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A Model of the “It” Products in Fashion

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One of the characteristics of the fashion marketplace is the unpredictability and apparent randomness of fashion hits. Another one is the information asymmetry among consumers. In this paper, we consider fashion as a means consumers use to signal belonging to a higher social rank and propose an analytical model of fashion hits in the presence of competition and consumers who can coordinate on which product to use. We show that, consistent with the observed market phenomenon, in equilibrium, consumer coordination involves randomization between products chosen, i.e., in randomness of fashion hits. Analyzing optimal consumer choice, we find that whenever low-type consumer demand for a product is positive, a price increase results in a higher probability of high-type consumers choosing this product but lower low-type consumer demand. We also show that although high-type consumers may prefer (higher) prices that would lead to complete separation of the high- and the low-type consumers through product use, in equilibrium, firms always price as to attract positive demand from low-type consumers. The equilibrium price and profits turn out to be nonmonotonic in the low-type consumer valuation of being recognized as belonging to a higher social rank. Equilibrium profits first increase and then decrease in this valuation.

Key words: game theory; status goods; uncertainty; consumer signalling; price competition

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Though this be madness, yet there is method in't.

—William Shakespeare, *Hamlet*

1. Introduction

As opposed to utilitarian products, fashion products are bought mostly for their social value, i.e., for their propensity to impress on others their user's desirability, such as taste, wealth, or otherwise belonging to a popular social group. For example, in his article for *Encyclopedia of Social Sciences*, Sapir (1931, p. 140) calls fashion “an outward emblem of personal distinction or of membership in some group to which distinction is ascribed,” and Simmel (1957, p. 541) maintains that “fashion... differentiates one time from another and one social stratum from another. It unites those of a social class and segregates them from others. The elite initiates a fashion and, when the mass imitates it in an effort to obliterate the external distinctions of class, abandons it for a newer mode.” In other words, fashion products are examples of status goods: products whose purpose is to signal that their user belongs to the desirable “upper class” (Veblen 1899, Blumer 1969, Pesendorfer 1995).

At the same time, a characteristic distinguishing fashion from other status goods is an apparent randomness of fashion hits: numerous new designs come out of fashion houses every season, but only a few

products turn out to be popular among consumers: “Say what you will about haute couture, it's nothing if not unpredictable,” asserts Frankel (1999), a fashion editor for *the Independent*. Fashion hits appear to emerge randomly: no one seems to be able to predict who will create the next hit product. Robinson (1961, p. 377) quotes a trade association director as saying “Thanks to fashion, this is an industry without statistics,” and Barnett et al. (2010, p. 164) summarize the same sentiment by describing luxury apparel as “an unpredictable market in which the success or failure of any new product is a matter of chance largely immune to predictive analysis.”

To illustrate the unpredictability of fashion hits, consider the phenomenon of the “it bag” in the fashion handbag market.¹ The *it bag* refers to a bag that is deemed a must-have product for social success, though it is often unavailable by the time it is widely recognized as such. There is a constant competition for the it bag among top fashion houses. In 1998, Fendi created the first bag referred to as the it bag by the popular press—the “original” Fendi

¹The term “it bag” gained popularity in late 1990s—see, e.g., Wikipedia contributors, “It bag.” *Wikipedia, The Free Encyclopedia*, Accessed September 28, 2012, http://en.wikipedia.org/wiki/It_bag.

Baguette. With such a successful debut, one could expect the same company would be able to build on its success and create the it bags for seasons to come. However, in the years that followed, the it bag of the season was made by Prada (in 1999), Dior (in 2000), Balenciaga (in 2001), Luella (in 2002), and Louis Vuitton (in 2003) (Rumbold 2007). Although all fashion houses strive to create the it bag, not only do they not know whether their product will become the it bag or not, they do not even seem to be able to do much to affect the choice. For example, Betts (2006) quotes Stuart Verves, the designer behind the "suddenly hot British brand Mulberry," as saying "Creating an 'It' bag is just dumb luck. ... You have to wait for your time" to support her point that "the creative coup is often more the result of serendipity than science."

This observation that randomness seems to be at the heart of fashion motivates our research. If one is to make predictions of and recommendations for the optimal firms' behavior in the fashion industry, one needs to understand the rules that govern the randomness of fashion hits. This paper analyzes the fashion hit selection and shows that although it is inherently random, the probability of a product becoming the fashion hit is in equilibrium uniquely defined. We then build on this result to make predictions of and recommendations for the firms' optimal profit-maximizing strategy in a competitive market.

