

Markdowns in Seasonal Conspicuous Goods

Kenan Arifoğlu

School of Management, University College London, Level 38, 1 Canada Square, London E14 5AA, United Kingdom, k.arifoglu@ucl.ac.uk

Sarang Deo

Indian School of Business, Gachibowli, Hyderabad, India, 500032, sarang_deo@isb.edu

Seyed M. R. Iravani

Department of Industrial Engineering and Management Sciences, Northwestern University, Evanston, IL 60208, s-iravani@northwestern.edu

In common parlance, *luxury* and *markdowns* are, in many respects, contradictory concepts. Markdowns decrease product exclusivity and hence consumers' willingness to pay (i.e., *snob effect*) since most consumers purchasing luxury desire uniqueness. Markdowns also encourage strategic (forward-looking) consumers to wait for lower prices (i.e., *strategic effect*). Yet, luxury retailers frequently adopt markdowns in practice to stimulate the demand for their seasonal products (i.e., *sales effect*). To study the impact of these three countervailing effects on a luxury retailer's markdown policy and rationing strategy, this paper develops a game-theoretic model with strategic and exclusivity-seeking consumers who have heterogeneous (*high* and *low*) valuations. We characterize a luxury retailer's equilibrium markdown and rationing strategies, and find that the retailer induces a buying frenzy (i.e., selling deliberately less than the demand) to increase consumers' willingness to pay when they are sufficiently exclusivity-seeking. We show that the retailer's markdown policy depends on consumers' desire for exclusivity when the proportion of consumers with high valuation is not too high or too low. Interestingly, we find that, in such cases, consumers' higher desire for exclusivity does not motivate the retailer to increase exclusivity and to adopt uniform pricing. To the contrary, it motivates the retailer to decrease the exclusivity and to adopt markdowns. By doing so, we identify exclusivity-seeking consumer behavior as another rationale behind markdown pricing. Lastly, we find that, when selling to exclusivity-seeking consumers, the negative impact of strategic consumer behavior is lower; however, ignoring it can be more costly.

Key words: conspicuous consumption; strategic consumers; luxury products; markdown pricing; buying frenzy

1. Introduction

Luxury retailers—such as Barneys New York, Farfetch, Saks Fifth Avenue, Neiman Marcus, and Nordstrom—frequently offer price markdowns on *seasonal* luxury products, e.g., high-fashion apparel, shoes, handbags, accessories such as scarves, tickets for luxury tours and cruises [Kopun, 2016; Wolfson and Wong, 2017; Berezina, 2017].¹ There are two important characteristics of seasonal luxury products. First, seasonal luxury products quickly become out of fashion and consumers have little or no interest in them after a short selling season (5 months) [Chevalier and Mazzalovo, 2008; Edelson and Moin, 2009; Murdock, 2016; Banham, 2017]. Second, they (especially, seasonal products of European designers) have very long production lead times, which limits luxury retailers' opportunity to replenish their stocks during the selling season (i.e., the stock is replenished only once well in advance) [Nguyen, 2004; The Economist,

¹ Approximately 30% of all luxury apparel was discounted in 2014 and 16% of these discounts were over 50% or more [Smith, 2014].

2004]. After setting their initial inventory levels, retailers use intertemporal pricing and often adopt price markdowns² to stimulate the demand for seasonal luxury products and thereby increase sales and profitability (i.e., ‘sales effect’).

However, ‘luxury’ and ‘markdowns’ are, in many respects, contradictory concepts. Most customers purchasing luxury products consume conspicuously, and they do not only satisfy their material needs but also seek uniqueness and value a luxury product less as more people use it [Vigneron and Johnson, 1999; Amaldoss and Jain, 2005a]. Such consumers are labeled as ‘snobs’ by Leibenstein [1950]. If a luxury retailer increases its sales, that will have an adverse impact on snobs’ willingness to pay, and therefore decrease the retailer’s profit (i.e., ‘snob effect’). There is also a growing concern that markdowns train consumers to be forward-looking (strategic) and encourage them to wait for lower prices and purchase only when luxury products are on a ‘deep’ sale [Reagan, 2015; Bain, 2016].³ Due to consumers’ strategic behavior, markdowns reduce retailers’ margins and might decrease their overall profits (i.e., ‘strategic effect’). Therefore, instead of offering price markdowns, several luxury experts advocate limiting the quantity and rationing some consumers by deliberately selling fewer items than the demand (i.e., ‘buying frenzy’) [Fury, 2015; Reagan, 2015; Ang, 2016]

As a result, luxury retailers face complex trade-offs while deciding on markdowns and their extent. On the one hand, they can use markdowns to increase sales (sales effect). On the other hand, markdowns encourage consumers to wait for lower prices (strategic effect) and decrease the exclusivity and consumers’ willingness to pay (snob effect). Hence, it is unclear whether luxury retailers should adopt markdown pricing. In this paper, we aim to clarify this and address the following research questions: When should a luxury retailer adopt markdowns? What is the role of exclusivity-seeking consumer behavior on a luxury retailer’s markdown strategy? What is the impact of strategic consumer behavior when selling to exclusivity-seeking consumers?

We develop a game-theoretic model with a profit-maximizing retailer selling a seasonal product over two periods to strategic consumers, who value both functionality and exclusivity of the product. We assume that consumers have heterogeneous (‘high’ and ‘low’) functional valuations. We model all consumers as ‘snobs’ and assume that they have the same sensitivity to consumption or desire for uniqueness (exclusivity). Motivated by seasonal conspicuous products whose consumption starts immediately after their purchase (e.g., high fashion apparel, luxury handbags, etc.), we assume that snobs are sensitive only to the cumulative consumption at the time of their purchase and perceive more social value from adopting the product early to consume it with fewer people. In our model, the retailer determines the order quantity and price in the

² Luxury retailers introduce every new seasonal product at a ‘retail price,’ and then mark the price down until the inventory is cleared or the selling season ends [Chevalier and Mazzalovo, 2008; Edelson and Moin, 2009]. By price markdowns, we refer to the permanent discounts (not temporary promotions) throughout the selling season.

³ According to the YouGov Affluent Perspective 2018 Global Luxury Retail report, half of global affluent shoppers buy luxury only when its price is marked down [David, 2018].

first period. Then, observing the first-period price and forming rational expectations about price and product availability in the second period, consumers decide whether to purchase in the first period or to wait for the second period. In the second period, the retailer determines the price, and then consumers who waited decide whether to purchase or not.

In contrast to some experts who believe that luxury is about exclusivity, and hence that luxury retailers should not adopt markdowns [Reagan, 2015; Ang, 2016; Kapferer, 2015], we find that luxury retailers should mark down, and it is actually consumers' desire for exclusivity that forces them to do so. We analyze a setting where consumers are strategic but not exclusivity-seeking and find that the retailer charges a uniform price (i.e., no markdown) and satisfies all demand (i.e., no buying frenzy). However, with exclusivity-seeking consumers, this result is no longer true and the retailer marks the price down and/or induces a buying frenzy. In particular, when selling to exclusivity-seeking consumers, the retailer rations and induces a buying frenzy to increase consumers' willingness to pay, which creates rationing risk for all consumers. This, together with the desire to consume early with fewer people, increases the value of consumption in the first period for all consumers, and, to exploit this, the retailer charges a high price in the first period and marks the price down in the second period. In sum, we identify exclusivity-seeking consumer behavior as another rationale behind markdowns that are frequently adopted by luxury retailers [Wolfson and Wong, 2017; Berezhna, 2017]. Moreover, counter to intuition, our analysis suggests that consumers' higher desire for exclusivity can motivate the retailer to decrease the exclusivity when the proportion of consumers with high valuation is intermediate (neither very high nor very low). In such cases, as consumers desire more exclusivity, all consumers are willing to pay more for the same level of exclusivity (i.e., high sales effect) and markdowns do not significantly reduce willingness to pay of high-value consumers who are purchasing the product at full price in the first period (i.e., low strategic effect). Consequently, the retailer increases its order quantity and sells to some consumers with low valuation by marking the price down. Further, we find that the negative impact of strategic consumer behavior on the retailer's profit becomes lower as consumers become more exclusivity-seeking. However, our numerical analysis suggests that, when selling to exclusivity-seeking consumers, the retailer should take the strategic consumer behavior into account, since ignoring it can be more costly and decrease the retailer's profit by up to 45%.

