), which holds only if $p_1^n = \tilde{p}_1^e(\bar{\alpha}_{\tilde{p}_1^n})$. Thus, when $\alpha = \bar{\alpha}_{\tilde{p}_1^n}$, it must be $p_1^n = \tilde{p}_1^e(\bar{\alpha}_{\tilde{p}_1^n})$. Since this must be unique, we have $\bar{\alpha}_{\tilde{p}_1^n} = \bar{\alpha}_{\tilde{p}_1^e}$, where

$$\begin{aligned}
p_1^n &= \tilde{p}_1^e(\bar{\alpha}_{\tilde{p}_1^e}) \\
\frac{-D(p_1^n, p_1^n)}{D'(p_1^n, p_1^n)} - W(v_2) &= \frac{-[1 + \bar{\alpha}_{\tilde{p}_1^e} W'(v_2, \tilde{\Delta})] D(\tilde{p}_1^e(\bar{\alpha}_{\tilde{p}_1^e}), \tilde{p}_1^n(\bar{\alpha}_{\tilde{p}_1^e}))}{D'(\tilde{p}_1^e(\bar{\alpha}_{\tilde{p}_1^e}), \tilde{p}_1^n(\bar{\alpha}_{\tilde{p}_1^e}))} - \bar{\alpha}_{\tilde{p}_1^e} W(v_2, \tilde{\Delta}) \\
\bar{\alpha}_{\tilde{p}_1^e} &= \frac{W(v_2)}{W(v_2, \tilde{\Delta}) + \frac{W'(v_2, \tilde{\Delta}) D(p_1^n, p_1^n)}{D'(p_1^n, p_1^n)}} = \bar{\alpha}_{\tilde{p}_1^n},
\end{aligned}$$

and $\tilde{\Delta} = \beta_i \Delta(p_2, \tilde{p}_1^e(\bar{\alpha}_{\tilde{p}_1^e})) = \beta_i \Delta(p_2, p_1^n)$.

Now, suppose $\alpha = \bar{\alpha}_{p_1^e}$. Then,

$$\begin{aligned}
p_1^n &= p_1^e(\bar{\alpha}_{p_1^e}) \\
\frac{-D(p_1^n, p_1^n)}{D'(p_1^n, p_1^n)} - W(v_2) &= \frac{-[1 + \bar{\alpha}_{p_1^e} W'(v_2, \tilde{\Delta})] D(p_1^e(\bar{\alpha}_{p_1^e}), p_1^e(\bar{\alpha}_{p_1^e}))}{D'(p_1^e(\bar{\alpha}_{p_1^e}), p_1^e(\bar{\alpha}_{p_1^e}))} - \bar{\alpha}_{p_1^e} W(v_2, \tilde{\Delta})
\end{aligned}$$

$$\bar{\alpha}_{p_1^e} = \frac{W(v_2)}{W(v_2,\tilde{\Delta}) + \frac{W'(v_2,\tilde{\Delta})D(p_1^n,p_1^n)}{D'(p_1^n,p_1^n)}},$$

and $\tilde{\Delta} = \beta_i \Delta(p_2, p_1^e(\bar{\alpha}_{p_1^e})) = \beta_i \Delta(p_2, p_1^n)$. Observe that $\bar{\alpha}_{p_1^e} = \bar{\alpha}_{\tilde{p}_1^n} = \bar{\alpha}_{\tilde{p}_1^e}$. Thus, we can define a single threshold

$$\bar{\alpha}_p = \begin{cases} \dfrac{W(v_2)}{W(v_2,\tilde{\Delta}) + \frac{W'(v_2,\tilde{\Delta})D(p_1^*,p_1^*)}{D'(p_1^*,p_1^*)}}, & \text{for } \epsilon_D \neq \epsilon_W \\ \infty, & \text{for } \epsilon_D = \epsilon_W, \end{cases}$$

where $p_1^* \in \{p_1^n, p_1^e(\bar{\alpha}_p), \tilde{p}_1^n(\bar{\alpha}_p), \tilde{p}_1^e(\bar{\alpha}_p)\}$. Further, in the benchmark economy ($\alpha = 0$), only the non-exploiting strategy is possible, which implies $p_1^{BM} = p_1^n$. Hence, $p_1^{BM} = p_1^n = p_1^e(\bar{\alpha}_p) = \tilde{p}_1^n(\bar{\alpha}_p) = \tilde{p}_1^e(\bar{\alpha}_p)$.

(i) $\epsilon_D > \epsilon_W$ implies $\bar{\alpha}_p > 0$. Further, by Lemma A.1, the prices $p_1^e(\alpha)$, $\tilde{p}_1^n(\alpha)$ and $\tilde{p}_1^e(\alpha)$ are decreasing in α when $\epsilon_D > \epsilon_W$ and $p_1^{BM} = p_1^n$ are constant in α. Hence, for any $\alpha \in (\min\{\bar{\alpha}, \hat{\alpha}\}, \bar{\alpha}_p)$, it follows $p_1^k > p_1^{BM}$, and for any $\alpha > \bar{\alpha}_p$ it follows $p_1^k < p_1^{BM}$.

(ii) $\epsilon_D < \epsilon_W$ implies $\bar{\alpha}_p < 0$. By Lemma A.1, the prices $p_1^e(\alpha)$, $\tilde{p}_1^n(\alpha)$ and $\tilde{p}_1^e(\alpha)$ are increasing in α when $\epsilon_D < \epsilon_W$ and $p_1^{BM} = p_1^n$ are constant in α. Hence, for any $\alpha > 0 > \bar{\alpha}_p$, it follows $p_1^k > p_1^{BM}$.

□

B.2 Proof of Proposition 1

Lemma B.1. *Suppose $\epsilon_D > \epsilon_W$. The price threshold is larger than any profit threshold,* $\max\{\hat{\alpha}, \bar{\alpha}\} < \bar{\alpha}_p$.

Proof. Suppose $\alpha = \bar{\alpha}_p$. Hence, $p_1^n = p_1^e(\bar{\alpha}_p) = \tilde{p}_1^n(\bar{\alpha}_p) = \tilde{p}_1^e(\bar{\alpha}_p)$. It follows

$$\pi^n = \frac{-D(p_1^n,p_1^n)^2}{D'(p_1^n,p_1^n)} < \frac{-[1+\alpha W'(v_2,\tilde{\Delta})]D(\tilde{p}_1^e(\bar{\alpha}_p),\tilde{p}_1^n(\bar{\alpha}_p))^2}{D'(\tilde{p}_1^e(\bar{\alpha}_p),\tilde{p}_1^n(\bar{\alpha}_p))} = \tilde{\pi}^e,$$

since $p_1^n = \tilde{p}_1^n(\bar{\alpha}_p) = \tilde{p}_1^e(\bar{\alpha}_p)$ and $W'(v_2,\tilde{\Delta}) > 0$. By Lemma A.4, it must be $\alpha > \hat{\alpha}$ when $\pi^n < \tilde{\pi}^e$. Thus, $\bar{\alpha}_p > \hat{\alpha}$.

