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Social pricing of luxury products in a distribution channel

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Abstract

The proliferation of social ***networking*** platforms like Facebook, Twitter, Instagram, and TikTok has greatly facilitated social interactions among individuals, and thus their product consumption has become more visible to their peers. This enhanced visibility influences consumers' purchase decisions of luxury products because it affects social value derived from conspicuous consumption of these products. In this paper, we develop an analytical model to study the impact of such social technologies on social pricing of a manufacturer and a retailer offering luxury products along a distribution channel. Consumers exhibit conspicuous consumption preferences and are grouped into *snobs* and *conformists*: Snobs value product exclusivity, while conformists desire product popularity. We derive the following interesting results. First, a better social technology that leads to higher visibility for conspicuous consumption can either raise or lower the wholesale price and retail price. Second, the manufacturer may gain (lose) while the retailer may lose (gain) under a better social technology; that is, the manufacturer's and retailer's preferences regarding the level of a social technology may not be aligned. Third, the advancement of a social technology may harm consumer surplus. Lastly, we consider several model extensions to validate our findings in broader contexts.

KEYWORDS
conspicuous consumption, distribution channel, luxury products, social technologies, social pricing

1 | INTRODUCTION

Social networking is gaining unprecedented prevalence. In 2021, the total number of monthly active users for Facebook, Instagram, and TikTok across the globe reaches 2.85, 1.07, and 1 billion, respectively, and one in five U.S. adults uses Twitter. Users spend considerable time and energy on these social networking platforms. For example, the total number of tweets per day is around 500 million, and a typical user allocates an average of 30 minutes per day to Instagram.[1]

Due to the proliferation of these social technologies, social interactions among individuals are greatly facilitated such that users' product consumption becomes more visible to their peers (Qiu & Whinston, 2017). This is achieved by browsing individuals' posted pictures and videos that include product consumption information. The enhanced visibility facilitated by social technologies plays a pivotal role in conspicuous consumption. Conspicuous consumption is usually associated with luxury products (e.g., S. Y. Gao et al., 2017; Li, 2019) because these products bring consumers not only material value but also social value that is heavily influenced by consumers' social interactions (Belk, 1988). As a result, we mainly consider the luxury product in this study. Moreover, focusing on this product category has significant practical implications, as it was projected that the market size of global luxury products would increase from US309.6 billion in 2021 to US382.6 billion in 2025.[2]

According to Amaldoss and Jain (2005a, 2005b), consumers can be labeled as *snobs* and *conformists* in terms

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of how they view the social value of a product from conspicuous consumption. Snobs desire product exclusivity in the sense that they prefer a product that is less commonly adopted by their peers (also see Bagwell & Bernheim, 1996; Leibenstein, 1950); whereas conformists seek product popularity, that is, they desire a product that is more commonly adopted by their friends (also see Jones, 1984; Ross et al., 1975). Social technologies facilitate consumers' social interactions and thus yield profound impacts on the social value of a product from conspicuous consumption for snobs and conformists. A snob who desires product exclusivity is more reluctant to buy a "hot" product that is frequently displayed by others on the social networking platforms; conversely, a conformist who desires product popularity is more willing to purchase such a product.

As highlighted earlier, social technologies play a critical role in influencing the social value of a luxury product, since they improve the visibility of conspicuous consumption by encouraging social interactions among consumers. Note that an important business relationship for firms in practice is in the form of a distribution channel consisting of a manufacturer and a retailer. As a result, a luxury-product manufacturer and its retailer in a distribution channel need to set their wholesale and retail prices wisely in response to the changes brought by social technologies. Moreover, firms also need to learn how social technologies affect their profits. In addition, from the perspective of a social planner, it is also crucial to have a deep understanding of the impact of social technologies on consumer surplus so that better policies can be enacted. Despite their importance, the above issues are generally overlooked in the literature. To fill this important research gap, our paper develops an analytical model to explicitly study the impacts of social technologies on firms' prices and profits as well as on consumer surplus. Specifically, the model consists of a manufacturer who produces a luxury product and sets the wholesale price, a retailer who procures this product from the manufacturer and decides the retail price, and consumers who have social (i.e., conspicuous consumption) preferences and make purchasing decisions in a distribution channel. The product gives consumers not only the intrinsic value but also the social value. Consumers are categorized into two groups based on their conspicuous consumption preferences: snobs who value product exclusivity and conformists who value product popularity (Amaldoss & Jain, 2005a, 2005b). That is, snobs (conformists) obtain higher social value from the product when fewer (more) consumers purchase this product. The social value of a product for consumers can also be influenced by the advancement of the social technologies. This construct is to capture the fact that the social value of a product for consumers can be further affected by social technologies due to their positive role in facilitating social interactions among consumers. It is worthwhile to point out that the novel elements of our model are (1) there is a newly added channel structure consisting of a manufacturer and retailer and (2) consideration of social technologies influencing the social value of a product by promoting consumers' social interactions.

Given our setting, one may intuitively expect that a better social technology that enhances the visibility of conspicuous consumption would increase both the wholesale price and retail price when enough consumers are conformists since the overall willingness to pay of consumers for the product is higher. In addition, one may also reasonably expect that such a better social technology may benefit all firms due to its positive effect on prices as well as consumers due to its positive effect on facilitating consumers' social interactions in this case. Interestingly, we find that the opposite result—a better social technology can drive down firms' prices and make one of the firms (either the manufacturer or retailer) and consumers worse off—may exist under certain circumstances. Moreover, we also consider several model extensions to show the robustness of our findings in broader contexts. First, we study the impacts of social technologies in an agency model in which a downstream retailer sets revenue share and an upstream manufacturer sets retail price. This aims to capture the impact of an alternative contract between the firms on our findings. Second, we examine a competition setting in which retailers compete in retail prices to show how retailer competition affects the results. Third, we consider an additional type of consumers in the market, in which consumers in this group do not have conspicuous consumption preferences. Lastly, we investigate the impact of the improvement of social technologies on the total welfare for both firms and consumers. The detailed results and their rationales are given below.

First, on the one hand, a better social technology that offers higher conspicuous consumption visibility can either increase or decrease the manufacturer's wholesale price, depending on the proportion of conformists and the marginal social value of the product from conspicuous consumption. A better social technology directly influences the overall willingness to pay of consumers for the product by making conspicuous consumption more visible. Note that each additional sale exerts a positive externality for conformists' product valuation but a negative one for that of snobs. As a result, in the presence of a high proportion of conformists, a better social technology raising the overall willingness to pay of consumers would directly make the manufacturer set a higher wholesale price. This increase in wholesale price due to the advancement of a social technology leads the retailer to charge a higher retail price, which in turn creates a lower product popularity. Moreover, it is worth noting that in this case most consumers desire product popularity such that the firms (including both the manufacturer and retailer) would want to increase product popularity. As such, interestingly, this resulted lower product popularity simultaneously motivates the manufacturer to strategically decrease its wholesale price to induce a lower retail price that helps sustain a higher product popularity.

In other words, a better social technology provides the manufacturer with an incentive to strategically set a lower wholesale price in an indirect manner. We identify that this indirect strategic move can be more attractive when the marginal social value of the product from conspicuous consumption is increasing in the number of consumers making purchases. In a nutshell, the manufacturer may decrease its wholesale price at optimum when enough consumers are

conformists and consumers are more sensitive to an additional increase in the number of consumers making purchases as this number increases. In contrast, when the marginal social value of the product from conspicuous consumption is decreasing in the number of consumers making purchases, the manufacturer may find it optimal to increase its wholesale price in the presence of a high proportion of conformists. This is because in this alternative scenario, strategically reducing the wholesale price is no longer lucrative. On the other hand, the impact of social technologies on the retailer's retail price is akin to that on the manufacturer's wholesale price for the same rationale. As a result, we find that a better social technology, which enhances social interactions among consumers, can cause higher or lower retail prices under similar circumstances.

Second, a better social technology can result in divergent impacts on the profitability of the manufacturer and retailer. On the one hand, a better social technology leads the manufacturer to get higher or lower profits, depending on the proportion of conformists in the market. Specifically, the manufacturer earns higher profits if this proportion is high but lower profits otherwise, as the overall willingness to pay of consumers to the product is higher in the former case but lower in the latter. On the other hand, the retailer may also gain or lose under a better social technology, depending on alternative conditions. That is, the presence of a high proportion of conformists can make the retailer earn lower profits, while the presence of a high proportion of snobs can make the retailer obtain higher profits. The above results occur when the marginal social value of the product from conspicuous consumption is decreasing in the number of consumers making purchases. Following the reasoning put forward in the first finding, the presence of a high proportion of conformists pushes up the wholesale price, while a high proportion of snobs drives down the wholesale price in this case. As a result, the retailer can earn lower profits in the former scenario but higher profits in the latter one. The above results suggest that the manufacturer's and retailer's preferences regarding the level of a social technology may not be aligned. That is, under a better social technology, the manufacturer may lose while the retailer may gain; or, conversely, the manufacturer may gain but the retailer may lose.

Third, a better social technology may benefit or hurt consumers. Specifically, it can make consumers worse off when the proportion of conformists is high and the marginal social value of the product from conspicuous consumption is decreasing in the number of consumers making purchases. This is because the retail price of the product is higher in this case. Conversely, a better social technology can make consumers better off from the induced lower retail price. This can happen in the presence of a high proportion of conformists if the marginal social value of the product from conspicuous consumption is increasing in the number of consumers making purchases. One of the key insights of this paper is that social technologies may not always benefit consumers but can sometimes hurt them, despite facilitated social interactions among consumers. This paper presents a possible detrimental effect of social technologies on consumers and thus adds a word of caution to social planers in drafting the policies that promote social technologies.

In summary, our findings complement the literature in two original ways. First, the extant literature pays little attention to conspicuous consumption in a distribution channel setting. Given the ubiquitous channel relationships between manufacturers and retailers in practice, there is a keen need to study how conspicuous consumption affects a manufacturer's wholesale price, a retailer's retail price, and their profitability. Second, the extant literature does not give sufficient consideration to the impact of social technologies on conspicuous consumption. As stated earlier, the proliferation of social technologies facilitates consumers' social interactions such that their conspicuous consumption becomes more visible to their peers. Therefore, examining the implications of social technologies on conspicuous consumption has practical significance. The findings of our paper fill the above two research gaps and thus offer new insights for manufacturers and retailers who offer luxury products in distribution channels to better adapt to the prevalence of social networking platforms (e.g., Facebook, Twitter, Instagram, and TikTok).