The remainder of this paper is organized as follows. §2 reviews the associated literature. We set up the model in §3, and present the main results in §4. Then, we analyze the interaction between exclusivity-seeking and strategic consumer behaviors in §5. §6 concludes the paper. Proofs of all results are presented in Appendix E.2.

2. Related Literature

Our paper contributes to the literature that study strategic consumer behavior, buying frenzy and conspicuous consumption.

Strategic (forward-looking) consumer behavior: Several papers have studied joint order quantity and pricing decisions of a firm in the presence of strategic consumers [Su, 2007; Aviv and Pazgal, 2008; Liu and van Ryzin, 2008; Cachon and Swinney, 2009; Liu and van Ryzin, 2011]. Unlike these papers, we model conspicuous consumption and find that consumers' desire for exclusivity changes some of the key insights from these papers. For instance, Liu and van Ryzin [2008] study a setting similar to ours and show that strategic rationing (buying frenzy) is optimal only when selling to risk-averse consumers (i.e., the firm does not ration with risk-neutral consumers). In contrast, our results show that, if consumers' desire for uniqueness is high, the firm rations strategically and induces a buying frenzy, even when consumers are risk-neutral.

Buying frenzy: DeGraba [1995] considers a setting where consumers are initially uncertain about the product value and learn their valuations over time. He finds that selling fewer units than demanded (buying frenzy) creates rationing risk for those consumers who want to wait to learn their valuations and induces them to buy early at a higher price while uninformed. Courty and Nasiry [2016] consider a similar setting as DeGraba [1995], but they assume that the firm does not commit to the second-period price, and the monopolist firm and consumers discount the future. They show that a buying frenzy occurs in the first period when consumers are sufficiently uncertain about their valuations and when they discount the future neither too high nor too low. Allen and Faulhaber [1991], and Stock and Balachander [2005] model asymmetric information between the firm and consumers, and show that a high-quality firm induces a buying frenzy to credibly signal its quality to uninformed consumers. Unlike these papers, we consider conspicuous consumption and show that consumers' desire for exclusivity can be another rationale behind buying frenzies in settings where the firm and consumers do not discount the future, and there is no information asymmetry and/or uncertainty in consumer valuations. We find that, with exclusivity-seeking consumers, a buying frenzy not only plays the role of sustaining markdown (or intertemporal) pricing and a firm can also induce a buying frenzy even under a uniform pricing policy to increase consumers' willingness to pay. Interestingly, we also find cases where, as consumers desire more uniqueness, the firm induces a buying frenzy, but decreases exclusivity (i.e., increases sales) at the same time.

Conspicuous consumption: Amaldoss and Jain [2005a,b] are among the first to develop analytical models to study the conspicuous consumption. Amaldoss and Jain [2005a], and Amaldoss and Jain [2005b], respectively, characterize the impact of consumers' desire for uniqueness and conformity on the demand and price of conspicuous goods in a monopoly and duopoly setting, and both validate their results in laboratory experiments. Unlike Amaldoss and Jain [2005a,b], our paper considers firms' capacity or order quantity decision, and assumes that conspicuous goods are sold over multiple periods. These modeling differences enable us to capture the impact of conspicuous consumption on firms' rationing strategies and (intertemporal) pricing policies.

Balachander and Stock [2009] find that offering a limited edition product can intensify the price competition in a duopoly when selling to exclusivity-seeking consumers. Amaldoss and Jain [2015], and Arifoğlu and Tang [2019], respectively, study the impact of reference group effects on firms' branding decisions and licensing strategies by using a model with two customer segments (snobs and followers), where snobs devalue the product as more followers purchase, while followers value the product more as more snobs purchase. Unlike our paper, these papers assume that the firm sells only in a single period, and they do not study intertemporal pricing with exclusivity-seeking consumers.

Amaldoss and Jain [2008] study the impact of reference group effects on a firm's pricing and product management strategies by using a framework similar to Amaldoss and Jain [2015]. Our theoretical framework is significantly different from Amaldoss and Jain [2008] in two main respects:

- First, Amaldoss and Jain [2008] do not focus on markdowns (or intertemporal pricing), and they assume that consumers do not *strategically* delay their purchases when the price is marked down.⁴ However, in our model, all consumers can strategically delay their purchases to get the product at a lower price. This setting enables us to completely characterize the impact of conspicuous consumption on a firm's markdown and rationing strategies with strategic customers.

- Second, Amaldoss and Jain [2008] assume that snobs are not sensitive to the consumption of other snobs, and they are willing to be different only from another group of consumers called followers (i.e., segment-specific desire for uniqueness). On the other hand, all consumers are snobs in our model and wish to be different from all other consumers (i.e., individual-level need for uniqueness) [Amaldoss and Jain, 2005a,b; Balachander and Stock, 2009]. Unlike the result⁵ in Amaldoss and Jain [2008], we find that, even in the absence of reference groups (followers), the firm induces a buying frenzy when consumers' desire for uniqueness is sufficiently high.

Tereyağoğlu and Veeraraghavan [2012] study exclusivity-seeking consumer behavior in a news-vendor setting, where the demand is uncertain and the firm salvages the remaining inventory in the second period at a much lower price.⁶ In contrast, the demand is deterministic in our model and we do not *a priori* assume that the firm marks the price down or salvages. Our model allows us to disentangle the impact of exclusivity-seeking consumer behavior and demand uncertainty and to show that exclusivity-seeking consumer behavior alone can lead to markdowns and buying frenzies. Rao and Schaefer [2013] assume

⁴ In Amaldoss and Jain [2008], snobs purchase only in the first period and followers purchase only in the second period.

⁵ In their analysis of limited editions, Amaldoss and Jain [2008] show that the firm increases prices over time (i.e., advance purchase discounts) and induces a buying frenzy only when followers have sufficiently high desire to assimilate with snobs. So they predict that there will be no intertemporal pricing and/or buying frenzy if there are no followers in the market.

⁶ Tereyağoğlu and Veeraraghavan [2012] consider uncertain demand and assume that the firm sells at the full price in the first period and salvages all leftover inventory at a price lower than per-unit production cost in the second period. In their model, in the absence of demand uncertainty, the firm will not create scarcity and will never sell in the second period at the salvage price, i.e., their model reduces to a single-period model. Consequently, their results hold only in the presence of *uncertain demand* and their analytical framework enables them to study the impact of conspicuous consumption coupled with uncertain demand.

that consumers are sensitive to the social status of people consuming the product (e.g., product value increases/decreases as more consumers with higher/lower wealth purchase the product), and they study the impact of quality and status-related considerations of consumers on a firm's pricing policy. In contrast, we assume that consumers are sensitive to the number (not social status) of people using the product. We also allow the firm to optimize over its order quantity in addition to prices.

Agrawal et al. [2015] analyze the product design and introduction strategies of a firm selling a durable product over multiple periods. They show that, with exclusivity-seeking consumers, firms do not prefer planned obsolescence and introduce products with high durability at low volume and high price. Our theoretical setting is different from Agrawal et al. [2015] on two key dimensions: First, they focus on luxury durable products and, consequently, assume that the firm can replenish its stock multiple times whereas we consider seasonal luxury products with a short selling season and, in line with practice, assume that the firm has a single replenishment opportunity. Second, they consider a secondary market for used goods and analyze consumers' decision *within a period* regarding purchasing a new product from the firm or a used product from the secondary market, while we focus on analyzing consumers' decision *across periods* regarding whether to purchase the product early or to wait for a lower price. These differences enable us to identify exclusivity-seeking consumer behavior as a rationale behind price markdowns and/or buying frenzies that are frequently adopted by luxury retailers.

Overall, our paper is the first that studies the impact of conspicuous consumption on markdowns and buying frenzies in the presence of forward-looking consumers.