Further, we have

$$\tilde{\pi}^n = \frac{-D(\tilde{p}_1^n(\bar{\alpha}_p),\tilde{p}_1^e(\bar{\alpha}_p))^2}{D'(\tilde{p}_1^n(\bar{\alpha}_p),\tilde{p}_1^e(\bar{\alpha}_p))} < \frac{-[1+\alpha W'(v_2,\tilde{\Delta})]D(p_1^e(\bar{\alpha}_p),p_1^e(\bar{\alpha}_p))^2}{D'(p_1^e(\bar{\alpha}_p),p_1^e(\bar{\alpha}_p))} = \pi^e,$$

since $p_1^e(\bar{\alpha}_p) = \tilde{p}_1^n(\bar{\alpha}_p) = \tilde{p}_1^e(\bar{\alpha}_p)$ and $W'(v_2,\tilde{\Delta}) > 0$. By Lemma A.4, it must be $\alpha > \bar{\alpha}$ when $\tilde{\pi}^n < \pi^e$. Thus, $\bar{\alpha}_p > \bar{\alpha}$. Hence, $\max\{\hat{\alpha}, \bar{\alpha}\} < \bar{\alpha}_p$. □

We denote the utility a consumer receives from the base good with v_1. The surplus of a classical consumer in the benchmark economy ($\alpha = 0$) is given by $U_c^{total} = v_1 - p_1 + W(v_2) - p_2 = v_1 - p_1^{BM}$ since $p_2 = W(v_2)$ in any benchmark (and symmetric non-exploiting) equilibrium. Hence, not consuming the add-on does not decrease the surplus of a classical consumer. A classical consumer benefits, compared to the benchmark, from the presence of behavioral consumers when $p_1^* < p_1^{BM}$. Otherwise, when $p_1^* > p_1^{BM}$, classical consumers are harmed.

(a) Since $p_1^n = p_1^{BM}$ in any symmetric non-exploiting equilibrium, the surplus of a classical consumer is the same as in the benchmark. Hence, they are unaffected by the presence of behavioral consumers. Further, the market is unchanged since prices are identical to the benchmark.

(b) (i) By Lemma A.3, there exists symmetric exploiting equilibria with $p_1^* = p_1^e(\alpha)$ for $\alpha > \min\{\bar{\alpha}, \hat{\alpha}\}$. By Lemma 1, we have $p_1^e(\alpha) > p_1^{BM}$ for $\alpha \in (\min\{\bar{\alpha}, \hat{\alpha}\}, \bar{\alpha}_p)$, which reduces a classical consumer's surplus compared to the benchmark. Thus, classical consumers are harmed by the presence of behavioral consumers. Lemma B.1 proofs that $\alpha \in (\min\{\hat{\alpha}, \bar{\alpha}\}, \bar{\alpha}_p)$ exists. By Lemma 1, we have $p_1^e(\alpha) < p_1^{BM}$ for all $\alpha > \bar{\alpha}_p$, which increases a classical consumer's surplus compared to the benchmark. Thus, classical consumers benefit by the presence of behavioral consumers.

(ii) By Lemma A.3, asymmetric equilibria exist only if $\hat{\alpha} < \alpha < \bar{\alpha}$. Therefore, by Lemma B.1, we have $\alpha < \bar{\alpha}_p$ in any asymmetric equilibrium, which implies, by Lemma 1, $\tilde{p}_1^n(\alpha) > p_1^{BM}$ and $\tilde{p}_1^e(\alpha) > p_1^{BM}$. Hence, regardless from which firm classical consumers buy the base good, their surplus is lower compared to the benchmark. Thus, classical consumers are harmed by the presence of behavioral consumers in any asymmetric equilibrium.

(c) By Lemma A.3, there exists symmetric exploiting equilibria and asymmetric equilibria. By Lemma 1, we have $p_1^* \in \{p_1^e(\alpha), \tilde{p}_1^n(\alpha), \tilde{p}_1^e(\alpha)\} > p_1^{BM}$ for all α. Hence, a classical consumer's surplus is lower compared to the benchmark in any symmetric exploiting equilibrium or asymmetric equilibrium. Thus, classical consumers are harmed by the presence of behavioral consumers.

□

B.3 Proof of Proposition 2

(a) The surplus of a behavioral consumer, when the behavioral effect does not increase the add-on utility, is given by $U_b^{total} = v_1 - p_1 + W(v_2) - p_2$, where v_1 denotes the gross utility received from the base good. The surplus of a behavioral consumer, when the behavioral effect increases the add-on utility, is given by $\tilde{U}_b^{total} = v_1 - p_1 + W(v_2, \tilde{\Delta}) - p_2$. The condition that behavioral consumers are worse off by exploitation is independent of whether U_b^{total} or $\tilde{U}_b^{total}$ applies:

$$U_b^{NE} = v_1 - p_1^n + W(v_2) - p_2^{NE} > v_1 - p_1^e(\alpha) + W(v_2) - p_2^E = U_b^E$$
$$\Leftrightarrow \quad p_1^e(\alpha) > p_1^n + W(v_2) - W(v_2, \tilde{\Delta}(p_1^e(\alpha))) \tag{5}$$
$$\tilde{U}_b^{NE} = v_1 - p_1^n + W(v_2, \tilde{\Delta}(p_1^n)) - p_2^{NE} > v_1 - p_1^e(\alpha) + W(v_2, p_1^e(\alpha)) - p_2^E = \tilde{U}_b^E$$
$$\Leftrightarrow \quad p_1^e(\alpha) > p_1^n + W(v_2) - W(v_2, \tilde{\Delta}(p_1^n)), \tag{6}$$

where the superscripts NE and E indicate the total surplus given a firm does (not) exploit. Observe that the term $W(v_2, \tilde{\Delta})$ in (5) and (6) is different because in the former, the reference price is $p_1^e(\alpha)$ and in the latter p_1^n. However, we show that the condition is satisfied for any reference price. The condition $p_1^e(\alpha) > p_1^n + W(v_2) - W(v_2, \tilde{\Delta})$ holds for all $\alpha \in [0, 1]$. It is immediate to see that the condition is satisfied when $\alpha \leq \bar{\alpha}_p$, which implies $p_1^e(\alpha) \geq p_1^n$ by Lemma 1, and since $W(v_2) < W(v_2, \tilde{\Delta})$. For asymmetric equilibria, we just need to substitute $p_1^e(\alpha)$ with $\tilde{p}_1^n(\alpha)$ or $\tilde{p}_1^e(\alpha)$, respectively. The condition is always satisfied since asymmetric equilibria only exist for $\alpha < \bar{\alpha}_p$ and $\tilde{p}_1^n(\alpha) \geq p_1^n$ and $\tilde{p}_1^e(\alpha) \geq p_1^n$ when $\alpha \leq \bar{\alpha}_p$.

When $\alpha > \bar{\alpha}_p$, which implies $p_1^e(\alpha) < p_1^n$, we need an intermediate step. Consider the following inequality and observe

$$\begin{aligned} \frac{[1+\alpha W'(v_2,\tilde{\Delta})]D(p_1^e(\alpha),p_1^e(\alpha))}{-D'(p_1^e(\alpha),p_1^e(\alpha))} &> \frac{D(p_1^n,p_1^n)}{-D'(p_1^n,p_1^n)} \\ \alpha > \frac{\frac{D(p_1^n,p_1^n)}{-D'(p_1^n,p_1^n)}\frac{-D'(p_1^e(\alpha),p_1^e(\alpha))}{D(p_1^e(\alpha),p_1^e(\alpha))}-1}{W'(v_2,\tilde{\Delta})} &= \frac{\frac{\epsilon_{D(e)}}{\epsilon_{D(n)}}-1}{W'(v_2,\tilde{\Delta})} \\ \alpha \geq 0 &> \frac{\frac{\epsilon_{D(e)}}{\epsilon_{D(n)}}-1}{W'(v_2,\tilde{\Delta})}, \end{aligned} \tag{7}$$

where $D(s) = D(p_1^s, p_1^s)$ for $s = n, e$. The last inequality follows from the fact that $\frac{\partial \epsilon_D}{\partial p_1} > 0$ when $\epsilon_D > \epsilon_W$ by the proof of Lemma A.2. Thus, we have $\epsilon_{D(n)} > \epsilon_{D(e)}$ when $p_1^e(\alpha) < p_1^n$, which implies $\frac{\epsilon_{D(e)}}{\epsilon_{D(n)}} - 1 < 0$.