1.1. The Fashion Industry

Fashion industry products are usually classified by season, especially so for high fashion. Fashion houses release their new designs at Fashion Weeks, normally about six months ahead of the season. For example, fall/winter collections are usually showcased between January and April. Journalists and select other fashion influencers, such as editors of prestigious fashion magazines, attend these events and gather information about new designer collections. They screen these collections and share their opinions on what is going to be "hot" in the upcoming season through word-of-mouth communication and fashion media such as fashion magazines, fashion blogs, and TV programs. Consumers decide what to buy when the products actually arrive at the market, which is several months later than the Fashion Week events. At that time, many consumers may not know exactly which product will be the most popular, but the main contenders are not that difficult to identify.² A particular product that catches on among consumers and

becomes a symbol of being "in" is often referred to as the "it" product.

It is important to note that although not released to consumers, the prices of fashion products are usually decided on much earlier than when the product goes on sale and before the it product is determined. For example, according to Eileen Balaban-Eisenberg, the executive vice president of the Connaught Group, fashion designers make the product price information available for the key influencers in the fashion world even before the fashion shows at which the products are introduced, although this price information is not made available for the general public at the time.³

Note that some status goods, such as diamonds, luxury watches, cars, and certain handbags are well known to be status goods. Owning any sufficiently expensive product is enough to convince others of the owner's high status. For example, having a Lamborghini may be all that is needed to impress one's wealth on others. For fashion products, however, what matters is whether one has the right product. The recognition of a person as being "in" crucially depends on the specific product she uses.

1.2. Information Asymmetry and Consumer Coordination

Not everyone has equal access to the information about what the right product is. The ability to acquire timely and accurate information is an important characteristic that differentiates one consumer from another in the fashion market. For example, although many blogs cover fashion, it is hard to discern which ones are run by the knowledgeable "fashion mavens." Those with good access to fashion information know what is in trend and buy accordingly. Those with poor ability to acquire information can only guess at what to buy. Of course, they could also wait to find out from the popular press what turned out to be fashionable, but buying late is usually synonymous with buying nothing as far as the fashion statement is concerned, as popular designs are often sold out for several months.⁴ Once these designs become widely available and recognized, the popularity often spells doom for their prestige.⁵

The following story by Chow (2009) is an example of the importance of information access for consumers. In 2009, the Swedish fashion brand H&M, in cooperation with designer Jimmy Choo, developed a special line of products under the name *Jimmy Choo*

³ See Balaban-Eisenberg (2010).

⁴ Reasonably attractive fashion hits of one season often do enjoy popularity for several years, even though they no longer serve as a fashion statement.

⁵ As in Yogi Berra's complaint about Ruggeri's restaurant, "Nobody goes there anymore. It's too crowded."

² See, for example, a blog discussion at *PureForum* (<http://forum.purseblog.com/handbags-and-purses/whats-the-new-it-bag-for-2010-a-539341.html>) about the it bag of 2010 (the it bag turned out to be the Mulberry *Alexa*).

for H&M. When fashion news columnists buzzed that the line was going to be a hit, consumers “in the know” lined up in front of H&M stores the night before the scheduled release on November 14, 2009 so that they could be the first to get in. By 1 P.M. that day, most of the special collection products were no longer available. This example illustrates that good access to fashion information is essential for consumers to get the it product before it is gone.

A product may often become fashionable because a relatively small group of “high-class” consumers adopts or recommends it. For example, editors of fashion magazines or popular blogs, the apparel and accessory choices made by movie stars or other celebrities, a collective chatter of connected fashion mavens, or trendsetters at elite clubs could spark a tipping point in the fashion trend. Hush Puppies were popularized by a few enthusiasts, including actor/fashion designer Isaac Mizrahi, in 1994 (Gladwell 2000), and there was an up-to-six-month shortage of UGG boots in late 2003 after a number of actresses were seen wearing them (Grant 2003); these are just two examples of the role that small groups of opinion leaders play. Fashion editors are also important agents in the fashion industry because their choices and recommendations have considerable impact on the fashion trends. In fact, some industry insiders argue that fashion editors are the single most important influencer of fashion.⁶ Yet the role of the consumer coordination has been largely ignored in the academic literature.

Note that the purpose of fashion use by those belonging to a higher social ranking (henceforth referred to as the high-type consumers) may be to distinguish themselves from those belonging to a lower social ranking (henceforth referred to as the low-type consumers), whereas the purpose of the fashion use by the low-type consumers may be primarily to mimic the high-type ones. The latter have the incentive to coordinate on their choice among consumers themselves, but not to coordinate with the low-type consumers, who have an incentive to adapt to the high-type coordination, but not to coordinate with each other. It is therefore natural that such coordination is designed to be recognizable by those of higher social rank but not by those of lower social rank. In other words, information asymmetry in which the high-type consumers may have better access to fashion information is a result of individual incentives as opposed to an arbitrary possibility.⁷

⁶ As Eileen Balaban-Eisenberg (2010) puts it, “Fashion editors do not predict trends, they influence them.”