3. Model Description and Preliminaries

We consider a risk-neutral monopoly⁷ firm (i.e., a luxury retailer) that sells a product over two periods to a population of strategic (forward-looking) and snobbish (exclusivity-seeking) consumers with unit demand. The firm introduces the product at a retail price (first period) and marks the price down, if any, towards the end of the season (second period). The product is a seasonal good (e.g., high-fashion luxury apparel) that quickly becomes out of fashion and is sold over a short selling season. (See Appendix D for the analysis of durable luxury (conspicuous) products.) Therefore, the firm can replenish its stock only once before the season and commits to it throughout [Su, 2007; Liu and van Ryzin, 2008; Nocke and Peitz, 2007; Möller and Watanabe, 2010].⁸

⁷ In Appendix B, we also analyze a duopoly model where two firms selling seasonal conspicuous products compete. We show that all our main insights in the paper continue to hold under competition. See Appendix B for further details.

⁸ High-fashion luxury apparel, especially those of European designers, have a very long replenishment lead time and a very short selling season so that luxury retailers in USA cannot replenish their stock more than once [Nguyen, 2004; The Economist, 2004]. Luxury retailers inform their customers about the availability of their products and thereby commit to the quantity [Rosenbloom, 2009b]. For further justification of commitment to order quantity, see Su [2007], and Liu and van Ryzin [2008].

3.1. Sequence of Events

The sequence of events is as follows. At the beginning of the first period, the firm chooses the first-period price (p_1) and its order quantity (Q), and incurs ordering costs (cQ). In the event of limited inventory, each consumer willing to buy the product has equal probability of getting it (i.e., proportional rationing) [Su, 2007; Liu and van Ryzin, 2008]. Also, consumers cannot resell their used products in a secondary market [Su, 2007; Amaldoss and Jain, 2008; Liu and van Ryzin, 2008]. After observing p_1 , and anticipating the price and product availability (or the fill rate) in the second period accurately through rational expectations, each consumer decides whether to buy the product in the first period or to wait for the second period. In the second period, the firm determines the second-period price p_2 first, and then observing p_2 , consumers waiting for the second period decide whether to purchase the product if it is available. Remaining unsold units, if any, have zero salvage value at the end of the second period.

3.2. The Consumers' Problem

Consumers do not discount the future and, without loss of generality, their number is normalized to 1.⁹ The value that each consumer receives from using the product has two parts: *functional* and *social* values.

Functional value: A consumer's functional valuation for the product is private information and it is independent from the consumption. Consumers are heterogeneous in their functional valuations and a $\theta \in (0, 1)$ fraction of them have a high functional valuation v_H while $1 - \theta$ fraction have a low functional valuation v_L ($c < v_L < v_H$). For notational simplicity, we let $\theta_c = (v_L - c) / (v_H - c)$, which is a measure of heterogeneity in consumer valuations, e.g., low θ_c implies high heterogeneity.

Consumers perceive certain brands as status symbols and ascribe higher quality, luxury or prestige to their consumption [Eastman et al., 1999; O'Cass and Frost, 2002; O'Cass and McEwen, 2004; Truong et al., 2008]. For example, in the same product category (e.g., handbags), a luxury brand such as Gucci has a higher perceived quality, and thus higher status, compared to a mass prestige ('masstige') brand such as Michael Kors [Truong et al., 2008, 2009].¹⁰ In our model this is captured by θ ; a product with higher θ has higher average perceived quality, and hence, can be interpreted as the product of a brand with higher status.

Social value: All consumers are snobbish and wish to be different from all other consumers.¹¹ Specifically, consumers receive positive social value (benefit) from the product exclusivity [Pesendorfer, 1995; Rao

⁹ Previous research has identified consumers discounting the future and (aggregate- or individual-level) demand uncertainty as two rationales behind intertemporal price discrimination (e.g., Su [2007]; Nocke and Peitz [2007]; Möller and Watanabe [2010]) and buying frenzies (e.g., DeGraba [1995]; Courty and Nasiry [2016]). Therefore, we ignore them in our model and focus only on exclusivity-seeking consumer behavior to tease out its impact on a firm's markdown and rationing strategies. We also considered a setting with individual-level demand uncertainty where consumers do not know their valuations initially and learn them over time. The analysis of this setting is very challenging, but we confirm our main results by numerically characterizing scenarios where exclusivity-seeking consumer behavior leads to intertemporal pricing (i.e., markdown pricing and advance purchase discounts).

¹⁰ Unlike luxury brands, masstige brands (e.g., Ralph Lauren, Emporio Armani, Michael Kors, Calvin Klein and Coach) offer prestige and symbolic benefits to masses by producing and selling less rare and more affordable products with lower quality and less extraordinariness [Silverstein and Fiske, 2003; Truong et al., 2009]. Consequently, within the same product category, a masstige brand has lower status (lower θ) compared to a luxury brand [Truong et al., 2009].

¹¹ We also analyzed a heterogeneous market with snobs and commoners, whose valuations are insensitive to the level of consumption, and confirmed our main insights. We do not present this analysis in our paper for brevity.

and Schaefer, 2013]. (See Appendix C for an alternative model where product exclusivity yields negative benefits to consumers.) The social value *linearly* decreases in the consumption (i.e., number of consumers who use the product) [Amaldoss and Jain, 2005b; Balachander and Stock, 2009; Agrawal et al., 2015].¹² Consumers are homogeneous in their sensitivity to consumption, which is denoted by $\lambda > 0$. People purchase conspicuous products mainly for public display of their uniqueness and wealth [O’Cass and McEwen, 2004; Truong et al., 2008; Heffetz, 2011; Gierl and Huettl, 2010]. It is natural to expect that snobbish consumers are more sensitive when buying more visible goods (e.g., shirt) than when buying less visible goods (e.g., loungewear and nightwear) [Chao and Schor, 1998; Gierl and Huettl, 2010]. Therefore, we interpret higher values of λ to denote products whose consumption is more visible.

When a new seasonal product (e.g., high-fashion apparel) is introduced, snobs want to adopt the product first to take advantage of the limited number of consumers at that point in time and the product loses much of its social value for snobs later when many other consumers adopt it [Vigneron and Johnson, 1999; Rogers, 2010]. Hence, consumers purchasing in the first period are sensitive to the consumption in the first period, denoted by h_1 , whereas those purchasing in the second period are sensitive to total consumption at the end, denoted by h , where $h \geq h_1$ and the dependence of h_1 and h on retailer’s selling strategy (i.e., p_1 , p_2 , and Q) is suppressed for notational convenience. We call this the *cumulative consumption model*, which corresponds to conspicuous products whose consumption starts immediately after their purchase, e.g., high fashion apparel, shoes, handbags, etc. (See Appendix A for the case where all consumers are sensitive to the total consumption at the end of two periods.) In the cumulative consumption model, the total value to a high-value consumer from consuming the product in the first and second period is $v_H + \lambda \bar{h}_1 - p_1$ and $v_H + \lambda \bar{h} - p_2$, respectively, where $\bar{h}_1 = 1 - h_1$ and $\bar{h} = 1 - h$.

Consumers form *rational expectations* on the price and product availability (fill rate) in the second period and they accurately anticipate both at equilibrium [Stokey, 1981; Becker, 1991; Amaldoss and Jain, 2005a, 2008, 2015]. We let $\phi \in [0, 1]$ denote the second-period availability probability, which depends on the order quantity and demand. Consequently, the first-period reservation price that will make high-value consumers indifferent between purchasing in the first period and waiting for the second period is given by:

$$r_{H1} = v_H + \lambda \bar{h}_1 - \phi (v_H + \lambda \bar{h} - p_2)^+,$$

where $(a)^+ = \max\{0, a\}$. Similarly, we obtain the first-period reservation price of low-value consumers as follows:

$$r_{L1} = v_L + \lambda \bar{h}_1 - \phi (v_L + \lambda \bar{h} - p_2)^+.$$

Also, it is easy to check that second-period reservation prices for high- and low-value consumers are, respectively, equal to $r_{H2} = v_H + \lambda \bar{h}$ and $r_{L2} = v_L + \lambda \bar{h}$.