Now, we use the property of inequality (7) to show that $p_1^e(\alpha) < p_1^n + W(v_2) - W(v_2, \tilde{\Delta})$ never holds for $\alpha \in [0, 1]$.

$$\begin{aligned} p_1^e(\alpha) &< p_1^n + W(v_2) - W(v_2,\tilde{\Delta}) \\ \frac{[1+\alpha W'(v_2,\tilde{\Delta})]D(p_1^e(\alpha),p_1^e(\alpha))}{-D'(p_1^e(\alpha),p_1^e(\alpha))} - \alpha W(v_2,\tilde{\Delta}) &< \frac{D(p_1^n,p_1^n)}{-D'(p_1^n,p_1^n)} - W(v_2,\tilde{\Delta}) \\ \alpha &> \underbrace{\frac{\frac{[1+\alpha W'(v_2,\tilde{\Delta})]D(p_1^e(\alpha),p_1^e(\alpha))}{-D'(p_1^e(\alpha),p_1^e(\alpha))} - \frac{D(p_1^n,p_1^n)}{-D'(p_1^n,p_1^n)}}{W(v_2,\tilde{\Delta})}}_{>0} + 1 > 1, \end{aligned}$$

which is a contradiction for any $\alpha \in [0, 1]$. Hence, it must be $p_1^e(\alpha) > p_1^n + W(v_2) - W(v_2, \tilde{\Delta})$ for any $\alpha \in [0, 1]$, which implies that behavioral consumers are always better off in a non-exploiting equilibrium (or benchmark economy) than in an exploiting equilibrium.

(b) We have $p_1^k > p_1^n$ when $\epsilon_D < \epsilon_W$, or $\epsilon_D > \epsilon_W$ and $\alpha < \bar{\alpha}_p$, where $p_1^k \in \{p_1^e(\alpha), \tilde{p}_1^n, \tilde{p}_1^e\}$, implying $D(p_1^k, \cdot) < D(p_1^n, p_1^n)$. Thus, consumer surplus in the base good market must be strictly lower when at least one firm exploits in equilibrium than in the symmetric non-exploiting equilibrium. Further, by part (*a*), behavioral consumers have a larger add-on surplus when not exploited. Classical consumers have an add-on surplus of zero in any case. Hence, total consumer surplus under exploitation is strictly lower when $\epsilon_D < \epsilon_W$, or $\epsilon_D > \epsilon_W$ and $\alpha < \bar{\alpha}_p$.

When $\epsilon_D > \epsilon_W$ and $\alpha > \bar{\alpha}_p$, we have $p_1^e(\alpha) < p_1^n$, implying $D(p_1^e(\alpha), p_1^e(\alpha)) > D(p_1^n, p_1^n)$. Hence, consumer surplus in the base good market must be strictly larger under exploitation. Asymmetric equilibria do not exist. From part (*a*) again, behavioral consumers have a larger add-on surplus when not exploited. Hence, the effect of exploitation on total consumer surplus is ambiguous. □

C Further Results

C.1 Monopoly and Perfect Competition

Suppose that base goods are perfectly differentiated, then each firm is a monopolist in its respective base-good market. Further, suppose that $D(p_1)$ is strictly decreasing, twice continuously differentiable, $\lim_{p_1 \to \infty} D(p_1) = 0$ and satisfies $D(p_1)D''(p_1) < 2D'(p_1)^2$. Observe that the monopolist's maximization problem is similar to equation (1) without $p_{1,-j}$, and yields $\pi^n = \pi(p_1^n, W(v_2))$ when choosing the non-exploiting strategy and $\pi^e = \pi(p_1^e(\alpha), W(v_2, \tilde{\Delta}))$ when choosing the exploiting strategy. Note that the profits and prices are similar to the symmetric outcomes with two firms. Therefore, we can directly apply Lemma A.1 and Lemma A.2, which implies that π^n is constant in α and π^e strictly increasing in α. Define the profit threshold $\hat{\alpha}$ such that $\pi^n = \pi^e$.

Lemma C.1.

(i) If $\alpha < \hat{\alpha}$, then the monopolist does not exploit and sets $p_1^* = p_1^n$ and $p_2^* = W(v_2)$.

(ii) If $\alpha > \hat{\alpha}$, then the monopolist exploits and sets $p_1^* = p_1^e(\alpha)$ and $p_2^* = W(v_2, \tilde{\Delta})$.

Proof. The proof is analogous to the proof of Lemma A.3. □

The remainder of the analysis is similar to the baseline model with two firms. The critical price threshold $\bar{\alpha}_p$ is unchanged. Therefore, Lemma 1 without asymmetric prices follows immediately. Further, analogous to Lemma B.1, we have $\hat{\alpha} < \bar{\alpha}_p$. Thus, Proposition C.1 (a) and (b) below follow and is analogous to Proposition 1 and 2.

Proposition C.1 (Monopoly and perfect competition)**.**

(a) Under a monopolist, the presence of behavioral consumers harms classical consumers in any exploiting equilibrium except if $\alpha > \bar{\alpha}_p$ and $\epsilon_D > \epsilon_W$. Classical consumers are unaffected in any non-exploiting equilibrium.

(b) Behavioral consumers are worse off when a monopolist exploits them. Exploitation strictly lowers total consumer surplus except when $\epsilon_D > \epsilon_W$ and $\alpha > \bar{\alpha}_p$. Then, the effect on total consumer surplus is ambiguous.

(c) Classical consumers are never harmed by the presence of behavioral consumers under perfect price competition. Classical consumers benefit in any symmetric exploiting equilibrium and are unaffected in any symmetric non-exploiting equilibrium.

Proof. (a) The proof is analogous to the proof to Proposition 1.

(b) The proof is analogous to the proof to Proposition 2.

(c) Firms must earn zero profits under perfect competition implying $p_{1,j}D(\cdot) = -p_2 Q(\cdot)$. Further, they must offer the lowest price given the zero profit constraint. Otherwise, firms would face zero demand. Thus, it must be $p_1^* = \min\{-W(v_2), -\alpha W(v_2, \tilde{\Delta})\}$. Hence, it is optimal to exploit behavioral consumers only if $\alpha W(v_2, \tilde{\Delta}) > W(v_2)$. The unique symmetric exploiting equilibrium exists if and only if $\alpha > \frac{W(v_2)}{W(v_2, \tilde{\Delta})}$. Otherwise, when $\alpha < \frac{W(v_2)}{W(v_2, \tilde{\Delta})}$, the unique symmetric non-exploiting equilibrium exists. In the benchmark economy with $\alpha = 0$, firms choose $p_2 = W(v_2)$ and

$p_1^{BM} = -W(v_2)$. Thus, in any symmetric non-exploiting equilibrium, firms set $p_1^n = p_1^{BM} = -W(v_2)$ and classical consumers are unaffected by the presence of behavioral consumers. In any exploiting equilibrium, it must be $p_1^e = -\alpha W(v_2, \tilde{\Delta}) < -W(v_2) = p_1^{BM}$. Hence, classical consumers have to pay strictly less in any exploiting equilibrium than in the benchmark and thus, benefit. Lastly, there exist no profitable deviations for firms. Changing p_2 leads to less add-on revenues and thus, a higher p_1 and zero base-good demand. Increasing p_1 leads to zero demand and thus zero profits. Decreasing p_1 would lead to negative profits.

□

C.2 Proof of Proposition 3

The surplus of a classical and behavioral consumer are characterized in the proof of Proposition 1 and 2, and given by U_c^{total}, U_b^{total} and $\tilde{U}_b^{total}$, respectively.

(a) Observe that $\frac{\partial p_1^e(\alpha)}{\partial \alpha} < 0$ when $\epsilon_D > \epsilon_W$ by Lemma A.1 and both firms exploit ex-ante when $\alpha_0 > \max\{\bar{\alpha}, \hat{\alpha}\}$ by Lemma A.3.