⁷ Following similar logic, Bourdieu (1984) argues that the changing customs and lifestyle of those in higher social ranks can be explained through their desire to distinguish themselves from the lower ranks in a way that is difficult to imitate. Specifically,

The interaction between the competitive firms and the high-type consumer coordination in the fashion industry is at the center of our research. Our model shows how the randomness of fashion hits comes as a result of high-type consumers’ coordination and their optimal response to the low-type consumers’ behavior. As stated previously, the first objective of this model is to understand the driving forces and the rules of randomness of fashion hits. The second objective is to predict and make recommendations for the optimal competitive firm strategy in such a market.

1.3. Summary of Results

In our model, which we formally introduce in §3, we consider two firms competing in a fashion market with two consumer types: the high type and the low type. The high-type consumers in our model are the “socially desired” type such that all consumers would prefer being recognized as of the high type than as of the low type. Consumer types are their private knowledge and are not directly observable by other consumers. Other consumers, however, form expectations of a given consumer type based on the product she uses. The high-type consumers may coordinate their choices as to maximize their expected utility. The game starts with each firm introducing one product. Then the high-type consumers engage in coordination about which product, if any, should be adopted. This coordination results in a recommendation of the choice to make. Only the high-type consumers know this recommendation. In the next stage, all consumers make the product purchase decision. Keeping in line with the assumption that fashion is used mainly for social reasons, we assume that consumers derive utility of a product only through its effect on how this choice affects other consumers’ beliefs that the consumer in question is of the high type.⁸ Because one of the main contributions of our paper is to analyze the role of consumer coordination, one of the important benchmarks we consider is the model without consumer ability to coordinate. This benchmark differs from the above model only in that the coordination stage is absent, and hence the high-type consumers have neither the ability to coordinate nor an informational advantage over the low-type consumers. The main results are as follows.

First, we find that in equilibrium, coordination will always involve randomness of product

Bourdieu considers the role of tastes and manners developed from childhood. We extend this logic to the context of contemporary fashion marketplace where consumers use products whose prices are set by firms. We thank an anonymous reviewer for suggesting this interesting parallel to us.

⁸ As we discuss in §3, such product value can be justified through the effect of product ownership on who the consumer will interact with in the matching game following product choice.

recommendations. In other words, the consumers' ability to coordinate always leads to randomness of fashion hits. Nevertheless, the probability of each product being selected as the it product is uniquely defined as a function of the product's price. Thus, unlike in the case without coordination, the expected sales are predictable and the expected profit functions can be uniquely derived. Another implication of the coordination in this model is that a market for fashion always exists (without coordination, a market may not exist if the valuation of the low-type consumers for being recognized as "in" is higher than that of the high-type consumers).

Second, we find that the expected high-type consumer demand and probability of a product becoming the it product (i.e., the most desirable and popular product) increase in own price if and only if the equilibrium demand from the low-type segment is positive. On the other hand, the equilibrium demand from low-type consumers decreases in price. We also find that the equilibrium price may be such that the product attracts strictly positive expected demand from the low-type consumers. Thus, in view of the previous result, in the neighborhood of the equilibrium price, the high-type consumers may appear to prefer the higher-priced products: even though they consider the direct effect of a higher price as a negative factor in choosing a product, they may end up selecting the product with higher probability if its price is increased from the equilibrium one. Looking at the welfare of high-type consumers, we also find that high-type consumers prefer the prices to be (weakly) higher than their optimal level for the firms.

Furthermore, we find that equilibrium prices and profits are not monotonic as functions of the low-type consumer valuation of being "in." In particular, as this valuation increases from zero to infinity, the equilibrium price first increases, then decreases, then increases again, and finally decreases. On the other hand, even though the total demand increases as the valuation increases, the profit first increases and then decreases. In other words, there is a level of low-type valuation of matching with high-type consumers, which is optimal for the industry.

Finally, compared with the monopoly case, we find that competition may increase price. This happens when low-type consumer valuation for being recognized as "in" is not too high.

The rest of this paper is organized as follows. Section 2 discusses some academic literature related to fashion and status goods. Section 3 fully specifies the model. Section 4 presents the analysis of the consumer strategy. Section 5 discusses the full equilibrium of the game and provides insights into the market dynamics, and §6 discusses the robustness of the results to some assumptions. Section 7 concludes.