¹² We also considered a setting where consumers’ sensitivity to consumption is decreasing non-linearly and showed that our main insights still hold. We do not present the analysis of this case for brevity.

3.3. The Firm's Problem

The firm chooses its order quantity (Q) and first- and second-period prices (p_1 and p_2) so as to maximize its profit. The firm's profit under a two-period pricing policy (p_1, p_2) is given by:

$$\Pi(p_1, p_2, Q) = p_1 \min \{D_1(p_1, p_2, Q), Q\} + p_2 \min \{D_2(p_1, p_2, Q), (Q - D_1(p_1, p_2, Q))^+\} - cQ, \quad (1)$$

where $D_1(p_1, p_2, Q)$ and $D_2(p_1, p_2, Q)$ are, respectively, the demand in the first and second periods given p_1 , p_2 , and Q . Next, by Lemma 1, we show that it is always optimal for the firm to set its first- and second-period prices equal to one of the reservation prices in respective periods.

LEMMA 1. *In the cumulative consumption model, the optimal price in each period is equal to the reservation price of either the high-value or low-value consumers in that particular period, i.e., $p_1 = r_{H1}$ or $p_1 = r_{L1}$, and $p_2 = r_{H2}$ or $p_2 = r_{L2}$.*

There are three possible pricing policies for the firm: uniform pricing, i.e., $p_1 = p_2$; advance purchase discounts, i.e., $p_1 < p_2$; and markdown pricing, i.e., $p_1 > p_2$. Due to single replenishment, the product availability is always higher in the first period and, under advance purchase discounts, consumers' utility from purchasing in the first period is always higher than or equal to that from waiting for the second period. Consequently, any advance purchase discounts policy is weakly dominated by some uniform pricing policy. Therefore, the firm's optimal pricing policy is either uniform pricing or markdown pricing.¹³ Consistent with Lemma 1, under markdown pricing, the firm charges the first-period reservation price of high-value consumers in the first period and the second-period reservation price of the low-value consumers in the second period (i.e., $p_1 = r_{H1}$ and $p_2 = r_{L2}$). Similarly, under uniform pricing, there is a single period and the firm either charges the reservation price of high-value or low-value consumers (i.e., $v_H + \lambda \bar{h}$ or $v_L + \lambda \bar{h}$).

4. Equilibrium Analysis

In this section, we use backward induction to characterize the equilibrium of the game between consumers and the firm. To better understand the impact of exclusivity-seeking consumer behavior, we first analyze the case with non-snobbish consumers (commoners) and then compare it with our analysis of the case with snobbish consumers.

4.1. Non-snobbish Consumers (Commoners)

As a benchmark, we first study the case with non-snobbish consumers or commoners ($\lambda = 0$). Our results in this subsection confirm the previous literature on non-snobbish consumers. The following proposition characterizes optimal selling strategy of the firm when $\lambda = 0$.

¹³ We consider uniform pricing as the optimal pricing policy if there is a tie between the firm's profit with uniform pricing and with markdown pricing, since it requires the least implementation effort.

PROPOSITION 1. *When consumers are not snobbish but strategic, the firm's optimal price (p) and order quantity (Q) are given, respectively, by $p = v_H$ and $Q = \theta$ if $\theta > \theta_c$; and by $p = v_L$ and $Q = 1$ if $\theta \leq \theta_c$.*

In line with Su [2007] and Liu and van Ryzin [2008], Proposition 1 implies that price markdowns and inducing a buying frenzy are never optimal when consumers are not snobbish. Next, we develop intuition into this result that would later be useful for the case with snobs.

Note that $Q < \theta$ cannot be an equilibrium as the firm can earn a strictly positive payoff $v_H - c$ by producing one more unit. Next, for $\theta < Q < 1$, the candidate markdown pricing policy should make the high-value consumers indifferent between buying in the first period and waiting for the second period. It should also make the low-value consumers indifferent between buying and not buying in the second period. Noting that the fill rate in the second period for high-value consumers is $(Q - \theta) / (1 - \theta)$, we get $p_1 = v_H - \frac{Q - \theta}{1 - \theta} (v_H - v_L)$ and $p_2 = v_L$ as these indifference points. Thus, by (1), firm's profit for $\theta < Q < 1$ is given by: $\Pi(Q) = \left(v_H - \frac{Q - \theta}{1 - \theta} (v_H - v_L) \right) \theta + v_L (Q - \theta) - cQ$.

Now, increasing the order quantity by one unit has two opposite effects on the firm's profit for $\theta < Q < 1$. On the one hand, each unit sold in the second period at price v_L increases the firm's profit by $v_L - c$, which we call the *sales effect*. On the other hand, due to strategic consumer behavior, it decreases each high-value consumer's first-period reservation price by $(v_H - v_L) / (1 - \theta)$ to keep them indifferent between the first and the second period. Since there are θ such consumers, it decreases the firm's first-period profit by $\theta (v_H - v_L) / (1 - \theta)$, which we call the *strategic effect*. For $\theta \geq \theta_c = (v_L - c) / (v_H - c)$, the strategic effect dominates the sales effect. As a result, the firm does not increase the order quantity beyond $Q = \theta$ and charges a high uniform price $p = v_H$ so that only high-value consumers are willing to purchase (i.e., demand is equal to θ). Consequently, the firm satisfies all demand and does not induce a buying frenzy for $\theta \geq \theta_c$. On the other hand, for $\theta < \theta_c$, the sales effect dominates the strategic effect so the firm increases the order quantity up to $Q = 1$ and sells to all customers at a low uniform price $p = v_L$.

In summary, when consumers are not exclusivity-seeking, the firm never marks the price down and does not induce a buying frenzy (i.e., deliberately ordering and selling fewer units than the demand). Will this result hold when consumers are snobbish? We will examine this next.

4.2. Snobbish Consumers

For the case with snobbish consumers, following the rationale from the previous section, first- and second-period prices are given, respectively, by

$$p_1 = v_H + \lambda(1 - \theta) - \frac{Q - \theta}{1 - \theta} (v_H - v_L) \quad \text{and} \quad p_2 = v_L + \lambda(1 - Q).$$

Thus, the sales effect ($v_L + \lambda(1 - Q) - c$) is no longer constant but depends on consumers' sensitivity to consumption λ and the order quantity Q while the strategic effect ($\theta (v_H - v_L) / (1 - \theta)$) is still the same

and independent from Q . In addition, a unit increase in a firm’s order quantity also decreases the second-period reservation price of each low-value consumer by λ because of the snobbish behavior. Since there are $(Q - \theta)$ such consumers, the total impact on the firm’s profit is a reduction of $\lambda(Q - \theta)$, which we call the *snob effect*. Note that the sales effect works in favor of increasing the order quantity while strategic and snob effects work against it. Consequently, the net result of these three effects on the firm’s optimal selling strategy is not immediately obvious and depends intricately on the relative values of the consumer sensitivity to consumption λ and the proportion of high-value consumers θ . We next characterize the firm’s equilibrium selling strategy with snobbish consumers.

4.2.1. Equilibrium pricing and rationing strategies. The firm chooses its order quantity and prices by maximizing its profit in (1). We assume that heterogeneity in consumer valuations is sufficiently high (i.e., $\theta_c \leq \sqrt{3}/2$) throughout this section to ensure that equilibrium order quantity and prices exist for all (θ, λ) . Proposition 2 characterizes the firm’s equilibrium pricing and rationing strategies. With a slight abuse of notation, we let Π denote the *equilibrium profit* in the cumulative consumption model with strategic consumers (i.e., $\Pi = \Pi(p_1, p_2, Q)$ where p_1, p_2 and Q are given in Table 1).