The remainder of the paper is organized as follows. Section 2 reviews the related literature. Section 3 lays out the model setup. We present the model results in Section 4. Section 5 considers several model extensions to verify the robustness of our results. We conclude this study in Section 6. All proofs are provided in the Supporting Information Appendix.

2 | RELATED LITERATURE

This paper has points of contact with two streams of the literature: (i) social pricing and (ii) conspicuous consumption. However, our paper is distinctively different from each stream in some crucial aspects and makes unique contributions to the literature.

First, this paper is related to the literature on social pricing. Social pricing is a pricing practice based on consumers' social interactions.[3] Jing and Xie (2011) theoretically find that a firm may gain from group buying that encourages consumers' social interactions. Luo et al. (2014) empirically demonstrate that social factors amplify the positive effect of product popularity on consumers' purchasing likelihood. Kumar and Rajan (2012) identify that social coupons are ineffective at improving customer acquisition and profits. Moreover, Qiu and Whinston (2017) find that upon taking into account behavioral observational learning, lower introductory prices are not always effective at boosting product demand when consumers share their purchases through social networks. H. Gao et al. (2021) show the effectiveness of social promotion in an online retail platform that encourages individuals to share coupons with their peers on a social network app. H. Gao et al. (2022) propose a novel social pricing mechanism based on consumers' social network value and find that this pricing strategy works for not only new consumers but also existing ones. As is evident, the extant

literature does not consider social pricing in a channel relationship. We fill this research gap by investigating how a manufacturer's wholesale price and a retailer's retail price are affected when social technologies play a pivotal role in a distribution setting. Our paper conveys actionable insights into social pricing practices of a manufacturer and a retailer in a distribution channel, given that social technologies (such as Facebook, Twitter, Instagram, and TikTok) have greatly enhanced social interactions among consumers and thus have largely influenced these firms.

Second, this paper complements the literature on conspicuous consumption. The idea of conspicuous consumption is directly associated with consumer network (e.g., social interactions) effects. To begin with, consumers can be influenced by the number of their peers making purchases. When consumers have conspicuous consumption preferences—snobs valuing product exclusivity and conformists valuing product popularity, some consumers' demand may increase in product price in both monopoly (Amaldoss & Jain, 2005a) and competition settings (Amaldoss & Jain, 2005b). Moreover, Amaldoss and Jain (2015) show that competing firms choose an umbrella branding strategy instead of an individual brand one when consumers are more snobbish based on their earlier framework. Using a signaling framework, Corneo and Jeanne (1997) find that conformist behavior may lead to an upward-sloping demand curve. In addition, when engaging in conspicuous consumption, consumers can also be influenced by the wealth level of their peers making purchases. Specifically, when consumers prefer a product that more wealthy consumers buy, a durable goods seller experiences price depreciation (Rao & Schaefer, 2013), low-quality copycats with high appearance resemblance are more likely to emerge in the market (Gao et al. 2017), the dominant firm's line extension can make its competitor earn more profits (Li, 2019), and a manufacturer can earn more profits under parallel imports of gray products (Li et al., 2022). On the empirical side, Charles et al. (2009) provide evidence of divergent patterns of expenditures on conspicuous spending across different races. Yuan et al. (2022) find that a brand logo's prominence can have an impact on consumers' choice for luxury products. Notably, the above literature does not pay attention to the two important issues in practice: (a) the impact of social technologies on conspicuous consumption and (b) the related channel issues, including how conspicuous consumption preferences affect the wholesale price of a manufacturer, retail price of a retailer, and profits of the firms under a social technology that facilitates social interactions among consumers. Our paper closes these two research gaps and sheds light on how social technologies and conspicuous consumption interact with each other and how firms in a distribution channel set their prices in response to such an interaction.

Moreover, it is worth noting that social value of a product is different from network externality studied in the literature (e.g., Parker & Van Alstyne, 2005). Admittedly, there are some similarities in the sense that either of them can be considered as a particular type of consumption externality. However, they also differ in the following crucial aspects. First, while network externality typically arises due to technological reasons (e.g., consumers experience network externality in the presence of software or hardware), the motivation for the social value considered in this paper is social or behavioral. It means that, unlike network externality which depends on the actual interactions among consumers, the social value of conspicuous consumption purely relies on how each consumer perceives about others' possession of the product. Second, although it is possible that all consumers experience either positive or negative network externality in consuming a product, they may also obtain different social values from the same product, which is the focus of this paper. That is, when engaging in conspicuous consumption, snobs seek product exclusivity whereas conformists look for product popularity.

In summary, to the best of our knowledge, this paper is the first attempt to develop an analytical model that studies social pricing of a manufacturer and a retailer in a distribution channel setting. In addition, the impact of social technologies on conspicuous consumption is generally overlooked in the extant literature but is explicitly investigated in this paper. Given the ubiquitous channel relationships between firms and the profound impact of social technologies on conspicuous consumption in practice, this paper provides important guidance for a manufacturer and a retailer in a distribution channel to wisely set wholesale and retail prices and thus better manage their profitability and also offers important insights for policymakers who wish to improve consumer surplus as a result.

3 | MODEL SETUP

We consider a distribution channel model in which an upstream luxury product manufacturer sets the wholesale price, a downstream retailer charges the retail price, and consumers exhibiting conspicuous consumption preferences make purchasing decisions. To reflect the reality highlighted in the introduction, we integrate the impact of social technologies on conspicuous consumption into the model. In doing so, we can explicitly derive how social technologies affect a manufacturer's wholesale price and profits, a retailer's retail price and profits, and consumers' purchase decisions and surplus.

In the model, a manufacturer decides the wholesale price w of its luxury product, which is charged to a retailer who then sets the product's retail price p to consumers. The marginal cost of production for the manufacturer is c. In line with the literature on conspicuous consumption, such as Amaldoss and Jain (2005a, 2005b), we assume that there are two types of consumers in terms of conspicuous consumption preferences: *snobs* and *conformists*. Specifically, snobs value product exclusivity, whereas conformists value product popularity. That is, the willingness to pay for snobs (conformists) decreases (increases) with the expected number of consumers who will purchase the product. As a result,

consumers' utilities obtained from the product depend on not only the intrinsic value but also the social value (which will be further explored below). Literature has shown that snobs and conformists generally coexist in the luxury product market (e.g., Kastanakis & Balabanis, 2014; Leibenstein, 1950). Without loss of generality, we assume that there is a unit mass of consumers in the market, with α proportion of them being snobs and the rest $1-\alpha$ being conformists. In practice, firms offering different products may learn different proportions by conducting the consumer research. Each consumer demands at most one unit of the product.

Given the expected number of consumers (consisting of both snobs and conformists) who make purchases z^e, the expected product utilities for snobs and conformists are $U_s(v,p,z^e) = v - \beta\lambda_s f(z^e) - p$ and $U_c(v,p,z^e) = v + \beta\lambda_c f(z^e) - p$, respectively. Here, the first term v represents the intrinsic value of the product for all consumers, which follows a uniform distribution over an interval from 0 to 1. The second terms $-\beta\lambda_s f(z^e)$ and $\beta\lambda_c f(z^e)$ are the social values of the product for snobs and conformists, respectively. We can further decompose the second terms as follows. First, the social value of the product from conspicuous consumption $f(z^e)$ for consumers is associated with the expected total number of consumers making purchases. We assume that $f(0) = 0$, and $f'(z^e) \geq 0$ for any $z^e \geq 0$ to reflect that consumers derive zero social value of the product from conspicuous consumption when no consumers make purchases, and the impact of the number of consumers making purchases on the social value of the product from conspicuous consumption is larger when more consumers make purchases. Second, $-\lambda_s$ and λ_c represent snobs' and conformists' degrees of conspicuous consumption preferences (i.e., the impact of conspicuous consumption on the social product values), respectively. This is to capture that snobs derive a negative social value from the product as they desire product exclusivity, while conformists derive a positive social value from the product as they value product popularity from conspicuous consumption. As a result, a higher λ_s (λ_c) translates to a stronger conspicuous consumption preference for snobs (conformists). Third, β measures the impact of social technologies (e.g., Facebook, Twitter, Instagram, and TikTok) on the visibility of conspicuous consumption. That is, the better the social technology, the more visible the consumers' conspicuous consumption to their peers (higher β). This is to capture that consumers' conspicuous consumption will be more visible to their peers, as a social technology facilitates consumers' social interactions.

Essentially, having a higher β is equivalent to having higher λ_s and λ_c at the same time; however, having one of the λ_s or λ_c higher is not equal to having a higher β. For instance, the proliferation of social networking platforms amplifies the social impact on both snobs and conformists; in contrast, a stronger conspicuous consumption preference for snobs (conformists) does not translate into a stronger conspicuous consumption preference for conformists (snobs) as their preferences are independent. In short, a change of social technology factor β affects all consumers' consumption behavior while a change of individual preference factor λ_s or λ_c affects either snobs or conformists. As a result, these parameters can capture different aspects that affect consumers' choices.

Our model has close ties with the following two important stylized facts of the luxury industry. First, consumers purchasing the luxury products usually belong to one of the following two types: snobs and conformists (e.g., Kastanakis & Balabanis, 2014; Leibenstein, 1950). That is, they care about social value in consuming the luxury product from contrasting ways: snobs prefer the product with less popularity while conformists desire the product with more popularity. Second, social networking platforms like Facebook, Twitter, Instagram, and TikTok play a more important role in determining the luxury product's social value by influencing its popularity, because consumption of luxury products becomes more visible to peers with the improvement of social interactions among individuals facilitated by the advancement of such social technologies. This means that consumers are more likely to be influenced by social technologies when purchasing the luxury products nowadays. We integrate the above consumer heterogeneity in conspicuous consumption and influence of social technologies on the social value of a product into an analytical model. As a result, our model can answer how the improvement of social technologies affects the luxury brands and their retailers in setting their prices to better manage their relationships.

The sequence of our model is as follows. At the first stage, the manufacturer sets the wholesale price w charged to the retailer. At the second stage, after observing the wholesale price w, the retailer sets the retail price p. At the third stage, all consumers (both snobs and conformists) decide whether or not to make purchases. We adopt the rational expectations equilibrium as the solution concept for this paper. We analyze the problem through the backward induction. To begin with, we look at consumers' purchase decisions, based on the retail price p. Next, given the consumer choices, we move to examine the retailer's decision on the retail price, based on the wholesale price w. Finally, conditional on the choices of the consumers and the retailer, we investigate the manufacturer's decision on the wholesale price.