2. Related Literature

Our paper is primarily related to the economic and marketing analysis of fashion and fads prevalent in many socially influenced markets. For example, "How can success in cultural markets be at once strikingly distinct from average performance, and yet so hard to anticipate for profit-motivated experts armed with extensive market research?" ask Salganik et al. (2006, p. 854). Although it is possible that some difficulty in predicting the outcomes is due to performance being a convex function of quality (Rosen 1981), Salganik et al. (2006) experimentally support the idea that social influence results in inherent randomness of choice. The extant literature offers two underlying mechanisms for seemingly random consumer coordination on a particular product within a category. One is the information cascade resulting from sequential consumer choice under incomplete information about the product. For example, Bikhchandani et al. (1992) argue that the convergence behavior we observe in fashion and fads can be explained through an informational cascade model. In their model, individuals act in sequence, and each individual makes a choice based on the actions of those acting before her and the private signal she receives. In the equilibrium, it is optimal for later consumers to follow the behavior of the very early consumers and ignore their own information. This leads to the convergence of consumer behavior. A fundamental building block of the information cascade models is the uncertainty about the intrinsic value of the product and the individual consumers having partial and private information about this value.⁹

Another stream of literature going back to the essay by Veblen (1899) emphasizes the role of fashion as a consumer-to-consumer signalling device. The idea is that people can signal their membership in a particular social class by their knowledge of the ways people of that class behave. Karni and Schmeidler (1990), studying the variation in the demand for fashion products from a purely consumer perspective without incorporating firms in the model, consider three product colors and two types of consumers. Consumers of one type prefer more consumers of the same type and fewer of the other type to use the same color they use, whereas consumers of the other type prefer more of both types of consumers to use the same color they use. In the equilibrium, there is a dynamic variation in demand for different colors, which mimics the dynamics of fashion cycles: consumers of the former type change colors to avoid being mimicked by

⁹ Information cascades are not confined to fashion. For example, Zhang (2010) empirically finds significant information cascades in the U.S. kidney replacement market.

consumers of the other type. Pesendorfer (1995) proposes a dynamic game between a monopoly firm and consumers to explain the occurrence of fashion cycles. Consumers are of two types, and everyone prefers to be matched with the desired type of consumers. The game is played for infinitely many periods, and in each period, consumers' payoffs are determined by the type of people they are matched with, which then depends on the fashion design they use. A fashion cycle arises in the equilibrium. As Pesendorfer notes, there is an inherent issue in modeling competition in a market for signalling devices. In competition in most markets, if products are not differentiated, the result is pricing at the marginal cost of one of the firms and sales going to the product with the lowest marginal cost. If the marginal costs of both firms are equal, profits are zero, and therefore the split of market share is inconsequential for profits or consumer welfare. On the other hand, in a market for signalling devices, a price reduction may rob the product of its value. Therefore, competition may not result in prices declining to marginal costs, and any combination of market shares may constitute an equilibrium.¹⁰ Thus, the extant literature on status goods mostly concentrates on the monopoly case. As we will see, considering the consumer coordination allows us to model competition, which is an important aspect of the fashion industry, in a way that results in the expected profits and market shares uniquely defined in equilibrium.

Our paper adopts this second approach of looking at fashion as a device used by consumers to convey information about their type to other consumers. Unlike the above literature, we model competition and the role and implications of high-type consumer coordination on which product to buy. Yoganarasimhan (2012) also considers the informational structure of the consumer market similar to our model (i.e., high-type consumers have better knowledge of what product is "it") and provides excellent examples of randomness in fashion. Her paper assumes that fashion hits are exogenously random with a given probability distribution and focuses on the question of whether the monopoly firm should reveal the information about which product is a hit to all consumers. Conversely, we endogenize the randomness of fashion hits (i.e., derive

the probability of a product becoming the it product) and consider firms competing in price. Our model contributes to an understanding of fashion markets in particular by proposing a theory both to explain the randomness of fashion hits and to predict the likelihood of a product becoming a fashion hit. In a related paper, Wernerfelt (1990) considers competition in advertising and assumes that the product-consumer type connection is a probabilistic function of advertising spending.

Because the signaling value of status goods depends on the mass and distribution of users, our paper is also related to the literature on consumers' desire for uniqueness and conformity (e.g., Leibenstein 1950; Becker 1991; Amaldoss and Jain 2005a, b; Balachander and Stock 2009), but it relates these desires to the type association. Again, that literature does not consider the role of consumer coordination and thus does not obtain the randomness of fashion as a result.