PROPOSITION 2. *In the cumulative consumption model with strategic consumers, the firm’s equilibrium pricing policy, order quantity, and demand are given by Table 1 for $\theta_c < \sqrt{3}/2$; moreover, the firm’s equilibrium markdown and rationing strategies exhibit a threshold structure in (θ, λ) plane as illustrated in Figure 1.*

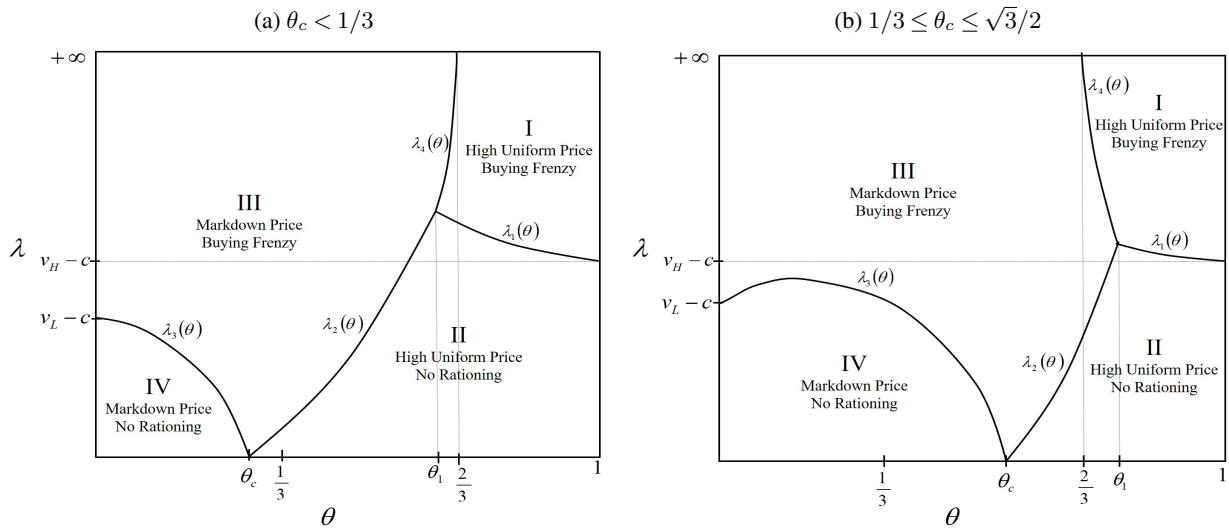


Figure 1 The firm’s optimal selling strategy in the cumulative consumption model. For a fixed v_H , the plane (θ, λ) is divided into four (I to IV) regions. The λ functions defining the boundary of regions in the figure are defined in Lemma A.2 in Appendix E.1.

Figure 1 illustrates Table 1 and distinguishes four different regions in (θ, λ) plane. In Regions I and II, strategic effect is significant (high θ) and, together with snob effect, always dominates the sales effect so

Table 1 The firm's equilibrium pricing policy, order quantity (Q) and demand in the cumulative consumption model with strategic consumers for $\theta_c < \sqrt{3}/2$, where $\lambda_1(\theta)$, $\lambda_2(\theta)$, $\lambda_3(\theta)$, $\lambda_4(\theta)$ and θ_1 are defined in Lemma A.2 in Appendix E.1. The uniform price is given by $p = v_H + \lambda(1 - Q)$ when the equilibrium pricing policy is uniform pricing, and first- and second-period prices are given, respectively, by $p_1 = v_H + \lambda(1 - \theta) - \frac{Q - \theta}{1 - \theta}(v_H - v_L)$ and $p_2 = v_L + \lambda(1 - Q)$ when the equilibrium pricing policy is markdown pricing.

Region	Pricing	Order Quantity (Q)	Demand Type	Condition
I	Uniform Pricing	$(v_H + \lambda - c)/2\lambda$ ($Q < \theta$)	High-value	$\{\lambda_1(\theta) < \lambda \leq \lambda_2(\theta), \theta > \max\{\frac{1}{2}, \theta_c\}\}$ $\cup \{\lambda_2(\theta) < \lambda \leq \lambda_4(\theta), \theta_1 \leq \theta < \frac{2}{3}, \theta_c \leq \frac{1}{3}\}$ $\cup \{\lambda > \max\{\lambda_2(\theta), \lambda_4(\theta)\}, \frac{2}{3} < \theta < \frac{1+\theta_c}{2}, \theta_c > \frac{1}{3}\}$ $\cup \{\lambda > \max\{\lambda_1(\theta), \lambda_2(\theta)\}, \theta \geq \max\{\frac{1+\theta_c}{2}, \frac{2}{3}\}\}$
II	Uniform Pricing	θ	High-value	$\{\lambda \leq \min\{\lambda_1(\theta), \lambda_2(\theta)\}, \theta \geq \max\{\frac{1}{2}, \theta_c\}\}$ $\cup \{\lambda \leq \lambda_2(\theta), \theta_c < \theta < \frac{1}{2}\}$
III	Markdown Pricing	$(v_L + \lambda(1 + \theta) - c - \frac{\theta}{1 - \theta}(v_H - v_L))/2\lambda$ ($\theta < Q < 1$)	High- and low-value	$\{\lambda > \lambda_3(\theta), \theta \leq \min\{\frac{1}{2}, \theta_c\}\}$ $\cup \{\lambda > \lambda_2(\theta), \theta_c < \theta \leq \frac{1}{2}\}$ $\cup \{\lambda_3(\theta) < \lambda < \lambda_1(\theta), \frac{1}{2} < \theta \leq \theta_c\}$ $\cup \{\lambda_2(\theta) < \lambda < \lambda_1(\theta), \theta \geq \max\{\frac{1}{2}, \theta_c\}\}$ $\cup \{\lambda \geq \max\{\lambda_1(\theta), \lambda_4(\theta)\}, \frac{1+\theta_c}{2} < \theta < \frac{2}{3}, \theta_c \leq \frac{1}{3}\}$ $\cup \{\lambda_1(\theta) \leq \lambda \leq \lambda_4(\theta), \frac{2}{3} < \theta \leq \theta_1, \theta_c > \frac{1}{3}\}$ $\cup \{\lambda > \max\{\lambda_1(\theta), \lambda_2(\theta)\}, \frac{1}{2} \leq \theta \leq \min\{\frac{1+\theta_c}{2}, \frac{2}{3}\}\}$
IV	Markdown Pricing	1	High- and low-value	$\{\lambda \leq \lambda_3(\theta), \theta \leq \theta_c\}$

that the firm charges a high uniform price (i.e., no markdowns) and only high-value consumers want to purchase. In Region I, consumers' desire for exclusivity λ is higher, and hence, unlike in Region II, the firm rations and induces a buying frenzy among high-value consumers to increase their willingness to pay. On the other hand, in Regions III and IV, the strategic effect is small (low θ), and the sales effect dominates both strategic and snob effects; therefore, the firm sells to all high-value consumers in the first period at a high price and marks the price down to sell to low-value consumers in the second period (i.e., markdown pricing). Moreover, consumers' desire for exclusivity is higher in Region III than in Region IV. Hence, the firm satisfies all demand in Region IV (i.e., no rationing) while, in Region III, it induces a buying frenzy among low-value consumers to increase their willingness to pay.

We observe from Figure 1 that the firm's pricing policy is independent from consumers' sensitivity to consumption (λ) for extreme (sufficiently high and sufficiently low) θ values, whereas it depends on consumers' sensitivity to consumption for intermediate (neither very high nor very low) θ values. Specifically, the firm charges a high uniform price and never adopts markdowns (due to strong strategic effect) when the proportion of high-value consumers is large (see Regions I and II of Figure 1 for $\theta > \max\{\theta_1, 2/3\}$), and it marks the price down and sells to low-value consumers (due to the strong sales effect) when the proportion of high-value consumers is sufficiently low (see Regions III and IV in Figure 1 for $\theta \leq \min\{\theta_c, 2/3\}$). For intermediate proportions of high-value consumers (i.e., see Regions II and III for $\theta_c < \theta \leq \min\{\theta_1, 2/3\}$),

the firm charges a high uniform price and sells to only high-value consumers (i.e., no markdowns) when consumers' desire for exclusivity is low ($\lambda \leq \lambda_2(\theta)$), and it marks the price down and sells to low-value consumers when consumers desire for exclusivity is high ($\lambda > \lambda_2(\theta)$). This is because the strategic effect is strong and dominates sales effect for $\lambda \leq \lambda_2(\theta)$ while low-value consumers' willingness to pay is higher and the sales effect dominates strategic and snob effects for $\lambda > \lambda_2(\theta)$. It is interesting to note that, for intermediate θ values, exclusivity-seeking consumer behavior works in favor of increasing sales and decreasing the exclusivity. We shall elaborate on this later in §4.2.2.