  (i) By definition, the ex-post equilibrium is identical to the ex-ante equilibrium for a small shock and both firms still set $p_1^e(\alpha)$. Denote with α_0 the share of behavioral consumers ex-ante and with α' the share ex-post. A small negative shock implies $\alpha' < \alpha_0$. Since $\alpha' < \alpha_0$ and $\frac{\partial p_1^e(\alpha)}{\partial \alpha} < 0$, we have $p_1^e(\alpha') > p_1^e(\alpha_0)$. Since $\frac{\partial W(v_2, \tilde{\Delta})}{\partial p_1} > 0$, the add-on price $p_2^* = W(v_2, \tilde{\Delta})$ also increases ex-post. The add-on surplus for behavioral consumers is either worse (when U_b^{total} applies) or unaffected (when $\tilde{U}_b^{total}$ applies) ex-post. The add-on surplus for classical consumers remains at zero. The base-good surplus for any type is strictly lower ex-post since v_1 is unchanged and p_1 is strictly larger. Hence, behavioral and classical consumers are worse off by a small negative shock in α.

  (ii) We first prove the result for classical consumers. By definition, a large negative shock leads to a non-exploiting equilibrium ex-post with $p_1^* = p_1^n = p_1^{BM}$ and $p_2^* = W(v_2)$. The add-on surplus remains at zero since $p_2^* = W(v_2)$. Hence, a classical consumer benefits when $p_1^e(\alpha_0) > p_1^{BM}$, which, by Lemma 1, is the case when $\alpha_0 < \bar{\alpha}_p$. Otherwise, for $\alpha_0 > \bar{\alpha}_p$, we have $p_1^e(\alpha_0) < p_1^{BM}$, and the shock harms classical consumers.

  The condition that behavioral consumers benefit from a large negative shock is independent of whether U_b^{total} or $\tilde{U}_b^{total}$ applies and is identical to the condition in the proof of Proposition 2. It must be $p_1^e(\alpha_0) > p_1^{BM} + W(v_2) - W(v_2, \tilde{\Delta})$ for any $\alpha \in [0, 1]$, which implies that the surplus of behavioral consumers in the benchmark economy (or non-exploiting equilibrium) is always larger than in the exploiting equilibrium.

  (iii) Since $\frac{\partial p_1^e(\alpha)}{\partial \alpha} < 0$, any increase in α lowers the base good price, $p_1^e(\alpha') < p_1^e(\alpha_0)$. Since $\frac{\partial W(v_2, \tilde{\Delta})}{\partial p_1} > 0$, the add-on price also decreases. Hence, both consumer types must be strictly better off, when α increases.

(b) Since $\epsilon_D < \epsilon_W$, it follows $\frac{\partial p_1^e(\alpha)}{\partial \alpha} > 0$ by Lemma A.1. Hence, by the logic in part (a), any reduction in α reduces prices, which benefits both consumer types. Similarly, any increase in α increases prices, which harms both consumer types.

□

C.3 Proof of Proposition 4

(a) First, a price cap $\bar{p}_2 \in (W(v_2), W(v_2, \tilde{\Delta}))$ affects only $\pi^e = \pi(p_1^e(\alpha), p_1^e(\alpha), W(v_2, \tilde{\Delta}))$ and $\tilde{\pi}^e = \pi(\tilde{p}_1^e(\alpha), \tilde{p}_1^n(\alpha), W(v_2, \tilde{\Delta}))$, but not $\pi^n = \pi(p_1^n, p_1^n, W(v_2))$ and $\tilde{\pi}^n = \pi(\tilde{p}_1^n(\alpha), \tilde{p}_1^e(\alpha), W(v_2))$. It follows that π^e and $\tilde{\pi}^e$ must be strictly lower when $\bar{p}_2$ constrains the maximization problem. The constrained maximization problem is

$$\max_{p_{1,j}}(p_{1,j} + \alpha\bar{p}_2)D_j(p_{1,j}, p_{1,-j}) \quad \text{s.t.} \quad W(v_2, \beta\Delta(p_1, \bar{p}_2)) \geq \bar{p}_2.$$

The side condition guarantees that behavioral consumers still purchase the add-on at price $\bar{p}_2$. Maximizing with the Karush–Kuhn–Tucker approach yields

$$\bar{p}_1^e = \frac{-[1 + \alpha W'(v_2, \beta\Delta(p_1, \bar{p}_2))]D(\bar{p}_1^e, \cdot)}{D'(\bar{p}_1^e, \cdot)} - \alpha\bar{p}_2,$$
$$\bar{\pi}^e = \frac{-[1 + \alpha W'(v_2, \beta\Delta(p_1, \bar{p}_2))]D(\bar{p}_1^e, \cdot)^2}{D'(\bar{p}_1^e, \cdot)}$$

Similar to the findings in Lemma A.1, $\bar{\pi}^e$ is strictly increasing in α. Hence, similarly to Lemma A.4, we can derive the profit thresholds, $\hat{\alpha}'$ and $\bar{\alpha}'$. Since $\bar{\pi}^e < \pi^e$ and $\bar{\pi}^e < \tilde{\pi}^e$, while π^n are unchanged $\tilde{\pi}^n$, it must be $\hat{\alpha}' > \hat{\alpha}$ and $\bar{\alpha}' > \bar{\alpha}$. Thus, by the equilibrium characterization in Lemma A.3, the symmetric non-exploiting equilibrium exists for a larger interval of α.

The new price threshold is given by

$$\bar{\alpha}_p' = \frac{W(v_2)}{\bar{p}_2 + \frac{\frac{\partial W(\cdot)}{\partial p_1} D(p_1^*, p_1^*)}{\frac{\partial D(p_1^*, p_1^*)}{\partial p_1}}},$$

which is strictly larger than without the regulation, $\bar{\alpha}_p' > \bar{\alpha}_p$, since $\bar{p}_2 < W(v_2, \tilde{\Delta})$ and the other terms are unchanged because p_1^{BM} is unchanged. Thus, similar to Lemma B.1, we can show $\bar{\alpha}_p' > \max\{\hat{\alpha}', \bar{\alpha}'\}$. The proof is analogous to the proof of Lemma B.1. Lastly, it must be $\bar{p}_1^e > p_1^e(\alpha)$. Observe that $\bar{p}_1^e = p_1^e(\alpha)$ when $\bar{p}_2 = W(v_2, \tilde{\Delta})$ and that $\bar{p}_1^e$ is strictly decreasing in $\bar{p}_2$, while $p_1^e(\alpha)$ is independent of $\bar{p}_2$. Hence, for any $\bar{p}_2 < W(v_2, \tilde{\Delta})$, it follows that $\bar{p}_1^e > p_1^e(\alpha)$.

(b) An ineffective price cap implies still exploitation ex-post. Since $\bar{p}_1^e > p_1^e(\alpha)$, classical consumers must be worse off ex-post. Similarly for behavioral consumers, but they pay a lower add-on price. When U_b^{total} applies, the benefit of a lower price is $W(v_2, \tilde{\Delta}) - \bar{p}_2$. In this case, behavioral consumers are better off by an inefficient policy if $W(v_2, \tilde{\Delta}) - \bar{p}_2 > \bar{\pi}_1^e - p_1^e(\alpha)$. Otherwise, they are worse off. When $\tilde{U}_b^{total}$ applies, the benefit of a lower price in the add-on market is zero. Thus, in this case, behavioral consumers are strictly worse off.

(c) The proof is analogous to the proof of Proposition 3. The surplus of behavioral consumers must be strictly larger in any symmetric non-exploiting equilibrium. For classical consumers, it depends on whether we have $\epsilon_D > \epsilon_W$ and $\alpha > \bar{\alpha}_p$, which implies $p_1^e(\alpha) < p_1^{BM} = p_1^n$, or $\epsilon_D > \epsilon_W$ and $\alpha < \bar{\alpha}_p$ or $\epsilon_D < \epsilon_W$, which both imply $p_1^e(\alpha) > p_1^{BM} = p_1^n$.