3.1 | Consumers

At the third stage, given the retail price and the expected number of consumers z^e, a snob will make a purchase if $U_s(v,p,z^e) \geq 0$. That is, the number of snobs who will make purchases is

$$z_s = \alpha\big(1 - p - \beta\lambda_s f(z^e)\big), \tag{1}$$

given that $p < 1 - \beta\lambda_s f(z^e)$; otherwise, there is no demand from snobs. Similarly, the number of conformists who will purchase the product is

$$z_c = (1-\alpha)\big(1 - p + \beta\lambda_c f(z^e)\big). \tag{2}$$

As such, taking the product demand from both snobs and conformists together, the total product demand of consumers is

then given by

$$\begin{aligned} z &= z_s + z_c \\ &= 1 - p + \big((1-\alpha)\beta\lambda_c - \alpha\beta\lambda_s\big) f(z^e) \\ &= 1 - p + \lambda f(z^e), \end{aligned} \tag{3}$$

where $\lambda \equiv \beta((1-\alpha)\lambda_c - \alpha\lambda_s)$. Essentially, the parameter λ is the overall social factor that produces the impact on the market outcomes, because all parameters in λ directly affect the sign (i.e., α) and the size (i.e., β, λ_c, and λ_s) of the social value of the product due to their influences on consumers' social interactions. As such, the overall social factor λ could be either positive or negative, depending on the values of the parameters α, λ_s and λ_c. Clearly, $\lambda > 0$ if $\alpha < \frac{\lambda_c}{\lambda_s+\lambda_c}$, and $\lambda \leq 0$, otherwise. In addition, $\frac{\partial\lambda}{\partial\beta} > 0$ if $\lambda > 0$, and $\frac{\partial\lambda}{\partial\beta} \leq 0$ otherwise. As such, a better social technology (i.e., a higher β) yields a positive influence on the overall social factor if there are enough conformists compared to snobs in the market; conversely, it produces a negative influence on the overall social factor otherwise.

Following the rational expectations framework, consumers' expectations are correct in equilibrium, which means that the realized market demand for the product coincides with the expected number of consumers who make purchases, that is, $z = z^e$. That is,

$$z = 1 - p + \lambda f(z). \tag{4}$$

As a result, the inverse demand function for the product of consumers can be expressed as

$$p = 1 - z + \lambda f(z). \tag{5}$$

To guarantee the law of demand, that is, the total product demand z is strictly decreasing in price p, we assume that the following condition is satisfied for the remainder of the analysis:

$$-1 + \lambda f'(z) < 0. \tag{6}$$

This condition also ensures that there exists a unique equilibrium for any price in the relevant range. It further implies that for the retailer, setting the retail price p is equivalent to choosing the total product quantity z. Following the fact that $f'(\cdot) \geq 0$, we note that condition (6) always holds as long as $\lambda \leq \frac{1}{f'(z)}$.

3.2 | Retailer

Based on the consumers' choices examined earlier, we then study the optimal decision of the retailer. For any wholesale price w set by the manufacturer, the retailer sets retail price p to maximize the profit $\Pi_r = (p - w)z$. Recall that (5) uniquely pins down the relationship between p and z, so it is equivalent to say that the retailer chooses z to maximize Π_r.

The optimal choice of z is determined by the following condition:

$$h(z) = w, \tag{7}$$

where $h(z) \equiv \frac{d(pz)}{dz} = 1 - 2z + \lambda(f(z) + zf'(z))$. Here, $h(z)$ represents the marginal revenue for the retailer. Intuitively, at optimum, the retailer should set the retail price (or choose the total product quantity) such that its marginal revenue $h(z)$ equals its marginal cost w. Moreover, we can verify that $\frac{dz}{dw} = \frac{1}{h'(z)} < 0$, which follows from the concavity of the retailer's profit function. This implies that the optimal demand z is always decreasing in the wholesale price w. Since the retail price p is decreasing in z by (5), the optimal retail price p must be increasing in w, that is, $\frac{dp}{dw} > 0$. That is, the retailer will set a higher price (or choose a lower total product quantity) as its marginal cost w increases.

3.3 | Manufacturer

Given that the retailer optimally chooses the total product quantity z according to (7), the manufacturer sets the wholesale price w to maximize its profit as a response. Since the optimal z is increasing in w, there also exists a one-to-one relationship between z and w. Hence, it is equivalent for the manufacturer to choose z to maximize $\Pi_m = (w - c)z = (h(z) - c)z$. The manufacturer's optimal choice of z, denoted by z^*, is determined by the following first-order condition:

$$h(z^*) + h'(z^*)z^* - c = 0. \tag{8}$$

Note that $h(z) + h'(z)z$ also captures the marginal revenue for the manufacturer, which must be equal to its marginal cost at optimum.

4 | RESULTS

In this section, we are interested in how social technologies affect the manufacturer's wholesale price and profit, retailer's retail price and profit, and consumers' purchase decisions and surplus.

Recall that $\lambda \equiv \beta((1-\alpha)\lambda_c - \alpha\lambda_s)$ as defined earlier. As a result, by studying the effect of the overall social factor λ on the total product demand z^*, wholesale price w^*, retail price p^*, manufacturer's profit Π_r^*, and retailer's profit Π_m^*, we can uncover how a social technology β (such as Facebook, Twitter, Instagram, and TikTok) that

influences the visibility of conspicuous consumption affects these equilibrium market outcomes. For ease of notation, we define $\Gamma(z) = \frac{1}{2}(z)^2 + \frac{1}{2}\alpha(1-\alpha)(\lambda_s+\lambda_c)^2\beta^2 f^2(z)$ for the remainder of this study. Based on the model setup, the following lemma summarizes the equilibrium market outcomes.

Lemma 1. *In equilibrium, the total product demand z^* is determined by (8); the manufacturer's wholesale price and retailer's retail price are $w^* = h(z^*)$ and $p^* = 1 - z^* + \lambda f(z^*)$, respectively; the manufacturer's and retailer's profits are $\Pi_m^* = (w^* - c)z^*$ and $\Pi_r^* = (p^* - w^*)z^*$, respectively; and the consumer surplus is $CS^* = \Gamma(z^*)$.*

4.1 | Impact of social technologies on product demand

Following the equilibrium condition (8), we can obtain the impact of the overall social factor λ on the equilibrium total product demand z^* below.

Proposition 1. *The equilibrium total product demand z^* is increasing in λ if and only if $g_z(z^*) > 0$, where $g_z(z^*) = f(z^*) + 3z^*f'(z^*) + (z^*)^2 f''(z^*)$.*

Proposition 1 states that the equilibrium product demand z^* can either increase or decrease in the overall social factor λ, depending on whether $g_z(z^*)$ is positive or negative. The intuition behind Proposition 1 is as follows. The parameter λ affects the equilibrium total product demand z^* through its impact on the marginal revenue of the manufacturer $h(z^*) + h'(z^*)z^*$. If the overall effect is positive, the manufacturer will raise z^* in response to an increase in λ; otherwise, the total product demand will be lower. It is evident that the overall effect would depend on the sensitivity of the manufacturer's marginal revenue to λ, which is captured by the function $g_z(\cdot)$. Note that $g_z(\cdot)$ is further affected by the shape of $f(\cdot)$. On the one hand, if $f(\cdot)$ is (weakly) convex ($f''(\cdot) \geq 0$), that is, the marginal social value of the product from conspicuous consumption for consumers is (weakly) increasing in the number of consumers making purchases, then we always have $g_z(\cdot) > 0$. This implies that the total product demand z^* must be increasing in λ. On the other hand, the total product demand z^* can only decrease in λ when $f(\cdot)$ is strictly concave ($f''(\cdot) < 0$), that is, the marginal social value of the product from conspicuous consumption for snobs and conformists is strictly decreasing in the number of consumers making purchases. Therefore, it is the sign of the second derivative of the function $f(\cdot)$ that drives the above results. Intuitively, $f''(\cdot) \geq 0$ ($f''(\cdot) < 0$) when consumers are more (less) sensitive to an additional increase in the number of consumers making purchases as this number increases.

Recall that $\lambda \equiv \beta((1-\alpha)\lambda_c - \alpha\lambda_s)$ again. Based on the above results, it can be readily verified that the equilibrium total product demand z^* can either increase or decrease in β, depending on the proportion of conformists $1-\alpha$ (whether α is above $\frac{\lambda_c}{\lambda_s+\lambda_c}$) and the sign of $g_z(z^*)$. Intuitively, the higher proportion of the conformists, the higher the total product demand, because each additional sale exerts a positive externality for conformists' product valuation but a negative one for snobs'. As a result, a better social technology, which facilitates social interactions among consumers and thus leads to higher visibility of their conspicuous consumption, should improve the total product demand in the presence of a high proportion of conformists. However, our findings suggest that the opposite can occur in the presence of a high proportion of conformists: A better social technology may reduce the total product demand if the marginal social value of the product from conspicuous consumption is decreasing in the number of consumers making purchases. This is because the firms do not have incentives to charge lower prices to create a higher product popularity when the consumers are less sensitive to an additional increase in the number of consumers making purchases as this number increases. Therefore, the product's retail price is higher in this case, which in turn drives down the total product demand.

4.2 | Impact of social technologies on wholesale price

Applying the equilibrium condition (8), the impact of the overall social factor λ on the equilibrium wholesale price w^* of the manufacturer is given as follows.

Proposition 2. *The equilibrium wholesale price w^* is increasing in λ if and only if $g_z(w^*) < g_w(z^*)$, where $g_w(z^*) = \frac{(f(z^*)+z^*f'(z^*))(h''(z^*)z^*+2h'(z^*))}{h'(z^*)} > 0$.*

Proposition 2 says that the equilibrium manufacturer's wholesale price w^* can either increase or decrease in the overall social factor λ, depending on whether $g_z(w^*)$ is below $g_w(z^*)$. One can gain an understanding about this proposition using the following reasoning. Since the relationship between w^* and z^* is given by $w^* = h(z^*)$, the impact of λ on the equilibrium wholesale price can be written as follows:

$$\frac{dw^*}{d\lambda} = \underbrace{\frac{\partial w^*}{\partial \lambda}}_{(+)} + \underbrace{\frac{\partial w^*}{\partial z^*}}_{(-)}\underbrace{\frac{dz^*}{d\lambda}}_{(?)}. \tag{9}$$

As such, there are direct and indirect effects of λ on w^*. First, the direct effect of λ on w^*, which is given by the term $\frac{\partial w^*}{\partial \lambda}$, is always positive. This captures the fact that a higher λ tends to raise consumers' overall willingness to pay for the product, which in turn enables the manufacturer

to set a higher wholesale price to maximally extract this surplus.