Figure 1 also shows that, for all θ values, consumers' higher desire for exclusivity makes the firm ration and induce a buying frenzy. Consumers are willing to pay more for the same level of exclusivity and thus sales effect becomes higher as consumers' desire for exclusivity increases. To exploit this and increase consumers' willingness to pay, the firm rations and induces a buying frenzy when consumers' desire for exclusivity is sufficiently high (see Regions I and III in Figure 1). Also note that the firm induces a buying frenzy while using a uniform pricing strategy in Region I. This, in contrast to the literature [Png, 1991; DeGraba, 1995; Liu and van Ryzin, 2008], implies that, when selling to exclusivity-seeking consumers, buying frenzies can be optimal when the firm does not adopt markdowns.

Lastly, together with the fact that markdowns are never optimal in our model when consumers are not exclusivity-seeking (by Proposition 1), Figure 1 implies that exclusivity-seeking consumer behavior makes the firm adopt markdowns (see Regions III and IV). This is formalized in Corollary 1. Corollary 1, taking into account a firm's optimal price and capacity decisions, uncovers another effect of exclusivity-seeking consumer behavior and is consistent with the markdown practice of some luxury retailers [Kopun, 2016; Wolfson and Wong, 2017; Berezhna, 2017].

COROLLARY 1. *Exclusivity-seeking consumer behavior leads to price markdowns when the proportion of high-value consumers is sufficiently low (i.e., $\theta < \max\{\theta_1, 2/3\}$).*

Even in the absence of rationing (i.e., Region IV in Figure 1), the first-period consumption is more valuable in our model; therefore, the firm can charge a high price, and only high-value consumers purchase in the first period, and it marks the price down and sells to all low-value consumers in the second period. Moreover, when consumers' desire for exclusivity is high, the firm strategically induces a buying frenzy to increase their willingness to pay. This creates a rationing risk for all consumers, which, together with consumers' desire to consume with fewer people, makes the consumption in the first period more valuable for high-value consumers. Consequently, when the proportion of high-value consumers is low and sensitivity to consumption is high (i.e., Region III in Figure 1), the firm adopts markdowns and induces a buying frenzy among low-value consumers in the second period.

4.2.2. Comparative statics. We next study the impact of two critical parameters of our model (namely, θ and λ) on the firm's order quantity and on the extent of price markdowns. Proposition 3 characterizes the behavior of firm's order quantity Q with respect to θ and λ .

PROPOSITION 3 (Order Quantity (Q)). (i) *When consumers' sensitivity to consumption is greater than a certain threshold (i.e., high λ), the firm orders more (i.e., higher Q) for high values of the proportion of high-value consumers θ compared to low values. Moreover, when the proportion of high-value consumers is greater than a certain threshold (i.e., high θ), the order quantity increases as the proportion of high-value consumers increases (i.e., Q is increasing in θ).*

(ii) *For intermediate values of the proportion of high-value consumers and sufficiently high heterogeneity in consumer valuations (i.e., intermediate θ and low θ_c), the order quantity is higher for higher values of consumers' sensitivity to consumption (i.e., Q is increasing in λ).*

Proposition 3(i) shows that, for sufficiently high values of consumers' sensitivity to consumption (i.e., $\lambda > \lambda_1(\theta_1)$ in Figure 1), a firm with higher θ ($\theta > \theta_1$) increases the order quantity and thereby decreases the exclusivity due to higher margins from a large customer population with high valuations. Luxury experts believe that high-status (luxury) products should be more exclusive than low-status (masstige) products [Kapferer, 2015]. However, Proposition 3(i) shows that this is not necessarily true and, within the same product category, products of luxury brands are not necessarily more exclusive than those of masstige brands. In line with this result, Farfetch sells Polo Ralph Lauren limited-edition men shorts, whereas it does not offer any limited-edition men shorts by high-status luxury brands such as Gucci and Valentino [Farfetch, 2019a].

Counter to intuition, Proposition 3(ii) shows that the firm increases sales and decreases the exclusivity for more exclusivity-seeking consumers (higher λ) when the proportion of high-value consumers θ is intermediate (i.e., Region III in Figure 1 for $\theta_c < \theta \leq \min\{\theta_1, 2/3\}$). For intermediate θ values, the sales effect always increases as λ increases, and it dominates strategic and snob effects for $\lambda > \lambda_2(\theta)$. Therefore, the firm increases its order quantity to sell to more low-value consumers and thus decreases the exclusivity for higher λ values.

We now analyze the extent of price markdowns. The pricing policy and order quantity change significantly depending on the consumers' valuations and their sensitivity to consumption (see Figure 1) so that a clean characterization of the extent of price markdowns ($1 - p_2/p_1$) with respect to consumers' sensitivity to consumption is analytically challenging. Therefore, we resort to numerical examples. Figure 2 illustrates that, depending on θ , the behavior of the extent of price markdowns with respect to λ can be very different.¹⁴

For low θ (e.g., $\theta = 0.1$ in Figure 2), as consumers become more snobbish, the firm's order quantity decreases and, due to snob and strategic effects, all consumers' willingness to pay increases (see Regions

¹⁴ Additional numerical examples with different parameter values resulted in similar findings.

III and IV in Figure 1 for $\theta < \theta_c$). For small λ values, the strategic effect dominates the snob effect so that high-value consumers' willingness to pay increases significantly more. Consequently, the firm increases the first-period price more and makes deeper discounts in the second period. However, for high λ values, the firm does not have to provide deeper discounts since the snob effect dominates and all consumers are more willing to consume in the first period.

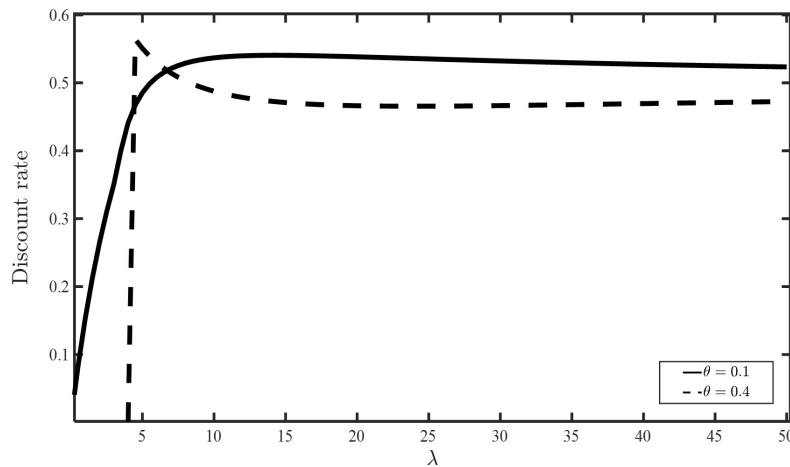


Figure 2 The extent of the price markdown ($1 - p_2/p_1$) in the cumulative consumption model as a function of sensitivity to consumption (λ) when $v_H = 15$, $v_L = 4$, $c = 1$ (i.e., $\theta_c = 0.286$).