Consumers' desire to communicate their type to each other provides a different but related perspective to the extensive literature on costly signalling done to sell a product or skill (e.g., Spence 1973, Milgrom and Roberts 1986, Balachander and Srinivasan 1994, Desai and Srinivasan 1995, Moorthy and Srinivasan 1995, Simester 1995, Anderson and Simester 1998, Kalra et al. 1998, Desai 2000, Soberman 2003).

3. Model Setup

The market consists of two firms offering one product each and a unit mass of consumers of two types: the high-type consumer segment has mass α and the low-type consumer has mass $1 - \alpha$. We assume that consumers are interested in "projecting" a high-type image of themselves or, in other words, in convincing other consumers that they are of high type. As the consumer type is not directly observed, consumers may try to signal their type through product choice. We further assume that the signalling value of the product is the only utility consumers derive from the products. This captures the notion that the fashion is a social device and its utility is derived from social interactions.

It is convenient to "rationalize" the utility of projecting an image through a social interaction that occurs after a product choice and in which the payoff depends on the type of consumers a given consumer interacts with. Specifically, following Pesendorfer (1995), we model the social value of a product as coming from a "matching game." In this game, consumers are randomly paired up with other consumers using the same product, and the payoff of a match between consumers of types j and k depends on j and k only ($j, k = 1, 2$); i.e., consumers of the same type are homogeneous. We normalize any consumer's payoff from matching with a low-type consumer to 0 and

¹⁰ This indeterminism of profit expectations and a lower bound on prices is also implied by the models in Bagwell and Bernheim (1996) and Becker (1991), although if consumer types are horizontally differentiated so that consumers of each type prefer to identify with their own type, products may have social value without being expensive or unpredictable (Kuksov 2007). However, in the latter case, the products are self-expressive, but not status goods. Competition in status goods can also be modeled through assuming high-enough heterogeneity among high-type consumers, with competitors targeting distinct market segments (Kuksov and Xie 2012), but the above-discussed problem arises when heterogeneity is not high enough. The model in this paper shows how one can model competition between undifferentiated status goods.

the payoff of the high-type consumer matching with a high-type consumer to 1. We denote the remaining parameter—the payoff of the low-type consumer from pairing up with a high-type consumer—by V . The consumer's objective in product choice is to maximize the expected payoff in the matching game net of the product's price. Therefore, the utilities of purchasing product k for a high- and low-type consumer are given by

$$U_h(k) = q_k - p_k \quad \text{and} \quad U_l(k) = q_k V - p_k, \quad (1)$$

respectively, where q_k is the fraction of high-type consumers among users of product k . To keep notation parsimonious, we will refer to the option of "neither" product as product $k = 0$ with the associated price of this option being $p_0 = 0$.

The above assumption that consumers are paired with each other according to their product use can be justified as an equilibrium strategy of consumers individually deciding on whether to accept a pairing. In equilibrium, one product will carry a better image than the other; i.e., it will have a higher proportion of high-type consumers among its users. Because consumer type is private information, the only criterion that consumers can use to decide whether to accept a proposed pairing with another consumer is his or her product choice. So consumers who have the product with the better image will only want to accept another consumer using the same product, as such strategy is feasible and results in a higher probability of pairing up with a high-type consumer. Although consumers who have the product with a worse image would like to pair up with consumers using the product, with a better image, given the above, such a strategy would not result in a pairing, because matching can only occur when both consumers are willing to do so. Consumers who have the product with the worse image can only pair up among themselves (see Burdett and Coles 1997 for an explicit consideration of consumer acceptance strategy in a matching game that proves the above matching pattern).

It is worthwhile to note that the above formalization of consumer utility as coming from the matching game is mathematically equivalent to the assumption that consumers derive social utility defined by Equation (1) from convincing the other consumers that they are of high type with probability q_k . In other words, motivation of the social utility through the matching game, although theoretically appealing, is not essential. Alternatively, we could postulate that consumers derive utility from projecting the image of high type and that this utility is proportional to the precision of the image.

Turning back to our model, we assume that high-type consumers have the ability to coordinate in such

a way that the outcome is unobserved by low-type consumers.¹¹ This assumption is crucial for our analysis. To formally model high-type consumer coordination, we assume that the high-type consumers have access to a coordinating device that displays the purchase recommendation so as to maximize the high-type consumer utility.¹² We will call this device the *coordinator*.