Second, the term $\frac{\partial w^*}{\partial z^*}\frac{dz^*}{d\lambda}$ measures the indirect effect of λ on w^* through z^*. Although we already know from earlier analysis that $\frac{\partial w^*}{\partial z^*} < 0$, the indirect effect is generally uncertain, since the effect $\frac{dz^*}{d\lambda}$ is ambiguous according to Proposition 1. Hence, the net effect of λ on w^* would depend on whether the direct effect or indirect effect dominates. Clearly, if λ has a negative effect on z^*, that is, $\frac{dz^*}{d\lambda} < 0$, then the indirect effect is always positive, implying a positive relationship between w^* and λ. Otherwise, if λ has a positive effect on z^*, it is possible that the overall effect of λ on w^* is negative.

Recall that $\lambda \equiv \beta((1-\alpha)\lambda_c - \alpha\lambda_s)$. Essentially, β governs the indirect effect as it influences both $\frac{\partial w^*}{\partial z^*}$ and $\frac{dz^*}{d\lambda}$. Proposition 2 suggests that the equilibrium wholesale price may either increase or decrease in β, depending on whether α is above $\frac{\lambda_c}{\lambda_s+\lambda_c}$ and whether $g_z(w^*)$ is above $g_w(z^*)$. It is worth noting that $\frac{dz^*}{d\lambda} > 0$ when $f''(\cdot) \geq 0$ by applying Proposition 1. It follows that in the presence of a high proportion of conformists, a better social technology that offers higher visibility of conspicuous consumption may lead to a lower wholesale price if the marginal social value of the product from conspicuous consumption is increasing in the number of consumers making purchases. The reason is that the indirect effect can be negative in this scenario.

One can better understand the above result using the following reasoning. In the presence of a high proportion of conformists, a better social technology directly makes the manufacturer to charge a higher wholesale price due to its positive influence on the overall willingness to pay of consumers. As a result, the retail price is higher given this higher wholesale price due to the advancement of a social technology, thereby leading to a lower product popularity. Moreover, note that when enough consumers value product popularity in the market, both the manufacturer and retailer will think about how to increase product popularity so as to cater to such consumers' preference. As such, interestingly, the resulted lower product popularity motivates the manufacturer to strategically reduce its wholesale price at the same time, in order to drive down the retail price that helps sustain a higher product popularity. That is, a better social technology also pushes the manufacturer to strategically reduce its wholesale price in an indirect manner. Specifically, we identify that the manufacturer may find this indirect strategic move more attractive when consumers are more sensitive to an additional increase in the number of consumers making purchases as this number increases. The reason is that in this case the indirect effect outperforms the direct effect, which in turn results in a lower wholesale price. In contrast, following the above similar reasoning, it can be readily seen that in the presence of a high proportion of conformists, a better social technology may also result in a higher wholesale price. This happens when consumers are less sensitive to an additional increase in the number of consumers making purchases as this number increases since the indirect effect is positive in this alternative scenario.

4.3 | Impact of social technologies on retail price

We further evaluate the effect of the overall social factor λ on the equilibrium retail price p^*. The following proposition summarizes the result.

Proposition 3. *The equilibrium retail price p^* is increasing in λ if and only if $g_z(z^*) < g_p(z^*)$, where $g_p(z^*) = \frac{f(z^*)(h''(z^*)z^*+2h'(z^*))}{-1+\lambda f'(z^*)} > 0$.*

Proposition 3 asserts that the equilibrium retailer's retail price p^* can either increase or decrease in the overall social factor λ, depending on whether $g_z(z^*)$ is below $g_p(z^*)$. Note that the impact of λ on p^* can be written as follows:

$$\frac{dp^*}{d\lambda} = \underbrace{\frac{\partial p^*}{\partial \lambda}}_{(+)} + \underbrace{\frac{\partial p^*}{\partial z^*}}_{(-)}\underbrace{\frac{dz^*}{d\lambda}}_{(?)}. \tag{10}$$

This impact can be split into two parts: a direct effect and an indirect effect. First, the direct effect $\frac{\partial p^*}{\partial \lambda}$ is always positive, which captures the fact that a higher λ raises consumers' overall willingness to pay for the product. Second, the indirect effect depends on both the sensitivity of demand function $\frac{\partial p^*}{\partial z^*}$ and the impact of λ on the total product demand $\frac{dz^*}{d\lambda}$. Although $\frac{\partial p^*}{\partial z^*}$ is negative, $\frac{dz^*}{d\lambda}$ can be positive or negative following Proposition 1. Hence, the indirect effect can be either positive or negative. Therefore, the overall effect of λ on p^* is ambiguous. However, if $\frac{dz^*}{d\lambda}$ is negative such that the indirect effect is also positive, then $\frac{dp^*}{d\lambda}$ must be positive.

It is worth noting that β governs the indirect effect as it influences both $\frac{\partial p^*}{\partial z^*}$ and $\frac{dz^*}{d\lambda}$. Similar to the impact of social technologies on the equilibrium wholesale price in the previous section, the equilibrium retail price may increase or decrease in β as well, depending on whether α is above $\frac{\lambda_c}{\lambda_s+\lambda_c}$ and whether $g_z(z^*)$ is above $g_p(z^*)$. Following Proposition 1, when there are enough conformists in the market, a better social technology facilitating social interactions among consumers may induce a lower retail price, if the marginal social value of the product from conspicuous consumption is increasing in the number of consumers making purchases. This is because the indirect effect is negative in

this scenario, given that $\frac{dz^*}{d\lambda} > 0$ when $f''(\cdot) \geq 0$ by applying Proposition 1.

The rationale of this result is similar to that of the impact of social technologies on wholesale price. In the presence of a high proportion of conformists valuing product popularity, the retailer wants to strategically decrease its retail price to encourage product popularity, which in turn contributes to encourage more consumers to make purchases. Intuitively, this strategic move is more likely to take place when consumers are more sensitive to an additional increase in the number of consumers making purchases as this number increases. On the contrary, in the presence of a high proportion of conformists, a better social technology may also make the retail price higher. This occurs when the marginal social value of the product from conspicuous consumption is decreasing in the number of consumers making purchases, in that the indirect effect can be negative in this alternative scenario.

4.4 | Impact of social technologies on manufacturer profit

The following proposition summarizes the impact of the overall social factor λ on the manufacturer's equilibrium profit Π_m^*.

Proposition 4. *The equilibrium profit of the manufacturer* Π_m^* *is always increasing in* λ.

Proposition 4 says that the equilibrium manufacturer's profit Π_m^* always increases in the overall social factor λ. Notice that the impact of λ on the manufacturer's profit Π_m^* is written as follows:

$$\frac{d\Pi_m^*}{d\lambda} = \underbrace{\frac{\partial \Pi_m^*}{\partial \lambda}}_{(+)} + \underbrace{\frac{\partial \Pi_m^*}{\partial z^*}}_{(=0)} \frac{dz^*}{d\lambda} > 0. \tag{11}$$

To begin with, the second term in (11) is zero by the envelope theorem, which reflects the fact that the manufacturer will always optimally choose the total product quantity z^* to maximize its profit Π_m^* regardless of the overall social factor λ. Next, the first term $\frac{\partial \Pi_m^*}{\partial \lambda}$, which captures the direct effect of λ on Π_m^*, is always positive. This is because ceteris paribus, a higher λ raises the overall willingness to pay of consumers for the product and thus enables the manufacturer to set a higher wholesale price, thereby causing a higher profit for the manufacturer.

Recall that as β becomes larger, λ can increase or decrease, which depends on whether α is above $\frac{\lambda_c}{\lambda_s+\lambda_c}$. In other words, λ can be higher under a better social technology, if there are enough conformists in the market; conversely, λ will be lower under such a better social technology if there are enough snobs. As a result, the advancement of a social technology that improves the visibility of conspicuous consumption makes the manufacturer earn a higher profit if there is a high proportion of conformists, whereas it makes the manufacturer obtain a lower profit if there is a high proportion of snobs.

4.5 | Impact of social technologies on retailer profit

We next consider the effect of the overall social factor λ on the retailer's equilibrium profit Π_r^*, which is stated in the following proposition.

Proposition 5. *The equilibrium profit of the retailer* Π_r^* *is increasing in* λ *if and only if* $g_z(z^*) > g_r(z^*)$, *where* $g_r(z^*) = \frac{z^* f'(z^*)(h''(z^*)z^* + 2h'(z^*))}{h'(z^*)} > 0$.

Proposition 5 states that the retailer's equilibrium profit Π_r^* can either increase or decrease in the overall social factor λ, depending on whether $g_z(z^*)$ is above $g_r(z^*)$. Note that the impact of λ on Π_r^* is written as follows:

$$\frac{d\Pi_r^*}{d\lambda} = \underbrace{\frac{\partial \Pi_r^*}{\partial \lambda}}_{(+)} + \underbrace{\frac{\partial \Pi_r^*}{\partial w^*}}_{(-)} \underbrace{\frac{dw^*}{d\lambda}}_{(?)} + \underbrace{\frac{\partial \Pi_r^*}{\partial z^*} \frac{dz^*}{d\lambda}}_{(=0)}. \tag{12}$$

According to (12), there are three effects of λ on Π_r^*. The first term $\frac{\partial \Pi_r^*}{\partial \lambda}$ is a positive direct effect, which captures the positive effect of an increase in λ on the overall consumer willingness to pay for the product. The second term $\frac{\partial \Pi_r^*}{\partial w^*} \frac{dw^*}{d\lambda}$ is an indirect effect: While the retailer takes the wholesale price w^* as fixed when setting the retail price, the manufacturer may react to an increase in λ by adjusting its wholesale price upwards or downwards in the first place. Given that $\frac{\partial \Pi_r^*}{\partial w^*} < 0$, which means that the retailer's profit Π_r^* is decreasing in its marginal cost w^*, the indirect effect is negative if $\frac{dw^*}{d\lambda} > 0$. The third term $\frac{\partial \Pi_r^*}{\partial z^*} \frac{dz^*}{d\lambda}$ is zero by the envelope theorem, which reflects the fact that the retailer will choose the total product demand z^* optimally to maximize its profit.