For intermediate θ values (e.g., $\theta = 0.4$ in Figure 2), the firm marks the price down only for sufficiently high λ values (see Region III in Figure 1 for $\theta_c < \theta < \min\{\theta_1, 2/3\}$), and hence, the jump occurs for $\theta = 0.4$ in Figure 2. This implies that a luxury retailer can offer deeper discounts on more visible products of the same brand (high λ). This might explain why luxury retailers such as Barneys New York and Farfetch offer either no discounts or very limited discounts on Calvin Klein loungewear and nightwear (low visibility) whereas they offer significant (up to 60-75%) discounts on Calvin Klein blazers, shirts and trousers (high visibility) [Barneys New York, 2019a; Farfetch, 2019b,c]. Moreover, by Proposition 3(ii), the firm's order quantity increases so that consumers' willingness to pay decreases for intermediate λ values after the jump in Figure 2. For intermediate λ values, the firm charges a much lower first-period price and makes lower discounts since the strategic effect, which represents the decrease in high-value consumers' willingness to pay, is significant. For high λ values, the snob effect ($\lambda(Q - \theta)$), which represents the decrease in low-value consumers' willingness to pay, is more significant. Therefore, the firm reduces the second-period price more than the first-period price and the extent of price markdowns increases for high λ values as is shown in Figure 2 for $\theta = 0.4$.

5. Impact of Strategic Consumer Behavior

Strategic consumer behavior limits the firm's ability to price discriminate as high-value consumers are willing to wait for lower prices. Several studies have shown that strategic consumer behavior adversely impacts on a firm's profit, and ignoring it can reduce a firm's profit significantly [Stokey, 1979; Aviv and Pazgal, 2008]. However, consumers' desire for exclusivity induces consumers to advance their consumption. Hence, one might expect that the negative impact of strategic consumer behavior on a firm's profitability might be lower when consumers are also exclusivity-seeking, and that ignoring strategic behavior might be less costly. We investigate these issues in this section.

We study the case with myopic consumers as a benchmark and use the superscript "M" for myopic consumers. Also, with a slight abuse of notation, we let Π^M denote the equilibrium profit with myopic consumers, and we define $\Pi(M)$ as firm's profit with strategic consumers when it misclassifies consumers and implements the myopic solution. Then, $(\Pi^M - \Pi) / \Pi^M$ denotes the percent decrease in a firm's profit due to strategic consumer behavior, and $(\Pi - \Pi(M)) / \Pi$ represents the percent decrease in a firm's profit when it ignores the strategic consumer behavior. Proposition 4 characterizes the firm's equilibrium pricing and rationing strategies with myopic consumers.

PROPOSITION 4. *In the cumulative consumption model with myopic consumers, the firm's equilibrium pricing policy, order quantity, and demand are given by Table 2; moreover, the firm's equilibrium markdown and rationing strategies exhibit a threshold structure in (θ, λ) plane as illustrated in Figure 3a.*

Table 2 The firm's equilibrium pricing policy, order quantity (Q^M) and demand in the cumulative consumption model with myopic consumers, where $\lambda_1^M(\theta)$, $\lambda_2^M(\theta)$, $\lambda_3^M(\theta)$, and θ_1^M are defined in Lemma A.3 in Appendix E.1. The uniform price is given by $p^M = v_H + \lambda(1 - Q^M)$ for $Q^M \leq \theta$ when the equilibrium pricing policy is uniform pricing, and first- and second-period prices are given, respectively, by $p_1^M = v_H + \lambda(1 - \theta)$ and $p_2^M = v_L + \lambda(1 - Q^M)$ when the equilibrium pricing policy is markdown pricing and $Q^M > \theta$.

Region	Pricing	Order Quantity (Q^M)	Demand Type	Condition
I	Uniform Pricing	$(v_H + \lambda - c) / 2\lambda$ $(Q^M < \theta)$	High-value	$\{\lambda > \lambda_2^M(\theta), \frac{2}{3} < \theta \leq \theta_1^M\}$ $\cup \{\lambda > \lambda_1^M(\theta), \theta > \theta_1^M\}$
III	Markdown Pricing	$(v_L + \lambda(1 + \theta) - c) / 2\lambda$ $(\theta < Q^M < 1)$	High- and low-value	$\{\lambda > \lambda_3^M(\theta), \theta \leq \frac{2}{3}\}$ $\cup \{\lambda_3^M(\theta) < \lambda < \lambda_2^M(\theta), \frac{2}{3} < \theta \leq \theta_1^M\}$
IV	Markdown Pricing	1	High- and low-value	$\{\lambda \leq \lambda_3^M(\theta), \theta \leq \theta_1^M\}$ $\cup \{\lambda \leq \lambda_1^M(\theta), \theta > \theta_1^M\}$

There is no strategic effect and consumers' willingness to pay is independent from markdowns when consumers are myopic. Therefore, the firm induces a buying frenzy in more cases and marks the price down in fewer cases when selling to strategic consumers (by $\lambda_1^M(\theta) > \lambda_1(\theta)$ and $\lambda_3^M(\theta) > \lambda_3(\theta)$, see Figures 1 and 3a). Also, consumers' willingness to pay in the first period is completely independent from the consumption

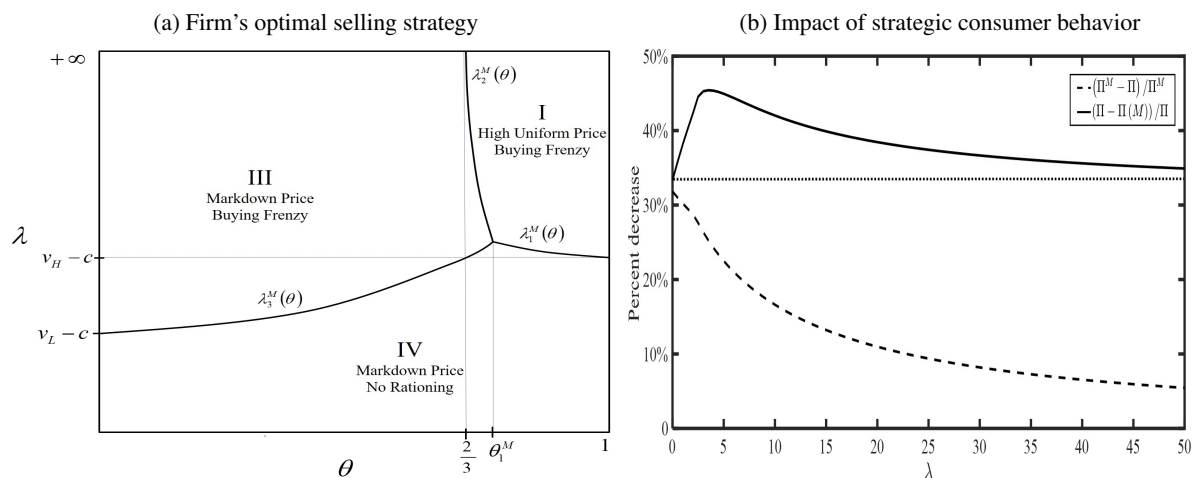


Figure 3 Results for myopic consumers. In Figure 3a, the plane (θ, λ) is divided into three regions for a fixed v_H ; and the λ^M functions defining the boundary of regions in the figure and θ_1^M are defined in Lemma A.3 in Appendix E.1. In Figure 3b, $v_H = 10, v_L = 2.8$, and $c = 1$ (i.e., $\theta_c = 0.2$), and $\theta = 0.3$.

in the second period when consumers are myopic. Thus, it is never optimal for the firm to sell only to high-value consumers without rationing them (i.e., Region II in Figure 1 disappears in Figure 3a).

Comparison of Figure 3a with Figure 1 indicates that the impact of strategic consumer behavior depends on consumers' sensitivity to consumption. When the sensitivity to consumption λ and the proportion of high-value consumers θ are both high or both low, the firm's equilibrium selling strategy is the same with or without strategic consumers, and the strategic consumer behavior has no impact on the firm's profit and can be completely ignored (i.e., $(\Pi^M - \Pi)/\Pi^M = 0$ and $(\Pi - \Pi(M))/\Pi = 0$). For other parameter values, the optimal strategies and the firm's profit can be quite different across the two scenarios. We illustrate some of the key insights using numerical examples in Figure 3b.