$\square$

C.4 Proof of Proposition 5

(a) A binding price floor implies $p_1^e(\alpha) < \underline{p}_1 < p_1^n = p_1^{BM}$ and thus, $\alpha > \bar{\alpha}_p$. When binding, the profit of an exploiting firm is $\pi^e = D(\underline{p}_1, \cdot)[\underline{p}_1 + \alpha W(v_2, \tilde{\Delta})]$. Observe that

$$\frac{\partial \pi^e}{\partial p_1} = D'(\cdot)[\underline{p}_1 + \alpha W(v_2, \tilde{\Delta})] + D(\cdot)[1 + \alpha W'(v_2, \tilde{\Delta})] < 0$$

when $\underline{p}_1 > \frac{[1+\alpha W'(v_2,\tilde{\Delta})]D(\cdot)}{-D'(\cdot)} - \alpha W(v_2, \tilde{\Delta})$, which holds for any

$$\underline{p}_1 > p_1^e(\alpha) = \frac{[1 + \alpha W'(v_2, \tilde{\Delta})]D(p_1^e(\alpha), p_1^e(\alpha))}{-D'(p_1^e(\alpha), p_1^e(\alpha)) - \alpha W(v_2, \tilde{\Delta})}.$$

Hence, for $p_1^e(\alpha) < \underline{p}_1 < \tilde{p}_1^n$ it follows

$$\begin{aligned} D(\underline{p}_1, \cdot)[\underline{p}_1 + \alpha W(v_2, \tilde{\Delta})] &> D(\tilde{p}_1^n, \cdot)[\tilde{p}_1^n + \alpha W(v_2, \tilde{\Delta})] \\ &> D(\tilde{p}_1^n, \cdot)[\tilde{p}_1^n + W(v_2)] = \frac{D(\tilde{p}_1^n, \cdot)^2}{-D'(\tilde{p}_1^n, \cdot)} = \tilde{\pi}^n \end{aligned}$$

Thus, we still have $\pi^e > \tilde{\pi}^n$ with a binding price floor. The second inequality holds because

$$\alpha W(v_2, \tilde{\Delta}) > \bar{\alpha}_p W(v_2, \tilde{\Delta}) = \frac{W(v_2, \tilde{\Delta})W(v_2)}{W(v_2, \tilde{\Delta}) + \frac{\frac{\partial W(v_2,\tilde{\Delta})}{\partial p_1} D(p_1^*, p_1^*)}{\frac{\partial D(p_1^*,p_1^*)}{\partial p_1}}} > W(v_2),$$

since $\alpha > \bar{\alpha}_p$ and $\frac{\frac{\partial W(v_2,\tilde{\Delta})}{\partial p_1} D(p_1^*, p_1^*)}{\frac{\partial D(p_1^*,p_1^*)}{\partial p_1}} < 0$. Similarly, for $p_1^e(\alpha) < \tilde{p}_1^n < \underline{p}_1$, we have

$$D(\underline{p}_1, \cdot)[\underline{p}_1 + \alpha W(v_2, \tilde{\Delta})] > D(\underline{p}_1, \cdot)[\underline{p}_1 + W(v_2)] = \frac{D(\underline{p}_1, \cdot)^2}{-D'(\underline{p}_1, \cdot)}.$$

Thus, symmetric exploitation is still optimal if the a price floor also affects the asymmetric outcome.

We can make the same arguments to show that $\tilde{\pi}^e > \pi^n$ ex-post. Hence, given the equilibrium characterization in Lemma A.3, symmetric exploitation is still optimal. Hence, any price floor $\underline{p}_1 < p_1^{BM}$ does not prevent exploitation.

(b) (i) A binding price floor implies $p_1^e(\alpha) < \underline{p}_1$. Since $\frac{\partial W(v_2,\tilde{\Delta})}{\partial p_1} > 0$ and $p_2^* = W(v_2, \tilde{\Delta})$ for any exploiting firm, the add-on price increases.

(ii) Since $D'(\cdot) < 0$ and $|D'(p_{1,j}, p_{1,-j})| > \left|\frac{\partial D_j(p_{1,j},p_{1,-j})}{\partial p_{1,-j}}\right|$, $p_1^e(\alpha) < \underline{p}_1$ implies $D(p_1^e(\alpha), p_1^e(\alpha)) > D(\underline{p}_1, \cdot)$.

The surplus of a classical and behavioral consumer are characterized in the proof of Proposition 1 and 2, and given by U_c^{total}, U_b^{total} and $\tilde{U}_b^{total}$, respectively. We can observe immediately that all consumers remaining in the market are worse since they have to pay a higher p_1. Classical consumers who do not buy anymore are worse off since it must be $v_1 - p_1^* \geq 0 > v_1 - \underline{p}_1$. Behavioral consumers who do not buy anymore benefit if $U_b = v_1 - p_1^e(\alpha)_1 + W(v_2) - W(v_2, \tilde{\Delta}) < 0$. Otherwise, they are harmed.

(c) We need to distinguish several cases. First, suppose $p_1^n = p_1^{BM} < \underline{p}_1 < p_1^k$, where $p_1^k \in \{p_1^e(\alpha), \tilde{p}_1^n, \tilde{p}_1^e\}$. In this case, a price floor distorts only the benchmark (or non-exploiting) outcome and the profits π^n. Hence, the threshold $\hat{\alpha}$ from Lemma A.4 is strictly lower. Given the equilibrium characterization in Lemma A.3, depending on the order of $\hat{\alpha}$ and $\bar{\alpha}$, the price floor either increases the range of the unique symmetric exploiting equilibrium or the range of asymmetric equilibrium at the cost of the range of the unique non-symmetric exploiting equilibrium.

Consider now $p_1^e(\alpha) < p_1^n = p_1^{BM} < \underline{p}_1$. This can only be the case when $\alpha > \bar{\alpha}_p$ and $\epsilon_D > \epsilon_W$, where only the unique symmetric exploiting equilibrium exists. If a firm exploits, it obtains $\pi^e = D(\underline{p}_1, \cdot)[\underline{p}_1 + \alpha W(v_2, \tilde{\Delta})]$. A non-exploiting firm obtains $\pi^n = D(\underline{p}_1, \cdot)[\underline{p}_1 + W(v_2)]$. Observe again that

$$\alpha W(v_2, \tilde{\Delta}) > \bar{\alpha}_p W(v_2, \tilde{\Delta}) = \frac{W(v_2, \tilde{\Delta}) W(v_2)}{W(v_2, \tilde{\Delta}) + \frac{\frac{\partial W(v_2, \tilde{\Delta})}{\partial p_1} D(p_1^*, p_1^*)}{\frac{\partial D(p_1^*, p_1^*)}{\partial p_1}}} > W(v_2),$$

since $\alpha > \bar{\alpha}_p$ and $\frac{\frac{\partial W(v_2, \tilde{\Delta})}{\partial p_1} D(p_1^*, p_1^*)}{\frac{\partial D(p_1^*, p_1^*)}{\partial p_1}} < 0$. Thus, we have $\pi^e > \pi^n$ and symmetric exploitation is still the unique equilibrium for $\alpha > \bar{\alpha}_p$.

Consider now $p_1^n = p_1^{BM} < p_1^k < \underline{p}_1$, which implies $\alpha < \bar{\alpha}_p$ and $\epsilon_D > \epsilon_W$, or $\epsilon_D < \epsilon_W$. Suppose that exploitation is optimal absent a price floor regulation. Then, by the argument above, exploitation must be still optimal for $p_1^n = p_1^{BM} < \underline{p}_1 \leq p_1^k$. In the special case $\underline{p}_1 = p_1^k$, we obtain again $\alpha W(v_2, \tilde{\Delta}) > W(v_2) \Leftrightarrow \pi^e > \pi^n$. Observe that $W(v_2, \tilde{\Delta})$ is strictly increasing in $\underline{p}_1$, while $W(v_2)$ remains constant. Thus, any larger price floor $p_1^n = p_1^{BM} < p_1^k < \underline{p}_1$ facilitates exploitation since a lower share α is required to satisfy the inequality $\alpha W(v_2, \tilde{\Delta}) > W(v_2)$.