To be consistent with the in-type homogeneity assumption, we further assume that all high-type consumers perfectly observe the coordinator's recommendation before the purchase decision, but the low-type consumers acquire no information about it until after the purchase decision stage. We assume that right before the matching game, low-type consumers also learn the recommendation. Although they can no longer purchase the recommended product, they could discard an item and not use it in the matching stage even if they have purchased it. This assumption is not essential for the main results.

The firms maximize their individual profits and have a constant and equal marginal product cost, which we normalize to zero. The game sequence and the decisions are as follows:

Stage 1. Firms 1 and 2 simultaneously introduce products and prices.

Stage 2. The coordinator recommends "product 1," "product 2," or "neither." The high-type consumers observe this recommendation; the low-type consumers do not.

Stage 3. Consumers make purchase decisions.

Stage 4. Low-type consumers observe the recommendation, and each consumer decides which product to use, if any, of the products purchased. The matching game is then played out, and consumers receive the utility according to Equation (1).

To fully define the payoffs in the matching game, we assume that choosing a product not chosen by anybody else results in zero payoff.¹³ We use subgame-perfect Nash equilibrium as the solution concept and solve the model by backward induction. Because our objective is to analyze the potential role of coordination, we will focus on equilibria in which the high-type consumers follow the recommendation; i.e., we assume that if a product is recommended by the

¹¹ According to Robinson (1961, p. 384), "The true fashion leaders comprise a much smaller and more esoteric group than is commonly supposed. They will have often lost interest in a designer by the time his name is known to the general public."

¹² Note that because the high-type consumer population is a priori homogeneous, there is no issue of trading off utility across high-type consumers.

¹³ This assumption simplifies notation but is not necessary for any results. Alternatively, and with no change in equilibrium results for all but a zero mass of consumers, we could define this payoff to be any value.

coordinator, all high-type consumers buy it, and if the device chooses neither, no high-type consumers buy either product. This is a natural assumption because the coordinator is chosen to maximize the high-type consumer utility, and therefore it is always optimal for the high-type consumers to follow its recommendation.¹⁴

4. Consumer Choice and the Optimal Coordination Rule

We devote special attention to the consumer and the coordination strategies rather than just to the equilibrium predictions of the full game; fully considering all possibilities of the subgame starting from the coordination stage would allow us not only to predict the equilibrium outcome of the full game but also to analyze the profit-maximizing strategy of a firm conditional on its expectation of the other firm's choices.

Note that the coordination can ensure high-type consumer payoff of α by the neither recommendation, which would be optimal for all high-type consumers to follow. Therefore, the coordinator would not be providing the best recommendation to the high-type consumers if it were to ever recommend a product with a price above $1 - \alpha$. Given that the low-type consumers can expect this part of the coordination strategy, they will have no demand for such a product either. Thus, a price above $1 - \alpha$ guarantees zero sales and profits. It will soon be clear that each firm can guarantee positive sales by pricing sufficiently low, and therefore, pricing above $1 - \alpha$ is a strictly dominated strategy. It will imply that pricing at 0 is also a strictly dominated strategy. Therefore, assuming, without loss of generality, that $p_2 \leq p_1$, we restrict our analysis in this section to the consumer strategies under the following condition:¹⁵

$$0 < p_2 \leq p_1 < 1 - \alpha. \quad (2)$$

¹⁴ An equilibrium in which high-type consumers completely ignore the recommendation also always exists, because if all consumers ignore any recommendation, there is no reason for any consumer to follow any recommendation. Considering such an equilibrium would amount to ignoring the role of the coordination. We will also discuss and rule out the possibility that high-type consumers follow the recommendation with probability $q \in (0, 1)$, or, equivalently, only some (positive mass) consumers follow it while the rest ignore it.

¹⁵ When $p_k = 1 - \alpha$, there is always an equilibrium where high-type consumers never coordinate on product k , and therefore product k receives zero demand. However, there are other equilibria, of which the most favorable to firm k will be defined by continuity from Proposition 1. As we will see in the following section, the latter outcome is the only one that can be an equilibrium outcome of the full game. Therefore, to avoid discussing these multiple equilibria throughout the text, we restrict our attention to $p_k < 1 - \alpha$ in this section.

Solving the game by backward induction, let us first consider consumer product use in Stage 4. Let us denote the low-type consumer demand for product k by x_k . If the coordinator recommended product $k \neq 0$, the users of product k will consist of all high-type consumers and those low-type consumers who purchased it. Note that the low-type consumers who bought product $j = 3 - k$ will choose not to use it. Therefore $q_k = \alpha / (\alpha + x_k)$ and $q_0 = 0$. The equilibrium value of q_j either is not defined (if the low-type consumers who purchased product j all decide not use the product) or is zero (if some low-type consumers bought product j and at least one of them decides to use it). The matching game payoff from using product j is zero in either case. If the coordinator recommended $k = 0$, i.e., not to buy either product, all consumers will end up not using either product in the matching game. This would lead to $q_1 = q_2 = 0$ (or undefined) and $q_0 = \alpha$.