As expected, Figure 3b (dotted line) shows that the strategic consumer behavior has a less negative impact on the firm's profit as sensitivity to consumption increases (i.e., λ increases), and thus the negative impact of strategic consumer behavior is lower with snobbish consumers ($\lambda > 0$) than with non-snobbish consumers ($\lambda = 0$). As is also the case with non-snobbish consumers [Aviv and Pazgal, 2008; Soysal and Krishnamurthi, 2012], the firm counteracts the strategic consumer behavior (strategic effect) by deliberately under-producing to induce purchases at high price, which decreases sales and hence the firm's profit. However, with snobbish consumers, this also increases the product exclusivity (snob effect) and consumers' willingness to pay (sales effect). As a result, the negative impact of strategic consumer behavior becomes lower as consumers become more sensitive to consumption. Interestingly, this does not necessarily imply that the firm can ignore strategic consumer behavior when selling to snobbish consumers. Figure 3b (solid line) shows that the negative impact of ignoring strategic consumer behavior with snobbish consumers can be substantial (e.g., up to 45%) and is always more than that with non-snobbish consumers ($\lambda = 0$). To

understand this, for $\theta > \theta_c$ (e.g., numerical example in Figure 3b), we compare the optimal pricing policy and order quantity in cases where the firm considers and ignores the strategic consumer behavior. We find that the firm charges a high uniform price for low λ values while it marks down and rations some low-value consumers for high λ values (see Regions II and III in Figure 1). However, when the firm ignores the strategic consumer behavior (see Regions III and IV in Figure 3a for $\theta > \theta_c$), it always marks the price down and sets a larger order quantity (i.e., $Q^M > Q$) so that all high-value consumers wait for the lower price in the second period. As consumers become more sensitive to consumption (i.e., λ increases), the firm's order quantity when ignoring the strategic consumer behavior approaches to its optimal order quantity, and thus the negative impact of ignoring strategic consumer behavior decreases.

6. Conclusion

Luxury retailers frequently adopt markdowns [Kopun, 2016; Berezhna, 2017]. However, with exclusivity-seeking consumers, markdowns create difficult trade-offs for them: On the one hand, markdowns stimulate demand and turn inventory into cash. On the other hand, markdowns reduce exclusivity and hence exclusivity-seeking consumers' willingness to pay [CNNMoney, 2009; Rosenbloom, 2009b; Fury, 2015; Ang, 2016], and encourage affluent consumers to delay their purchases and wait for lower prices [Reagan, 2015; Bain, 2016; David, 2018]. We develop a game-theoretic model to analyze markdown and rationing strategies of a retailer selling to exclusivity-seeking and strategic consumers. Our analysis offers some useful insights into managerially relevant questions.

- *Does higher consumer desire for uniqueness motivate the retailer to price uniformly and not mark the price down?* By marking the price down, the retailer can increase its sales and sell to consumers with lower valuations, which will reduce the product exclusivity. Therefore, it is intuitive to expect that the retailer should adopt uniform pricing and not mark the price down as consumers' desire for uniqueness increases. Consistent with observations that the products of (high-status) luxury brands are never discounted, whereas there are frequent markdowns on the products of (low-status) *masstige* brands [see pg. 187; Kapferer, 2015],¹⁵ we find that, irrespective of the level of consumers' desire for exclusivity, markdown pricing is always optimal when the proportion of high-value consumers is sufficiently low, and never optimal when the proportion is sufficiently high. When the proportion of high-value consumers is intermediate, the retailer marks the price down only if consumers' desire for uniqueness is high. This, contrary to intuition, implies that higher consumer desire for uniqueness encourages the retailer to mark the price down when the proportion of high-value consumers is not too high and explains why some luxury retailers adopt price markdowns [Kopun, 2016; Wolfson and Wong, 2017; Berezhna, 2017]. To understand this counter-intuitive result, note that the strategic effect is low when the proportion of high-value consumers is low. In addition,

¹⁵ For example, based on our casual observations from their websites, Barneys New York and Farfetch charge a high price and offer no discounts on men shirts by high-status luxury brands such as Fendi and Gucci, while they offer discounts on men shirts by low-status (*masstige*) brands such as Calvin Klein and Ralph Lauren [Farfetch, 2019c; Barneys New York, 2019b].

for higher values of consumer desire for uniqueness, the snob effect is high, and hence, the retailer rations some consumers. The rationing risk, and the fact that consumers value using the product early with fewer people, increase all consumers' willingness to pay to purchase the product in the first period. Consequently, when consumers' desire for exclusivity is sufficiently high and the proportion of high-value consumers is not too high, the retailer charges a high price and sells to high-value consumers in the first period, and it marks the price down and sells to low-value consumers in the second period.

- *Does higher consumer desire for uniqueness motivate the retailer to increase exclusivity and/or to induce a buying frenzy?* One might expect that, as consumers seek more uniqueness, the retailer will deliberately sell less than the demand (i.e., buying frenzy) and increase the exclusivity. In line with this intuition, we find that the retailer should always induce a buying frenzy to increase consumers' willingness to pay when they are sufficiently exclusivity-seeking. This explains why we observe that luxury retailers offer limited editions or create waiting lists of products mostly with high consumption visibility.¹⁶ Also, we show that, with exclusivity-seeking consumers, a buying frenzy need not always be used to sustain markdown pricing, and the retailer can induce a buying frenzy when it adopts uniform pricing. Further, contrary to the intuition, we find that, when the proportion of high-value consumers is neither too high nor too low, the retailer decreases exclusivity by marking the price down and selling to more consumers as they desire more uniqueness. In such cases, the retailer induces a buying frenzy but does not increase exclusivity. This provides an alternative explanation for why luxury retailers offer limited editions or waiting lists to commit to a low quantity of certain products while they do not for others [Rosenbloom, 2009a; Clifford, 2011].

- *How does the presence of strategic (forward-looking) consumers, who can wait for lower prices, affect a luxury retailer?* Strategic consumer behavior limits the retailer's ability to price discriminate and thus adversely impact on its profit. On the other hand, their desire for uniqueness induces consumers to advance their purchases. Intuitively, one might argue that the negative impact of strategic consumer behavior on a firm's profitability might be lower when consumers are exclusivity-seeking, and that ignoring strategic behavior might be less costly. Consistent with the intuition, we find that the negative impact of strategic consumer behavior on a retailer's profit is lower with exclusivity-seeking consumers. This is because when the retailer decreases the order quantity to counteract the strategic consumer behavior, it actually leads to an increase in high-value consumers' willingness to pay. Yet, ignoring strategic consumer behavior and implementing a strategy corresponding to myopic consumers can be more costly when faced with exclusivity-seeking consumers. Thus, luxury retailers should take strategic consumers into account and carefully determine their markdown strategies.

¹⁶ For example, luxury retailers (e.g., Nordstrom, Farfetch and Bergdorf Goodman) offer limited-edition jackets, shoes, and sunglasses by Balenciaga, Valentino, Calvin Klein and Michael Kors, and have waiting lists for Hermes Birkin handbag and Chanel sequined tweed coat [Clifford, 2011; Stoppard, 2015; Farfetch, 2019a].

Limitations and Future Research. Our model can be extended to incorporate aggregate demand uncertainty. The demand uncertainty increases the rationing risk for consumers delaying their purchases. As a result, consumers can make a higher upfront payment in the first period, and the firm, in turn, can charge a higher first-period price. Hence, we expect price markdowns to be optimal in more cases when the aggregate demand is uncertain. Further, our model can be extended by considering a more general setting where consumers are risk-averse and their valuations are drawn from a continuous distribution. Our preliminary attempts indicate that such a modeling extension poses significant analytical challenges; however, through an extensive numerical study, we find that our main insights (e.g., exclusivity-seeking consumer behavior leads to price markdowns and buying frenzies) are still valid in this more general setting. Another interesting issue to explore is the long-run impact of markdowns on consumer valuations. After observing a product on markdown in one season, consumers may no longer be willing to pay a higher price for a similar product of the same brand in the next season. This certainly reduces the firm's incentive to mark the price down. However, modeling this phenomenon requires a multi-period analysis of strategic consumer behavior, which might be analytically challenging. Also, the long-term effect of intertemporal pricing on consumer valuations is probably a much bigger concern for the firms that own the luxury brand than for retailers that sell it. This would require modeling different parties within the channel through which the luxury products are brought to the market and could result in misaligned incentives in the channel, which could be mitigated through appropriate contracting mechanisms.

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