The net effect $\frac{d\Pi_r^*}{d\lambda}$ is always positive if the indirect effect is positive, that is, $\frac{dw^*}{d\lambda} < 0$. That is, if an increase in λ lowers the wholesale price w^* set by the manufacturer, then it will unambiguously raise the profit of the retailer as well. However, when $\frac{dw^*}{d\lambda} > 0$, the net effect would depend on whether the direct effect or indirect effect dominates. Moreover, the net effect $\frac{d\Pi_r^*}{d\lambda}$ can be negative only when $\frac{dw^*}{d\lambda} > 0$.

Essentially, β governs the indirect effect as it affects both $\frac{\partial \Pi_r^*}{\partial w^*}$ and $\frac{dw^*}{d\lambda}$. Proposition 5 suggests that the retailer's equilibrium profit can either increase or decrease in β, which depends on both whether α is above $\frac{\lambda_c}{\lambda_s+\lambda_c}$ and whether $g_z(z^*)$

is above $g_r(z^*)$. In other words, when $g_z(z^*)$ is below $g_r(z^*)$, a better social technology that facilitates social interactions among consumers can make the retailer obtain a lower profit when there are enough conformists in the market; in contrast, such a better social technology can make the retailer earn a higher profit when there are enough snobs. According to Propositions 1 and 2, this is more likely to happen when the marginal social value of the product from conspicuous consumption is decreasing in the number of consumers making purchases (i.e., $f''(\cdot) \leq 0$). Put more explicitly, in the presence of a high proportion of conformists, the manufacturer will set a higher wholesale price, when consumers are less sensitive to an additional increase in the number of consumers making purchases as this number increases. As a result, the retailer earns lower profits in this case due to the higher wholesale price. On the contrary, else being equal, the presence of a high proportion of snobs would result in a lower wholesale price, which in turn improves the retailer's profitability instead.

Having determined the impact of social technologies on the manufacturer's and retailer's profits, we then can address the question of whether social technologies can benefit both the manufacturer and retailer or only one of them. The formal result is given in Proposition 6, which is based on Propositions 4 and 5.

Proposition 6. *In equilibrium, the profit of the manufacturer Π_m^* is increasing in λ while the profit of the retailer Π_r^* is decreasing in λ if $g_z(z^*) < g_r(z^*)$; the profits of both the manufacturer and retailer are increasing in λ otherwise.*

The most interesting result from Proposition 6 is that the manufacturer's and retailer's preferences regarding the level of a social technology may not be aligned. Specifically, we show that in the presence of a high proportion of conformists, the manufacturer may gain while the retailer may lose from a better social technology when the marginal social value of the product from conspicuous consumption is decreasing in the number of consumers making purchases. This is because although the manufacturer benefits from a high proportion of conformists, the retailer suffers from the resulted higher wholesale price charged by the manufacturer. In contrast, if there is a high proportion of snobs, the manufacturer may lose while the retailer may gain when the marginal social value of the product from conspicuous consumption is decreasing in the number of consumers making purchases. The reason is that although the manufacturer might suffer from a high proportion of snobs, the retailer might benefit from the resulted lower wholesale price set by the manufacturer. However, we do find that a social technology can have similar impacts on the profits of the manufacturer and retailer. For example, both the manufacturer and retailer may benefit from a better social technology when there is a high proportion of conformists and consumers are more sensitive to an additional increase in the number of consumers making purchases as this number increases.

4.6 | Impact of social technologies on consumer surplus

Lastly, we study the impact of social technologies β on the equilibrium consumer surplus CS^*. Unlike the analysis in the previous sections, since CS^* is the weighted average of the surplus of both snobs and conformists, it depends not only on the influence of the overall social factor λ but also on consumers' individual preference parameters including λ_s and λ_c. Hence, we explicitly investigate the impact of β (instead of λ which is studied earlier) on the equilibrium consumer surplus CS^*. The formal result is given in the following proposition.

Proposition 7. *The equilibrium consumer surplus CS^* is increasing in β if and only if*

$$\psi(z^*)f(z^*) - \big(z^* + \psi(z^*)f'(z^*)\big)\frac{g_z(z^*)}{h''(z^*)z^* + 2h'(z^*)}\lambda > 0, \tag{13}$$

where $\psi(z) = \alpha(1-\alpha)(\lambda_s + \lambda_c)^2\beta^2 f(z)$.

Proposition 7 asserts that the equilibrium consumer surplus CS^* can either increase or decrease in social technologies β under certain circumstances. The intuition behind Proposition 7 can be understood by decomposing the impact of β on CS^* into two components:

$$\frac{dCS^*}{d\beta} = \underbrace{\frac{\partial CS^*}{\partial \beta}}_{(+)} + \underbrace{\frac{\partial CS^*}{\partial z^*}}_{(+)}\underbrace{\frac{dz^*}{d\lambda}}_{(?)}\underbrace{\frac{d\lambda}{d\beta}}_{(?)}. \tag{14}$$

The first term $\frac{\partial CS^*}{\partial \beta}$ captures the direct effect of β on consumer surplus, which is always positive, as consumers derive a higher overall utility under a higher β. To gain a better understanding of this result, it is useful to express consumer surplus CS^* as the sum of surplus from both snobs and conformists as below

$$CS^* = \frac{1}{2\alpha}(z_s^*)^2 + \frac{1}{2(1-\alpha)}(z_c^*)^2. \tag{15}$$

Here z_s^* and z_c^* are the total number of snobs and conformists who make purchases, which are written as

$$z_s^* = \alpha\big(z^* - \beta(1-\alpha)(\lambda_s + \lambda_c)f(z^*)\big), \tag{16}$$

$$z_c^* = (1-\alpha)\big(z^* + \beta\alpha(\lambda_s + \lambda_c)f(z^*)\big). \tag{17}$$

From (16) and (17), we can see that an increase in β will have a negative direct effect on z_s^* and a positive direct effect on z_c^*. Hence, it will result in a lower surplus of snobs but a higher surplus of conformists. However, the net direct effect of β on

consumer surplus is positive, which follows from the feature that consumer surplus is a convex function of demand from each type of consumers.

The second term of (14) captures the indirect effect of β on CS^* through the total product demand z^*, which is ambiguous in general. Although the equilibrium consumer surplus CS^* increases with the total product demand z^* (i.e., $\frac{\partial CS^*}{\partial z^*} > 0$), the signs of $\frac{dz^*}{d\lambda}$ and $\frac{d\lambda}{d\beta}$ can be positive or negative. On the one hand, we already know from Proposition 1 that $\frac{dz^*}{d\lambda} > 0$ if the marginal social value of the product from conspicuous consumption is increasing in the number of consumers making purchases (i.e., $f''(\cdot) \geq 0$). On the other hand, by the definition of λ, it is straightforward to see that $\frac{d\lambda}{d\beta} > 0$ if and only if $\lambda > 0$. Therefore, the indirect effect of β on CS^* can be negative if (i) $\frac{dz^*}{d\lambda} > 0$ and $\frac{d\lambda}{d\beta} < 0$ or (ii) $\frac{dz^*}{d\lambda} < 0$ and $\frac{d\lambda}{d\beta} > 0$.

Note that β governs the indirect effect as it influences $\frac{\partial CS^*}{\partial z^*}$, $\frac{dz^*}{d\lambda}$, and $\frac{d\lambda}{d\beta}$. As a result, the overall effect of β on CS^* will depend on whether the direct effect or indirect effect dominates. If the indirect effect is also positive, then an increase in β will always improve consumer surplus. This can happen when the retailer charges a lower retail price, which is possible if there are enough conformists in the market and the marginal social value of the product from conspicuous consumption is increasing in the number of consumers making purchases (Proposition 3).

However, if the indirect effect is negative, it is possible that a higher β can result in lower consumer surplus. This can occur when the retailer sets a higher retail price instead, a situation that is probably present when there is a high proportion of conformists and the marginal social value of the product from conspicuous consumption is decreasing in the number of consumers making purchases, according to Proposition 3. In short, consumers can be better off or worse off when a social technology that enhances the visibility of conspicuous consumption emerges in the market.

To summarize, this paper produces several important managerial insights. First, a social technology that facilitates consumers' social interactions may drive down both the manufacturer's wholesale price and retailer's retail price. This can happen when enough consumers are conformists and the marginal social value of the product from conspicuous consumption is increasing in the number of consumers making purchases. Second, one of the firms (either the manufacturer or retailer) may lose from the emergence of a better social technology. In other words, the manufacturer's and retailer's preferences regarding the level of a social technology may not be aligned. For instance, in the presence of a high proportion of conformists, the manufacturer may gain while the retailer may lose when consumers are less sensitive to an additional increase in the number of consumers making purchases as this number increases. Third, consumers may suffer from the introduction of a better social technology due to the resulted higher retail price of the product.

5 | MODEL EXTENSIONS

In this section, we consider several model extensions to generalize our base model in broader contexts. To begin with, we study an agency model in which a downstream platform sets revenue share and then an upstream seller determines the retail price. Next, we investigate a competition model in which two retailers compete in retail prices. Further, we take into account the existence of the additional type of consumers who do not have conspicuous consumption preferences. Finally, we explore the impact of the improvement of social technologies on the total welfare of both firms and consumers. We illustrate that our main results from the base model are robust to these alternative model settings.

5.1 | Agency model

In practice, an upstream seller (retailer) may sell its products via a downstream platform (manufacturer) by signing an agency contract (Tian et al., 2018). For instance, the handbag maker Coach sells its products through Amazon; in this case Coach sets the retail price while Amazon charges the commission fee. This agency model has become popular due to the proliferation of online platforms (Tan & Carrillo, 2017). To capture this alternative channel relationship, we consider an agency model in which the downstream platform chooses the revenue share proportion while the upstream seller sets the retail price (e.g., Geng et al., 2018; Pu et al., 2022; Tan, 2022; Tan et al., 2016).