□

C.5 Sequential Buying

We suppose the same setup as in the baseline model, but a fraction $\rho \in (0, 1)$ of base good buyers search for the cheapest add-on, while the fraction $(1 - \rho)$ stays loyal and purchases the add-on from the same company. Firms know the distribution of loyal consumers but cannot price discriminate. They choose prices p_1 and p_2 simultaneously and can commit to add-on prices.

In equilibrium, firms still choose between the non-exploiting strategy ($p_2 \leq W(v_2)$) and the exploiting strategy ($W(v_2) < p_2 \leq W(v_2, \tilde{\Delta})$), but mix over the choice of add-on prices. To see this, consider the symmetric equilibria given in Lemma A.3. Since searching consumers buy the add-on from the cheapest seller, a firm can profitably deviate by setting a slightly lower price and capturing all non-loyal customers. Hence, setting the monopolistic add-on price $p_2 \in \{W(v_2), W(v_2, \tilde{\Delta})\}$ with probability 1 is not optimal. The other extreme, marginal cost pricing and earning zero after-sales profits, is also not optimal. Firms can always just sell the add-on to the loyal consumers at the valuation of either classical or behavioral consumers and make positive after-sales profits. Thus, there is mixing in add-on prices, where firms must be indifferent between mixing, and potentially attracting some consumers from the rival, or setting $p_2 \in \{W(v_2), W(v_2, \tilde{\Delta})\}$, and sell the add-on to only loyal (non-) classical consumers. This result resembles the findings of Baye and Morgan (2001).

The expected profit of a non-exploiting firm is given by

$$\mathbb{E}\pi_j^n(p_{1,j}, p_{1,-j}, p_2^n) = p_{1,j}D_j(\cdot) + (1-\rho)D_j(\cdot)p_2^n + \rho[1 - F^n(p_2^n)][D_j(\cdot) + D_{-j}(\cdot)]p_2^n.$$

The term $1 - F^n(p_2^n)$ denotes the probability to set a lower add-on price than the competitor. The expected profit of an exploiting firm is given by

$$\mathbb{E}\pi_j^e(p_{1,j}, p_{1,-j}, p_2^e) = p_{1,j}D_j(\cdot) + \alpha(1-\rho)D_j(\cdot)p_2^e + \alpha\rho[1 - F^e(p_2^e)][D_j(\cdot) + D_{-j}(\cdot)]p_2^e.$$

Firms can always obtain positive add-on profits by selling the add-on to loyal consumers at $p_2 \in \{W(v_2), W(v_2, \tilde{\Delta})\}$, and earn $(1-\rho)D_j(\cdot)W(v_2)$ or $\alpha(1-\rho)D_j(\cdot)W(v_2, \tilde{\Delta})$, respectively, in the aftermarket. Therefore, firms must be indifferent between mixing and just selling to loyal consumers at the monopolistic price. We show in the proof of Lemma C.2 below that $F^n(W(v_2)) = 1$ and $F^e(W(v_2, \tilde{\Delta})) = 1$. This allows us to rewrite the expected profits accordingly

$$\begin{aligned}
\mathbb{E}\pi_j^n(p_{1,j}, p_{1,-j}, W(v_2)) &= [p_{1,j} + (1-\rho)W(v_2)]D_j(\cdot), \\
\mathbb{E}\pi_j^e(p_{1,j}, p_{1,-j}, W(v_2, \tilde{\Delta})) &= [p_{1,j} + \alpha(1-\rho)W(v_2, \tilde{\Delta})]D_j(\cdot).
\end{aligned}$$

Observe that the maximization problems are very similar to the baseline model and identical when $\rho = 0$. Thus, we can proceed like in the baseline model: substitute the expected add-on revenue into the profit function (1) and derive the base-good prices and profits in the three different outcomes. The results of Lemma A.1 and Lemma A.2 are similar, we only need to adjust properly for the term $(1-\rho)$. Further, the equilibrium structure is identical to Lemma A.3, with the only difference that firms mix over p_2 instead of setting an add-on price with probability 1, which we will prove in Lemma C.2 below. The result of Lemma 1 is unchanged and we still have $\max\{\hat{\alpha}, \bar{\alpha}\} < \bar{\alpha}_p$ for $\epsilon_D > \epsilon_W$. Therefore, Propositions 1 and 2 follow immediately. The derivations and proofs are available on request.

Lemma C.2.

(i) A non-exploiting firm draws an add-on price p_2^n from a continuous and atomless price distribution $F^n(p_2^n)$ with $p_2^n \in (\underline{p}_2^n, W(v_2))$.

(ii) An exploiting firm draws prices an add-on price p_2^e from a continuous and atomless price distribution $F^e(p_2^e)$ with $p_2^e \in (\max\{\underline{p}_2^e, W(v_2)\}, W(v_2, \tilde{\Delta}))$.

Proof. (i) A non-exploiting firm must be indifferent between mixing over p_2 and setting $p_2 = W(v_2)$. Thus, we can derive the equilibrium price distribution $F^n(p_2^n)$

$$\begin{aligned} \mathbb{E}\pi_j^n(p_{1,j}, p_{1,-j}, p_2^n) &= \mathbb{E}\pi_j^n(p_{1,j}, p_{1,-j}, W(v_2)) \\ (1-\rho)D_j(\cdot)p_2^n + \rho[1 - F^n(p_2^n)][D_j(\cdot) + D_{-j}(\cdot)]p_2^n &= (1-\rho)D_j(\cdot)W(v_2) \\ F^n(p_2^n) &= 1 - \frac{(1-\rho)D_j(\cdot)[W(v_2) - p_2^n]}{\rho[D_j(\cdot) + D_{-j}(\cdot)]p_2^n}. \end{aligned}$$

The upper bound is given by $W(v_2)$

$$F^n(W(v_2)) = 1 - \frac{(1-\rho)D_j(\cdot)[W(v_2) - W(v_2)]}{\rho[D_j(\cdot) + D_{-j}(\cdot)]W(v_2)} = 1.$$

Set $F^n(p_2^n) = 0$ to obtain the lower bound $\underline{p}_2^n$

$$\begin{aligned} F^n(\underline{p}_2^n) &= 0 \\ (1-\rho)D_j(\cdot)[W(v_2) - \underline{p}_2^n] &= \rho[D_j(\cdot) + D_{-j}(\cdot)]\underline{p}_2^n \\ \underline{p}_2^n &= \frac{(1-\rho)D_j(\cdot)W(v_2)}{D_j(\cdot) + \rho D_{-j}(\cdot)}. \end{aligned}$$

We can immediately verify that $\mathbb{E}\pi_j^n(p_{1,j}, p_{1,-j}, \underline{p}_2^n) = \mathbb{E}\pi_j^n(p_{1,j}, p_{1,-j}, W(v_2))$, which implies that firms obtain the same expected profit for all prices on the equilibrium support. The price distribution $F^n(p_2^n)$ is continuous and atomless since $D(\cdot)$ is continuous, $W(v_2)$ is constant, and $\frac{\partial F^n(p_2^n)}{\partial p_2^n} > 0$. For a detailed proof see Baye and Morgan (2001).

(ii) The proof is analogous to part (i). We simply have to replace p_2^n with p_2^e and $W(v_2)$ with $W(v_2, \tilde{\Delta})$. Note that an exploiting firm must set an add-on price $p_2^e > W(v_2)$. Therefore, the lower bound is given by $\max\{\underline{p}_2^e, W(v_2)\}$. It is straightforward to verify that $\mathbb{E}\pi_j^e(p_{1,j}, p_{1,-j}, W(v_2)) = \mathbb{E}\pi_j^e(p_{1,j}, p_{1,-j}, W(v_2, \tilde{\Delta}))$ when $\underline{p}_2^e < W(v_2)$. □

C.6 Unit Demand

We use a Hotelling model to analyze the unit demand case with classical and behavioral consumers, which are uniformly distributed on the interval $[0, 1]$. Consumers buy at most one unit of the base good with valuation v_1 at price p_1. We suppose that v_1 is sufficiently large such that the market is covered in equilibrium. Two firms are located at each extreme, $l \in \{0, 1\}$. They sell identical main products and add-ons, and produce at similar marginal costs c and zero, respectively. Without loss of generality, assume that firm j is located at $l = 0$ and firm $-j$ at $l = 1$. Buying a good imposes transportation costs t on the consumer. The rest of the setup is identical to the baseline model in Section 2, but we use an explicit add-on utility function $W(v_2, \tilde{\Delta}) = v_2\beta_i(1 + p_1 - p_2)$ with $\beta_i \in \{0, 1\}$.