In Stage 3, high-type consumers follow the recommendation, but a low-type consumer has to make her decision based on her expectation of the coordination and her expectation of the proportion of other low-type consumers buying each product. She can choose product 1, product 2, both, or neither.

A low-type consumer purchase of product $k \neq 0$ gives her the expected matching utility of $q_k V$ when product k is coordinated on by the high-type consumers and 0 when product $3 - k$ is coordinated on. This incremental utility from the product choice does not depend on whether she also decides to purchase product $3 - j$, which means that low-type consumer choice to buy or not to buy each of the two products can be treated as two separate decisions. Specifically, the consumer will purchase one unit of product k , $k = 1, 2$, if and only if $U_l(k) \geq U_l(0)$. However, the equilibrium low-type consumer demands for the two products end up being interrelated because the high-type consumer coordination on product k and the low-type consumer expectation of this coordination depend on the high-type consumer trade-off between adopting product k and $j = 3 - k$. Note that $U_l(k)$ decreases in the mass of low-type consumers who decide to buy product k . Given the low-type consumer expectation of the probability with which product k is coordinated on, the low-type consumer demand for either product will therefore be determined by equating $U_l(k) = U_l(0)$ whenever this equation leads to an internal solution.

To determine the equilibrium coordination strategy (Stage 2), one needs to take into account high-type consumer expectation of low-type consumer behavior in the following stage, given p_1 and p_2 . Because the best choice to coordinate on depends on expected low-type consumer decisions, and low-type consumer decisions depend on low-type consumer

expectations of the coordination, the equilibrium coordination strategy follows from the simultaneous solution to high- and low-type consumers' equilibrium conditions. A priori, the coordination strategy must be one of the following: (1) follow a pure strategy and choose one of the options; (2) randomize between two options, e.g., picking product 1 and product 2 or deciding between product 1 and neither; or (3) randomize between all three options. We will show that, given prices satisfying Equation (2), choosing neither only or randomizing between one of the products and neither is never optimal. Therefore, the equilibrium coordination conditions come from the indifference between the two products or between all the three options, or from choosing one product only.

In equilibrium, for each product, there must be some low-type consumers who do not buy it. This is because if all low-type consumers buy a product in equilibrium, the net-of-price payoff for the high-type consumers of buying that product must be smaller than α , and hence it is strictly optimal to coordinate on neither instead of this product.

Furthermore, we will show that whenever the low-type consumer demand for each of the two products is positive, it is optimal to randomize the coordinated choice across all the three options. We will also show that the equilibrium pricing strategy is such that in expectation, each product receives positive demand from the low-type consumers, although when the equilibrium pricing strategy is mixed, the optimal coordination strategy is to randomize between the two products only and for the low-type consumers to only buy the lower-priced product.

Let δ_k denote the probability that the coordinator picks product k , and let x_k denote the size of low-type consumers who purchase product k , $k = 1, 2$. Then the following proposition characterizes the optimal coordination strategy and the consumer behavior conditional on the prices of the two products.

PROPOSITION 1. *Given two prices satisfying Equation (2), we have*

Area 1 ("Low-price area"): If $\alpha(1 - V)(p_1 + p_2) + (2 - V)p_1p_2 < \alpha^2V$, the coordination randomizes between all the three options, and low-type consumer demand is positive for both products.

Area 2 ("Medium-price area"): If $\alpha(1 - V)(p_1 + p_2) + (2 - V)p_1p_2 \geq \alpha^2V$ but $p_2(1 - V + p_1) + (p_1 - V) \cdot (1 - p_1) < 0$, the coordination randomizes between products 1 and 2 and low-type consumer demand is positive for both products.

Area 3 ("High-price area"): If $p_2(1 - V + p_1) + (p_1 - V) \cdot (1 - p_1) > 0$ but $p_1 < 1 - p_2/V + p_2$, the coordination randomizes between products 1 and 2 and low-type consumer demand is positive only for product 2.

Area 4 ("Very-high-price area"): If $p_1 \geq 1 - p_2/V + p_2$, the coordination will choose product 2 with probability 1 and product 1 receives no demand.