In the model, to begin with, the platform P sets revenue share $1 - r \in (0, 1)$, which stipulates the share of sales revenue that the seller S receives, and the platform retains the remaining r share. Next, the seller, taking r as given, then determines retail price p for the product. Finally, upon observing retail price p, both snobs valuing product exclusivity and conformists valuing product popularity make their purchase decisions.[4]

5.1.1 | Seller

The total product demand of consumers is still captured by (5). For any given $r \in (0, 1)$, the seller chooses the retail price p to maximize the profit $\Pi_S = ((1 - r)p - c)z$. Since setting the retail price p is equivalent to choosing the total product quantity z, the optimal z is determined by the following first-order condition:

$$(1 - r)h(z) - c = 0. \tag{18}$$

Compared to the choice of the retailer in the base model as given by (7), we can see that the seller will choose the same level of total product quantity if $w = \frac{c}{1-r}$. Equivalently, we can write the revenue share in terms of product quantity z,

which is given by

$$r = 1 - \frac{c}{h(z)}. \tag{19}$$

Then, the seller will choose a lower product quantity z as the platform sets a higher revenue share r. That is, $\frac{dr}{dz} = \frac{ch'(z)}{h^2(z)} < 0$.

5.1.2 | Platform

Given the seller's choice in (19), the platform chooses r to maximize the following profit:

$$\begin{aligned}\Pi_P &= rpz \\ &= \left(1 - \frac{c}{h(z)}\right)(1 - z + \lambda f(z))z. \end{aligned} \tag{20}$$

The total product demand of consumers in equilibrium z^A is determined by the following first-order condition:

$$rp + \left(\frac{dr}{dz}p + \frac{dp}{dz}r\right)z = 0, \tag{21}$$

where $\frac{dr}{dz} = \frac{ch'(z)}{h^2(z)}$ and $\frac{dp}{dz} = -1 + \lambda f'(z)$. Note that the superscript "A" of notations in this section represents the case of the agency model. Given that $p + \frac{dp}{dz}z = h(z)$, the first-order condition can be rewritten as $h(z) + \frac{dr}{dz}pz - c = 0$, that is,

$$h(z^A) + \frac{ch'(z^A)}{h^2(z^A)}(1 - z^A + \lambda f(z^A))z^A - c = 0. \tag{22}$$

Then, we can summarize the equilibrium outcomes in the following proposition.

Lemma 2. *In the agency model, in equilibrium, the total product demand z^A is given by (22); the revenue share proportion chosen by the platform r^A and the retail price set by the seller p^A are $r^A = 1 - \frac{c}{h(z^A)}$ and $p^A = 1 - z^A + \lambda f(z^A)$, respectively; the platform's and seller's profits are $\Pi_P^A = r^A p^A z^A$ and $\Pi_S^A = ((1 - r^A)p^A - c)z^A$, respectively; and the consumer surplus is $CS^A = \Gamma(z^A)$.*

We further explore the impacts of social technologies β on the total product demand z^A, revenue share r^A, retail price p^A, seller profit Π_S^A, platform profit Π_P^A, and consumer surplus CS^A in equilibrium. For exposition, we highlight the results in the following proposition.

Proposition 8. *In the agency model, in equilibrium, although the platform's profit Π_P^A is always increasing in λ, the total product demand z^A, revenue share r^A, retail price p^A, and seller's profit Π_S^A can be increasing or decreasing in λ. Moreover, the equilibrium consumer surplus CS^A can be either increasing or decreasing in β.*

The intuition behind Proposition 8 is similar to that in the base model. First, the positive impact of λ on Π_P^A is due to the demand expansion effect for the platform: A higher λ increases the overall willingness to pay of consumers for the product, and thus it raises the profit of the platform. Second, λ affects z^A through its effect on the marginal revenue of the platform $h(z) + \frac{dr}{dz}pz$. The overall effect could be positive or negative, depending on the shape of $f(z)$. Third, λ also has a direct effect and an indirect effect on r^A, as given by

$$\frac{dr^A}{d\lambda} = \underbrace{\frac{\partial r^A}{\partial \lambda}}_{(+)} + \underbrace{\frac{dr^A}{dz^A}}_{(-)}\underbrace{\frac{dz^A}{d\lambda}}_{(?)}. \tag{23}$$

While the direct effect $\frac{\partial r^A}{\partial \lambda}$ is always positive, the indirect effect $\frac{dr^A}{dz^A}\frac{dz^A}{d\lambda}$ is ambiguous in general because of the undetermined sign of $\frac{dz^A}{d\lambda}$. Clearly, if $\frac{dz^A}{d\lambda} < 0$ so that the indirect effect is also positive, then we must have $\frac{dr^A}{d\lambda} > 0$, implying a positive impact of λ on r^A. Such an effect is similar to the effect of λ on w^* in the base model. Following a similar argument, since the impact of λ on p^A can be written as

$$\frac{dp^A}{d\lambda} = \underbrace{\frac{\partial p^A}{\partial \lambda}}_{(+)} + \underbrace{\frac{\partial p^A}{\partial z^A}}_{(-)}\underbrace{\frac{dz^A}{d\lambda}}_{(?)}, \tag{24}$$

the ambiguous effect of λ on p^A can also be explained.

Fourth, we can write the impact of λ on Π_S^A as follows:

$$\frac{d\Pi_S^A}{d\lambda} = \underbrace{\frac{\partial \Pi_S^A}{\partial \lambda}}_{(+)} + \underbrace{\frac{\partial \Pi_S^A}{\partial r^A}}_{(-)}\underbrace{\frac{dr^A}{d\lambda}}_{(?)} + \underbrace{\frac{\partial \Pi_S^A}{\partial z^A}}_{(=0)}\frac{dz^A}{d\lambda}. \tag{25}$$

Again, following the same reasoning as in the base model, the net effect of λ on Π_S^A depends on whether the indirect effect $\frac{\partial \Pi_S^A}{\partial r^A}\frac{dr^A}{d\lambda}$ is positive or negative, given that the direct effect $\frac{\partial \Pi_S^A}{\partial \lambda}$ is always positive. Clearly, when the indirect effect is also positive so that an increase in λ results in a lower revenue share r^A (i.e., $\frac{dr^A}{d\lambda} < 0$), then Π_S^A should also increase in λ.

Lastly, the impact of β on consumer surplus CS^A can be written as follows:

$$\frac{dCS^A}{d\beta} = \underbrace{\frac{\partial CS^A}{\partial \beta}}_{(+)} + \underbrace{\frac{\partial CS^A}{\partial z^A}}_{(+)}\underbrace{\frac{dz^A}{d\lambda}}_{(?)}\underbrace{\frac{d\lambda}{d\beta}}_{(?)}. \tag{26}$$

While the direct effect of λ on consumer surplus $\frac{\partial CS^A}{\partial \beta}$ is always positive, the indirect effect can be either positive

or negative, depending on the effect of λ on total product demand z^A as well as the effect of β on λ. When α is above the threshold $\frac{\lambda_c}{\lambda_s+\lambda_c}$, the indirect effect is negative if $\frac{dz^A}{d\lambda} > 0$.

In a nutshell, there are two key differences between the agency model and the base model. First, unlike the latter setting in which the retailer sets the retail price, it is the seller who chooses the retail price in the agency model. Second, while the manufacturer determines the wholesale price before the retailer makes the pricing decision in the base model, the platform now acts as a first mover in choosing the revenue share. The second difference can explain why there exists an ambiguous impact of a better social technology on the profit of the seller instead of the platform in the agency model. Other results from the two models are qualitatively consistent. This reflects the fact that the revenue share proportion chosen by the platform in the agency model plays a similar role as the wholesale price set by the manufacturer in the base model.

5.2 | Retailer competition

In the base model, we consider a monopoly case in which there is a single retailer in the distribution channel. Alternatively, there may exist multiple competing retailers dealing with a single manufacturer. To reflect this, we extend the base model by incorporating two retailers to study the effect of retailers' competition on the equilibrium market outcomes.

We consider a model in which a manufacturer M sells its products through two differentiated retailers $R1$ and $R2$. The manufacturer sets wholesale price and retailers set retail prices. Consumers may make purchases from one of the retailers. To model competition between the retailers, we assume that they compete in the Hotelling manner. That is, retailer 1 is located at 0 while retailer 2 is located at 1 in a linear city. There is a unit mass of consumers who are uniformly distributed over the unit interval [0,1]. Let x represent the location of a consumer. Similar to the base model, consumers' intrinsic value for the product remains v, which is uniformly distributed over [0,1]. This consumer construct is to allow the manufacturer to face a downward-sloping demand curve and also enables both the manufacturer and retailers to have market power in setting their prices. As a result, the market may not be fully covered in equilibrium as consumers with low intrinsic values may not make any purchases. Moreover, like the base model, since a retailer does not fully pass through the wholesale price set by the manufacturer to consumers, a retailer's profits will depend on the wholesale price as well. Hence, the parameter λ may have a nontrivial impact on the wholesale price and retail prices, as well as on the manufacturer's and retailers' profits.

As such, the utility of a snob who purchases from retailer 1 is $U_s^1(v,x,p_1,z^e) = v - \beta\lambda_s f(z^e) - p_1 - tx$, where v is the snob's intrinsic value of the product, x is the snob's location, z^e is the expected total number of consumers who make purchases and p_1 is the retail price set by retailer 1. Similarly, the utility of a snob who purchases from retailer 2 is $U_s^2(v,x,p_2,z^e) = v - \beta\lambda_s f(z^e) - p_2 - t(1-x)$. As for conformists, the utility of a conformist who purchases from retailer 1 is $U_c^1(v,x,p_1,z^e) = v + \beta\lambda_c f(z^e) - p_1 - tx$, and the utility of a conformist who purchases from retailer 2 is $U_c^2(v,x,p_2,z^e) = v + \beta\lambda_c f(z^e) - p_2 - t(1-x)$.

The sequence of this extended model is as follows. At the first stage, the manufacturer sets the wholesale price w charged to both retailers. At the second stage, both retailers set their retail prices p_1 and p_2 simultaneously. At the third stage, all consumers decide whether or not to make purchases.