C.6.1 Aftermarket

In the last stage, after buying the base good, consumers can buy an add-on with valuation v_2 at price p_2. A classical consumer ($\beta = 0$) buys the add-on when $v_2 \geq p_2$ and a behavioral consumer ($\beta = 1$) buys when $\frac{v_2(1+p_1)}{1+v_2} \geq p_2$. Similar to the baseline model, firms extract the entire rent and choose $p_2^* \in \{v_2, \frac{v_2(1+p_1)}{1+v_2}\}$ in equilibrium. Therefore, the add-on demand is given by $Q_j(p_{2,j}, D_j(p_{1,j}, p_{1,-j})) \in \{D_j(\cdot), \alpha D_j(\cdot)\}$.

C.6.2 Firm's Problem

The base-good demand of either firm is determined by the indifferent consumer $\bar{x}$, who is located at $\bar{x} = \frac{1}{2} + \frac{p_{1,-j}-p_{1,j}}{2t}$. The demand and profit functions of firm j are given by

$$D_j(p_{1,j}, p_{1,-j}) = \bar{x} = \frac{1}{2} + \frac{p_{1,-j} - p_{1,j}}{2t},$$
$$\pi_j(p_{1,j}, p_{1,-j}, p_{2,j}) = \left[p_{1,j} - c\right] \left[\frac{1}{2} + \frac{p_{1,-j} - p_{1,j}}{2t}\right] + Q_j(p_{2,j}, D_j(.))p_{2,j}.$$

The base-good prices and firm profits in the symmetric non-exploiting and symmetric exploiting outcome are given by

$$p_1^n = t + c - v_2, \qquad \pi^n = \pi(p_1^n, p_1^n, v_2) = \frac{t}{2}$$
$$p_1^e(\alpha) = t + \frac{c - \frac{\alpha v_2}{1+v_2}}{1 + \frac{\alpha v_2}{1+v_2}}, \quad \pi^e = \pi\left(p_1^e(\alpha), p_1^e(\alpha), \frac{v_2(1+p_1^e(\alpha))}{1+v_2}\right) = \frac{t}{2}\left(1 + \frac{\alpha v_2}{1+v_2}\right)$$

We can observe immediately that $\pi^e > \pi^n$ for all $\alpha > 0$.[31] The reason for this is the covered market assumption, which is often used in Hotelling models. However, possible asymmetric strategies enable the existence of symmetric non-exploiting equilibria.

The prices and profits in asymmetric outcomes are

$$\tilde{p}_1^n(\alpha) = t + \frac{2(c - v_2)}{3} + \frac{c - \frac{\alpha v_2}{1+v_2}}{3(1 + \frac{\alpha v_2}{1+v_2})}$$
$$\tilde{p}_1^e(\alpha) = t + \frac{c - v_2}{3} + \frac{2(c - \frac{\alpha v_2}{1+v_2})}{3(1 + \frac{\alpha v_2}{1+v_2})}$$
$$\tilde{\pi}^n = \pi\left(\tilde{p}_1^n(\alpha), \tilde{p}_1^e(\alpha), v_2\right) = \frac{1}{2t}\left[t + \frac{v_2(1 + v_2 + \alpha(v_2 - 1 - c))}{3(1 + v_2(1+\alpha))}\right]^2$$
$$\tilde{\pi}^e = \pi\left(\tilde{p}_1^e(\alpha), \tilde{p}_1^n(\alpha), \frac{v_2(1+\tilde{p}_1^e(\alpha))}{1+v_2}\right) = \frac{\left[t(1 + v_2(1+\alpha)) - \frac{1}{3}v_2(1 + v_2 + \alpha(v_2 - 1 - c))\right]^2}{2t(1+v_2)(1 + v_2(1+\alpha))}.$$

Note that demands under asymmetric strategies can be negative. We focus on interior solutions and assume that $D(\tilde{p}_1^n, \tilde{p}_1^e) > 0$ and $D(\tilde{p}_1^e(\alpha), \tilde{p}_1^n(\alpha)) > 0$.[32]

[31] It can be shown that the introduction of behavioral consumers does not affect the optimal location of a firm.

[32] If $D(\tilde{p}_1^n, \tilde{p}_1^e) \leq 0$ or $D(\tilde{p}_1^e(\alpha), \tilde{p}_1^n(\alpha)) \leq 0$, only symmetric equilibria exists.

C.7 Equilibrium

The equilibria characterization is similar to Lemma A.3.

Lemma C.3.

(i) If $\alpha < \min\{\bar{\alpha}, \hat{\alpha}\}$*, then both firms do not exploit and set* $p_1^* = p_1^n$ *and* $p_2^* = v_2$ *.*

(ii) If $\alpha > \max\{\bar{\alpha}, \hat{\alpha}\}$*, then both firms exploit and set* $p_1^* = p_1^e(\alpha)$ *and* $p_2^* = \frac{v_2(1+p_1^e(\alpha))}{1+v_2}$*.*

(iii) If $\bar{\alpha} < \alpha < \hat{\alpha}$*, then either both firms do not exploit symmetrically or both firms exploit symmetrically.*

(iv) If $\hat{\alpha} < \alpha < \bar{\alpha}$*, then firm* j *does not exploit and sets* $p_1^* = \tilde{p}_1^n(\alpha)$ *and* $p_2^* = v_2$*, and firm* $-j$ *exploits and sets* $p_1^* = \tilde{p}_1^e(\alpha)$ *and* $p_2^* = \frac{v_2(1+\tilde{p}_1^e(\alpha))}{1+v_2}$*.*

Proof. The proof is analogous to the proof of Lemma A.3. Note that $\frac{\partial \tilde{\pi}^n}{\partial \alpha} < 0$. Thus, the threshold $\bar{\alpha}$ exists. Further, we have $\pi^n > \tilde{\pi}^e$ and $\tilde{\pi}^n > \pi^e$ when $\alpha = 0$. Since $\frac{\partial \pi^n}{\partial \alpha} = 0$, $\frac{\partial \pi^e}{\partial \alpha} > 0$, $\frac{\partial \tilde{\pi}^e}{\partial \alpha} > 0$, and $\frac{\partial \tilde{\pi}^n}{\partial \alpha} < 0$, the thresholds $\hat{\alpha}$ and $\bar{\alpha}$ must be unique. □

The critical price threshold is given by $\bar{\alpha}_p = \frac{1+v_2}{1+c-v_2}$. This leads to the following result similar to Lemma 1.

Lemma C.4.