Prior to the formal presentation of the equilibrium results, we briefly discuss the decisions made by consumers as well as firms. The detailed analysis in this section is relegated to the Supporting Information Appendix. First, we can show that in the rational expectations equilibrium, the total product demand z is implicitly determined by $z - \lambda f(z) = 1 + \frac{(p_1-p_2)^2}{4t} - \frac{t+2p_1+2p_2}{4}$. When both retailers set the same retail prices (i.e., $p_1 = p_2 = p$), the inverse demand function becomes

$$p = 1 - \frac{t}{4} - z + \lambda f(z). \tag{27}$$

Compared to the inverse demand function (5) in the base model, the consumers' overall willingness to pay for the product is lowered by $\frac{t}{4}$, which captures the transportation costs incurred when purchasing from each retailer. Second, by solving retailers' optimization problems, we can obtain that for any wholesale price w, the equilibrium total product demand is implicitly determined by $\theta(z) = w$, where $\theta(z) = 1 - \frac{t}{4} - z + \lambda f(z) - \tau(z)$ and $\tau(z) = \frac{4tz(1-\lambda f'(z))}{4z+3t-(4z+t)\lambda f'(z)}$. Note that $\tau(z)$ is the markup of each retailer, which is always positive. It reflects that each retailer has some market power in setting prices and thus earns a positive profit. Finally, the manufacturer chooses the total product demand z to maximize its profit $\Pi_m = (\theta(z) - c)z$. We use the superscript "C" to represent the case of the competition model. As a result, the equilibrium market outcomes are formally stated in the following lemma.

Lemma 3. *Suppose a manufacturer sells its products through two differentiated retailers. In equilibrium, the total product demand is z^C, which is determined by $\theta(z^C) + \theta'(z^C)z^C - c = 0$; the wholesale price and retail prices are $w^C = \theta(z^C)$ and $p^C = 1 - \frac{t}{4} - z^C + \lambda f(z^C)$, respectively; the manufacturer's and retailers' profits are $\Pi_m^C = (w^C - c)z^C$ and $\Pi_r^C = \frac{1}{2}(p^C - w^C)z^C$, respectively; and the consumer surplus is $CS^C = \frac{t^2}{96} + \Gamma(z^C)$.*

We then evaluate the impacts of social technologies β on the total product demand z^C, wholesale price w^C, retail prices p^C, manufacturer profit Π_m^C, retailers' profit Π_r^C, and consumer surplus CS^C in equilibrium. The results are summarized in the following proposition.

Proposition 9. *Suppose a manufacturer sells its products through two differentiated retailers. In equilibrium, although the manufacturer's profit Π_m^C is always increasing in λ, the total product demand z^C, wholesale price w^C, retail prices p^C, and retailers' profits Π_r^C can be either increasing or decreasing in λ. Moreover, the equilibrium consumer surplus CS^C can be either increasing or decreasing in β.*

The results of Proposition 9 are qualitatively consistent with those in the base model. The intuition behind these results is very similar except for retailers' profits. First, the positive impact of λ on Π_m^C is due to the demand expansion effect, which reflects that a higher λ increases the overall willingness to pay of consumers for the product, regardless of where they complete purchases. Next, λ will affect the total product demand z^C through its effect on the marginal revenue of the manufacturer $\theta(z^C) + \theta'(z^C)z^C$, which could be positive or negative. The function $f(\cdot)$ also plays a vital role in determining the sign and magnitude of this effect. Further, the net impact of λ on the wholesale price w^C is also influenced by a positive direct effect and an ambiguous indirect effect through λ's impact on the total product demand z^C. When the indirect effect is positive (e.g., $\frac{dz^C}{d\lambda} < 0$), there exists a positive impact of λ on the wholesale price w^C. The intuition for the impact of λ on the retail price p^C and the impact of β on consumer surplus CS^C is similar to that in the base model. On the one hand, an increase in λ has a qualitatively similar impact on p^C as in the base model, since the equilibrium inverse demand function in (27) is simply a downward shift from that in (5). On the other hand, since consumer surplus CS^C also depends on the total number of snobs and conformists who make purchases, a similar result can be identified as in the base model.

The impact of λ on retailers' profit Π_r^C is slightly different from that in the base model. Recall that each retailer's profit is $\Pi_r^C = \frac{1}{2}(p^C - w^C)z^C = \frac{1}{2}\tau(z^C)z^C$. As we have shown in the base model, the impact of λ on Π_r^C can be written as follows:

$$\frac{d\Pi_r^C}{d\lambda} = \underbrace{\frac{\partial \Pi_r^C}{\partial \lambda}}_{(+)} + \underbrace{\frac{\partial \Pi_r^C}{\partial w^C}}_{(-)}\underbrace{\frac{dw^C}{d\lambda}}_{(?)} + \underbrace{\frac{\partial \Pi_r^C}{\partial z^C}}_{(?)}\underbrace{\frac{dz^C}{d\lambda}}_{(?)}. \tag{28}$$

Intuitively, there are also three effects of λ on Π_r^C. The first term $\frac{\partial \Pi_r^C}{\partial \lambda}$ is the positive direct effect, which captures the fact that the consumers' overall willingness to pay for the product is positively related to the overall social factor λ. The second term $\frac{\partial \Pi_r^C}{\partial w^C}\frac{dw^C}{d\lambda}$, which is the indirect effect of λ on Π_r^C, can also be positive or negative, depending on λ's net effect on the wholesale price w^C. However, the third effect, which measures λ's indirect impact on Π_r^C through the total product demand, is no longer absent as in the monopoly model. The reason is that under retailer competition, each retailer only captures half of the market share instead of the total product demand as in the base model. Hence, each retailer only chooses half of the total product demand to maximize its profit when competing with its rival. Nevertheless, the net impact of λ on Π_r^C remains ambiguous, depending on whether the positive direct effect dominates the other two effects. Finally, because the third effect can be either positive or negative, we can conjecture that the competition between retailers may make each retailer benefit or suffer from a better social technology, the result of which will depend on consumers' conspicuous consumption preferences as well as the degree of product differentiation between retailers.

In sum, the insights in this subsection are similar to those in the base model. The reason is that the competition between retailers mainly affects the pricing power of each retailer but does not change the manufacturer's ability to set the wholesale price.

5.3 | Additional type of consumers

In the base model, we have assumed that there are only two types of consumers: snobs and conformists. It is possible that there may exist another type of consumers whose decisions in purchasing luxury products are not affected by other consumers' purchasing behavior.[5] That is, these consumers care about neither product exclusivity nor product popularity. To model the purchasing behavior of these consumers, we extend our base model by considering this additional type of consumers explicitly. That is, α_1 proportion of consumers are snobs, α_2 proportion of consumers are conformists, and the rest $1 - \alpha_1 - \alpha_2$ proportion of consumers do not care about the choices of other consumers. The utility functions of snobs and conformists are the same as in the base model. As for the new type of consumers (i.e., regular type), the expected utility is simply $U_r(v, p) = v - p$, which does not depend on the expected total number of consumers who make purchases z^e.

Following a similar approach as in the base model, we can derive that the demand for snobs, conformists, and regular consumers is z_s, z_c, and z_r, where $z_s = \alpha_1(1 - p - \beta\lambda_s f(z^e))$, $z_c = \alpha_2(1 - p + \beta\lambda_c f(z^e))$, and $z_r = (1 - \alpha_1 - \alpha_2)(1 - p)$. Then the total demand is given by $z = z_s + z_c + z_r$, which implies that

$$z = 1 - p + \beta(\alpha_2\lambda_c - \alpha_1\lambda_s)f(z^e). \tag{29}$$

In equilibrium, since $z = z^e$, the inverse demand function is determined by

$$p = 1 - z + \beta(\alpha_2\lambda_c - \alpha_1\lambda_s)f(z). \tag{30}$$

If we redefine $\lambda \equiv \beta(\alpha_2\lambda_c - \alpha_1\lambda_s)$, then the inverse demand function can also be written as $p = 1 - z + \lambda f(z)$, which is identical to that in the base model. As a result, the parameter λ continues to be the overall social factor, which could also be positive or negative, depending on the values of parameters α_1, α_2, λ_s, and λ_c. Clearly, $\lambda > 0$ if $\alpha_1 < \frac{\lambda_c}{\lambda_s}\alpha_2$ and $\lambda \leq 0$

otherwise. In addition, $\frac{\partial\lambda}{\partial\beta} > 0$ if $\lambda > 0$, and $\frac{\partial\lambda}{\partial\beta} \leq 0$ otherwise. That is, a better social technology (i.e., a higher β) yields a positive influence on the overall social factor if the proportion of conformists is sufficiently high as compared to that of snobs.

Since neither the overall social factor λ nor the impact of a better social technology on the social factor $\frac{\partial\lambda}{\partial\beta}$ depends on the proportion of regular consumers $1-\alpha_1-\alpha_2$ directly, the existence of the regular consumers will have no direct impact on the market demand. Given that the demand function is the same as in the base model, the decisions of the manufacturer and retailer will also be identical. This implies that the equilibrium characterized in Lemma 1 continues to hold. When we turn to evaluate the impacts of social technologies on the equilibrium outcomes, it is straightforward to see that the equilibrium wholesale price, retail price and total demand, and the equilibrium profits of the manufacturer and the retailer all rely on the overall social factor λ only. Hence, Propositions 1–6 remain to be valid.

As consumer surplus is the weighted average of the surplus of each consumer, it will not rely on the overall social factor λ, but on the proportions of different types of consumers α_1 and α_2 as well as the preference of each type of consumers λ_s and λ_c. Hence, Proposition 7 needs to be further analyzed. Nevertheless, as we have shown in the Supporting Information Appendix, the main results in Proposition 7 also hold qualitatively. That is, the equilibrium consumer surplus CS^* can either increase or decrease in social technologies β depending on different conditions. While the detailed analysis and conditions are provided in the Supporting Information Appendix, the intuition for this result can be understood by decomposing the impact of β on CS^* into two components

$$\frac{dCS^*}{d\beta} = \underbrace{\frac{\partial CS^*}{\partial\beta}}_{(+)} + \underbrace{\frac{\partial CS^*}{\partial z^*}}_{(+)}\underbrace{\frac{dz^*}{d\lambda}}_{(?)}\underbrace{\frac{d\lambda}{d\beta}}_{(?)}. \tag{31}$$

The first term $\frac{\partial CS^*}{\partial\beta}$ captures the direct effect of β on consumer surplus, which is always positive. To gain a better understanding of the direct effect, it is useful to express consumer surplus CS^* as the sum of surplus from all three types of consumers as follows:

$$CS^* = \frac{1}{2\alpha_1}(z_s^*)^2 + \frac{1}{2\alpha_2}(z_c^*)^2 + \frac{1}{2(1-\alpha_1-\alpha_2)}(z_r^*)^2. \tag{32}$$

Here z_s^*, z_c^*, and z_r^* are the total number of snobs, conformists, and regular consumers who make purchases, which are written as

$$\begin{aligned} z_s^* &= \alpha_1\big(z^* - \beta((1-\alpha_1)\lambda_s + \alpha_2\lambda_c)f(z^*)\big),\\ z_c^* &= \alpha_2\big(z^* + \beta(\alpha_1\lambda_s + (1-\alpha_2)\lambda_c)f(z^*)\big),\\ z_r^* &= (1-\alpha_1-\alpha_2)(z^* - \beta\lambda f(z^*)). \end{aligned} \tag{33}$$

We can see that an increase in β will have a negative direct effect on z_s^* and a positive direct effect on z_c^*. Hence, it will result in a lower surplus for snobs but a higher surplus for conformists. The direct effect of β on z_r^* will be negative if $\lambda > 0$ and positive if $\lambda < 0$. However, the net direct effect of β on consumer surplus is positive, which follows from the fact that consumer surplus is a convex function of demand from each type of consumers. The second term of (14) captures the indirect effect of β on consumers, whose sign is ambiguous in most situations. Hence, the net effect of social technologies on consumer surplus relies on whether the direct effect or indirect effect dominates. As in the base model, a better social technology may result in either a higher or lower consumer surplus even if there are three types of consumers.

5.4 | Social technology and social welfare

We have so far assumed that social technology is exogenous, which is determined by neither the manufacturer nor the retailer and is even less likely to be affected by consumers. In contrast, it is also possible that a social planner who cares about the social welfare is able to influence the choice of the social technology. It is worthwhile to explore this situation since the improvement of social technologies may have different implications for the manufacturer and retailer, who may have divergent preferences regarding a better social technology.[6]

We define the welfare function to be the sum of firms' profits and consumer surplus, which can be written as

$$W^* = \Pi_m^* + \Pi_r^* + CS^*. \tag{34}$$

We can show that W^* can either increase or decrease in β, and the detailed analysis is relegated in the Supporting Information Appendix. Intuitively, the impact of social technology β on welfare can be written as follows:

$$\frac{dW^*}{d\beta} = \underbrace{\frac{\partial W^*}{\partial\beta}}_{(?)} + \underbrace{\frac{\partial W^*}{\partial z^*}}_{(+)}\underbrace{\frac{dz^*}{d\lambda}}_{(?)}\underbrace{\frac{d\lambda}{d\beta}}_{(?)}. \tag{35}$$

The first term captures the direct effect of β on W^*, while the second term captures the indirect effect. Unlike the direct effect of β on consumer surplus CS^*, which is always positive, the direct effect of β on welfare W^* can be positive or negative, which reflects the fact that β will have an ambiguous impact on the total profits of firms. We further consider the following two situations depending on whether α is above $\frac{\lambda_c}{\lambda_s+\lambda_c}$ or not.

First, when α is below $\frac{\lambda_c}{\lambda_s+\lambda_c}$ (i.e., there exists a high proportion of conformists), then we know that $\lambda > 0$ and $\frac{d\lambda}{d\beta} > 0$. It can be easily verified that $\frac{\partial W^*}{\partial\beta} > 0$, which means that a better social technology always has a positive direct impact on welfare. Moreover, the indirect effect of β on W^* is also

positive if and only if $\frac{dz^*}{d\lambda} > 0$. Therefore, when the equilibrium total demand z^* is increasing in the overall social factor λ, which is true if $g_z(z^*) > 0$, we always have $\frac{dW^*}{d\beta} > 0$. That is, a better social technology has a positive effect on welfare. In such scenarios, a social planner always wants to improve the social technology so as to raise welfare in the absence of any cost. In addition, since we have already known that $\frac{d\Pi_M^*}{d\beta} > 0$ and $\frac{dCS^*}{d\beta} > 0$ provided that $\frac{dz^*}{d\lambda} > 0$, a better social technology will also have a positive impact on the manufacturer's profit and on consumer surplus. It means that the improvement of social technology that increases welfare will also benefit the manufacturer and consumers but may hurt the retailer. In contrast, when $\frac{dz^*}{d\lambda} < 0$ (i.e., $g_z(z^*) < 0$), the indirect effect of β on W^* can be either positive or negative. Then, in this case, a social planner may not always want to improve the social technology.

Next, we consider the case where α is above $\frac{\lambda_c}{\lambda_s+\lambda_c}$ (i.e., there exists a low proportion of conformists). Then we know that $\lambda < 0$ and $\frac{d\lambda}{d\beta} < 0$. In this case, the overall impact of a better social technology on welfare is more complicated, since both the direct effect and the indirect effect of β on W^* can be either positive or negative depending on different parameter values. Hence, the improvement of social technologies is more likely to produce divergent impacts on firms and consumers, and thus total welfare.

6 | CONCLUSION AND DISCUSSION

Social networking platforms such as Facebook, Twitter, Instagram, and TikTok make our product consumption more visible to our peers because they have largely promoted consumers' social interactions. For instance, our product adoption can be known by more people if they can access information contained in the pictures and videos that we share through social networking platforms. This impact is particularly associated with the consumption of luxury products, as the social value of these products is undoubtedly influenced by consumers' social interactions empowered by social technologies. As a result, firms offering luxury product need to wisely set their prices and manage their profitability in response to these new challenges.

Clearly, the extant literature generally overlooks the impact of social technologies on social pricing of such firms in a distribution channel setting. This paper attempts to fill this important research gap by explicitly developing an analytical model in which a manufacturer sets the wholesale price, a retailer sets the retail price, and consumers exhibiting conspicuous consumption make purchases. Specifically, consumers are of two types: snobs valuing product exclusivity and conformists valuing product popularity. Based on our study, we obtain several interesting insights that are not yielded in the extant literature.

To begin with, under a better social technology that facilitates consumers' social interactions, both the wholesale price and retail price can be lower when there is a high proportion of conformists in the market. This happens when the marginal social value of the product from conspicuous consumption is increasing in the number of consumers making purchases. The mechanism behind this result is that the firms have incentives to strategically charge lower prices (i.e., wholesale price and retail price) to encourage product popularity in this case, which in turn makes the product more lucrative for more consumers. Second, a better social technology may yield divergent impacts on the profits of the manufacturer and retailer; that is, it may benefit one of the firms (either the manufacturer or retailer) but make the other worse off. For instance, when the proportion of conformists is high and the marginal social value of the product from conspicuous consumption is decreasing in the number of consumers making purchases, the manufacturer may gain due to the consumers' overall increased willingness to pay for the product, while the retailer may lose due to the increased wholesale price. Third, consumers may be better off or worse off under a better social technology. Put differently, consumer surplus may be lower or higher due to the increased or decreased retail price.

Moreover, we also show the robustness of our findings in several alternative settings. In the first model extension, we study a scenario where the downstream retailer determines revenue share while the upstream manufacturer sets the retail price. In the second model extension, we investigate a scenario where two retailers compete in retail prices. In the third model extension, we consider the possibility of the existence of additional type of consumers whose choices are not affected by the number of consumers making purchases. In the fourth model extension, we offer insights to the social planner who chooses the level of social technologies in improving the total welfare of both firms and consumers. The results from these model extensions are similar to those from the base model, thereby validating our results in broader contexts.

Notably, one interesting result of our paper is that the manufacturer's and retailer's preferences regarding the level of a social technology may not be well aligned. As shown earlier, this misalignment is influenced by the size of each segment of consumers and the sensitivity of consumers to an additional increase in the number of consumers making purchases as this number increases. The fundamental reason for this misalignment is that the manufacturer and retailer independently make their pricing decisions and thus one party's optimal price may not favor the other party. As a result, under a linear contract between the manufacturer and retailer that we focus on in this paper, mitigating this misalignment is generally difficult because the above influencing factors stem from exogenous consumer side. However, such a misalignment may be alleviated through other contractual arrangements between the manufacturer and retailer. For instance, nonlinear contracts (e.g., two-part tariff contracts under Nash bargaining) that can solve the contractual externalities in a distribution channel are able to align the two

parties' preferences regarding the advancement of a social technology. The manufacturer may also directly restrict the price set by the retailer through resale price maintenance, which ensures that the retailer's price choice perfectly favors the manufacturer itself.

Our results provide important guidance for the luxury product manufacturer and retailer, given that social networking platforms have gained unprecedented prevalence. For example, according to our results, the manufacturer and retailer should lower their prices when enough consumers are conformists and the marginal social value of the product from conspicuous consumption is increasing in the number of consumers making purchases. In contrast, these firms should raise their prices in alternative circumstances to better adapt to the changes of consumers' social interactions brought by social technologies. Our results also shed light on how policymakers regulate the platforms offering social networking services that facilitate consumers' social interactions. Based on our findings, a social technology may increase a product's price, which hurts consumers as a result. This occurs when there is a high proportion of conformists and the marginal social value of the product from conspicuous consumption is decreasing in the number of consumers making purchases. Therefore, to alleviate this negative impact, policymakers may pose some restrictions on social networking platforms. For example, a restriction could be limiting the number of people in forming an interest group such that their conspicuous consumption is less visible to their peers.

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ENDNOTES

[1] The above statistics come from https://www.omnicoreagency.com/facebook-statistics/, https://www.omnicoreagency.com/instagram-statistics/, https://www.omnicoreagency.com/tiktok-statistics/, and https://www.omnicoreagency.com/twitter-statistics/, accessed June 2, 2022.

[2] https://www.statista.com/study/61582/in-depth-luxury/, accessed June 2, 2022.

[3] As a result, it can be understood that daily deal platforms such as Groupon perform social pricing as well, given that consumers might get discounts based on their social networks (Bai et al., 2020).

[4] In the Supporting Information Appendix, we also consider a franchise model in which an upstream manufacturer sets the revenue share and then a downstream retailer sets the retail price. All results in the franchise model are qualitatively the same as those in the base model. Compared to the agency model, one key difference is that the profit of the manufacturer rather than that of the platform is increasing in the overall social factor λ.

[5] We thank an anonymous reviewer for suggesting this interesting research direction.

[6] We thank an anonymous reviewer for suggesting this important model extension.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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