(i) Suppose $1 + c > v_2$*. If* $\alpha \in (\min\{\bar{\alpha}, \hat{\alpha}\}, \bar{\alpha}_p)$*, then the base good is more expensive in any symmetric exploiting or asymmetric equilibrium than in the benchmark. If* $\alpha > \bar{\alpha}_p$*, then the base good is cheaper in any symmetric exploiting equilibrium.*

(ii) Suppose $1 + c < v_2$*. The base good is always more expensive in any symmetric exploiting or asymmetric equilibrium than in the benchmark.*

Proof. (i)

$$
\begin{aligned}
& \alpha < \frac{1+v_2}{1+c-v_2} = \bar{\alpha}_p \\
\Leftrightarrow \quad & c + \alpha v_2(1+c-v_2) < c + v_2(1+v_2) \\
\Leftrightarrow \quad & (c-v_2)\left(1 + \frac{\alpha v_2}{1+v_2}\right) < c - \frac{\alpha v_2}{1+v_2} \\
\Leftrightarrow \quad & t + c - v_2 < t + \frac{c - \frac{\alpha v_2}{1+v_2}}{1 + \frac{\alpha v_2}{1+v_2}} \\
\Leftrightarrow \quad & p_1^{BM} < p_1^e(\alpha)
\end{aligned}
$$

$$
\begin{aligned}
& \alpha < \frac{1+v_2}{1+c-v_2} \\
\Leftrightarrow \quad & \frac{1}{3}(c-v_2) < \frac{c - \frac{\alpha v_2}{1+v_2}}{3(1 + \frac{\alpha v_2}{1+v_2})} \\
\Leftrightarrow \quad & t + c - v_2 < t + \frac{2(c-v_2)}{3} + \frac{c - \frac{\alpha v_2}{1+v_2}}{3(1 + \frac{\alpha v_2}{1+v_2})} \\
\Leftrightarrow \quad & p_1^{BM} < \tilde{p}_1^n(\alpha)
\end{aligned}
$$

$$
\begin{aligned}
& \alpha < \frac{1+v_2}{1+c-v_2} \\
\Leftrightarrow \quad & 2(c-v_2) < \frac{2(c-\frac{\alpha v_2}{1+v_2})}{3(1+\frac{\alpha v_2}{1+v_2})} \\
\Leftrightarrow \quad & t+c-v_2 < t+\frac{c-v_2}{3}+\frac{2\left(c-\frac{\alpha v_2}{1+v_2}\right)}{3(1+\frac{\alpha v_2}{1+v_2})} \\
\Leftrightarrow \quad & p_1^{BM} < \tilde{p}_1^e(\alpha)
\end{aligned}
$$

(ii)

$$
\begin{aligned}
p_1^{BM} &< p_1^e(\alpha) \\
t+c-v_2 &< t+\frac{c-\frac{\alpha v_2}{1+v_2}}{1+\frac{\alpha v_2}{1+v_2}} \\
\alpha(1+c-v_2) &< 1+v_2 \\
\alpha > 0 &> \frac{1+v_2}{1+c-v_2}
\end{aligned}
$$

Since $1+c-v_2<0$, the direction of inequality reverses when dividing. The proof for $p_1^{BM} < \tilde{p}_1^n(\alpha)$ and $p_1^{BM} < \tilde{p}_1^e(\alpha)$ when $1+c-v_2<0$ is analogeous.

□

Similar to Lemma B.1, the price threshold is always larger than the profit thresholds when $1+c-v_2>0$. When $1+c-v_2<0$, then $\bar{\alpha}_p<0$, which corresponds to the case of $\epsilon_D<\epsilon_W$.

Lemma C.5. *Suppose* $1+c>v_2$. *Then* $\max\{\hat{\alpha},\tilde{\alpha}\}<\bar{\alpha}_p$.

Proof. Suppose $\alpha=\bar{\alpha}_p=\frac{1+v_2}{1+c-v_2}$. Then

$$
\begin{aligned}
\tilde{\pi}^e &> \pi^n \\
\frac{t(1+c)}{2(1+c-z)} &> \frac{t}{2} \\
0 &> -\frac{tv_2}{2}
\end{aligned}
$$

By Lemma C.3, it must be $\alpha>\hat{\alpha}$ when $\pi^n<\tilde{\pi}^e$. Thus, $\bar{\alpha}_p>\hat{\alpha}$.

Further, when $\alpha=\bar{\alpha}_p=\frac{1+v_2}{1+c-v_2}$, then

$$
\begin{aligned}
\pi^e &> \tilde{\pi}^n \\
\frac{t(1+c)}{2(1+c-z)} &> \frac{t}{2} \\
0 &> -\frac{tv_2}{2}
\end{aligned}
$$

Note that $\pi^n=\tilde{\pi}^n$ and $\pi^e=\tilde{\pi}^e$ when $\alpha=\bar{\alpha}_p=\frac{1+v_2}{1+c-v_2}$. By Lemma C.3, it must be $\alpha>\bar{\alpha}$ when $\tilde{\pi}^n<\pi^e$. Thus, $\bar{\alpha}_p>\bar{\alpha}$. Hence, $\max\{\hat{\alpha},\tilde{\alpha}\}<\bar{\alpha}_p$. □

Given the results of Lemma C.3, Lemma C.4 and Lemma C.5, Propositions C.2 and C.3 follow immediately, which resembles the main findings in the baseline model stated by Propositions 1 and 2.

Proposition C.2 (Unit demand)**.**

(a) Behavioral consumers do not affect the market in any symmetric non-exploiting equilibrium.

(b) Suppose $1+c > v_2$. Then the presence of behavioral consumers: (i) harms classical consumers in any symmetric exploiting equilibrium if $\alpha < \bar{\alpha}_p$ and benefits otherwise, (ii) harms classical consumers in any asymmetric equilibrium.

(c) Suppose $1+c < v_2$. Then the presence of behavioral consumers harms classical consumers in any symmetric exploiting or asymmetric equilibrium.

Proof. The proof is analogous to the proof of Proposition 1, where $1+c > v_2$ corresponds to the case of $\epsilon_D > \epsilon_W$ and $1+c < v_2$ corresponds to $\epsilon_D < \epsilon_W$. □

Proposition C.3 (Consumer surplus - unit demand)**.**

(a) Behavioral consumers are worse off when firms apply the exploiting strategy.

(b) The exploiting strategy strictly lowers total consumer surplus except when $1+c > v_2$ and $\alpha > \bar{\alpha}_p$. Then, the effect on total consumer surplus is ambiguous.

Proof. The proof is analogous to the proof of Proposition 2, where $1+c > v_2$ corresponds to the case of $\epsilon_D > \epsilon_W$. The condition for $U_b^{NE} > U_b^E$, and $\tilde{U}_b^{NE} > \tilde{U}_b^E$ must still hold for any $p_1^n < p_1^k(\alpha)$, where $p_1^k \in \{p_1^e(\alpha), \tilde{p}_1^n, \tilde{p}_1^e\}$. Thus, we need to verify only the case of $1+c > v_2$ and $\alpha > \bar{\alpha}_p = \frac{1+v_2}{1+c-v_2}$. Note that no asymmetric equilibrium exists in this case. Using $p_1^e(\alpha) = t + \frac{c - \frac{\alpha v_2}{1+v_2}}{1+\frac{\alpha v_2}{1+v_2}}$, $p_1^n = t + c - v_2$, $W(v_2) = v_2$, and $W(v_2, \tilde{\Delta}) = \frac{v_2(1+p_1^e(\alpha))}{1+v_2}$, then Inequality (5) reduces to

$$\frac{t}{1+v_2} > \frac{(1+c)(\alpha-1)}{1+v_2+\alpha v_2},$$

which holds since $\alpha \in [0,1]$. If $\tilde{U}_b^{total}$ applies, we need to use $W(v_2, \tilde{\Delta}) = \frac{v_2(1+p_1^n)}{1+v_2}$. Then, Inequality (6) reduces to

$$\frac{v_2(1+c-v_2+t)}{1+v_2} + \frac{c+v_2(c-\alpha)}{1+v_2+\alpha v_2} > c,$$

which holds given $1+c > v_2$ and $\alpha > \bar{\alpha}_p = \frac{1+v_2}{1+c-v_2}$. □

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Abstract
A common and seemingly innocuous practice involves offering optional extra items during the purchasing process. We study such a market with consumers whose preferences for the extra are sensitive to the context of the more expensive base product, making the extra offer appear more attractive than it actually is. The presence of context-sensitive consumers can soften competition in the market for the base product, making the base product more expensive than in a standard economy. This not only jeopardizes their own surplus but also creates a negative externality on the surplus of the other consumers who have standard preferences.

Jel Classification
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