For $p_1 > p_2$, the coordination choice probabilities and the low-type consumer demands for the two products in the four areas above are stated in Table 1.¹⁶

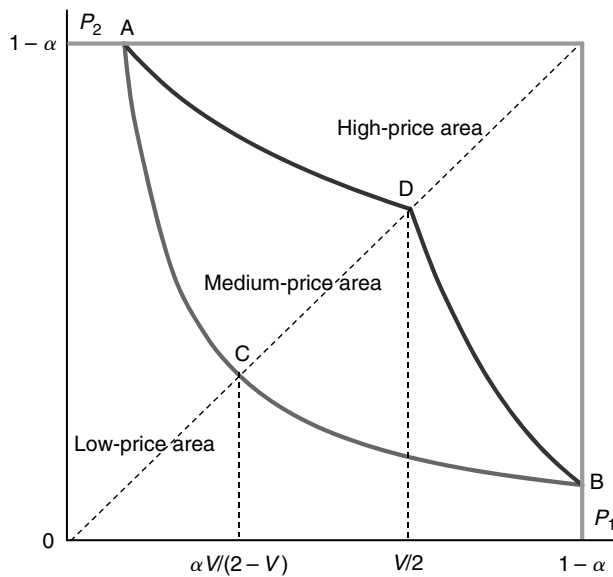
PROOF. See the online appendix (at <http://dx.doi.org/10.1287/mksc.1120.0742>). □

Note that some areas may be empty for some V or α . Area 4 is not empty only when $V < 1 - \alpha$. The other three areas are not empty for $V < 2(1 - \alpha)$. For $V \geq 2(1 - \alpha)$, the medium- and high-price regions disappear as well. It is then immediately apparent that for V above this cutoff, the full equilibrium of the game must involve the coordinator selecting neither with positive probability. Area 1 is the only one where the coordinator will select neither with positive probability. This is because high-type consumers can only get the payoff of α if the coordinator picks neither. The coordinator must recommend a product to make the high-type consumers obtain a higher payoff. However, when prices are low enough, no randomizing between the two products would prevent the low-type consumers from buying, and the coordinator ends up having to result in neither with a positive probability. Figure 1 illustrates the areas in Proposition 1 and how they change with V .

To understand how parameter values affect the equilibrium, note that in Area 1, the probability of coordinating on neither increases in α . This is because when the fraction of high-type consumers becomes larger, the utility from pairing with a random consumer (i.e., pairing with a high-type consumer with probability α and a low-type consumer with probability $1 - \alpha$) increases, making the neither option more attractive. The probability of the coordination picking neither also increases in V . This is because as the low-type valuation for social interactions increases relative to that of the high-type consumers, it becomes more and more difficult to create a fashion hit without letting the low-type consumers buy. In fact, as V goes to infinity, the probability that the coordinator recommends any product tends to zero. Also note that as a product's price decreases to zero, the product's penetration of the low-type consumer segment approaches full, even as its probability of being chosen by the

¹⁶ As we derive in the online appendix, for $p_1 = p_2$, the equilibrium of the equilibrium of the consumer choice subgame can be different from the one stated in Table 1. Specifically, in Areas 3 and 4, any subgame in which the coordination picks the two products with probabilities δ_1 and $1 - \delta_1$, where $\delta_1 \in [0, 1]$ for Area 4 and $\delta_1 \in [p_1/V, 1 - p_1/V]$ for Area 3, and low-type consumer demand is zero for either outcome. However, as we show in §5, such equilibria of the consumer choice subgame cannot be reached with a positive probability in a subgame-perfect equilibrium of the full game.

Figure 1 Plot of Areas Defined in Proposition 1 (to Scale for $\alpha = 1/4, V = 1$)



Notes. The line ACB will always be below ADB as long as the medium-price and high-price areas exist. When prices are symmetric, $P_1 = P_2 = \alpha V / (2 - V)$ marks the boundary between the low-price and medium-price areas, and $P_1 = P_2 = V/2$ separates the medium- and high-price areas. As V increases, lines ACB and ADB will shift upward and rightward but will always be symmetric around the 45° line. Also, the low-, medium-, and high-price areas will all exist as long as $V < 2 - 2\alpha$. When $V > 2 - 2\alpha$, both the medium- and high-price areas disappear. Also, for $V < 1 - \alpha$, there is an additional “very-high-price” area above the high-price area.

coordinator tends to zero. Examining the coordination outcome probabilities in Table 1, one can also see the following effect of price.

COROLLARY 1. *An increase in a product’s price leads to the high-type consumers coordinating on it with a higher probability but fewer low-type consumers buying it in all regions except the higher-priced product in Areas 3 and 4. In Area 3, an increase in the higher-priced product leads to a lower probability of it being coordinated on, whereas in Area 4, the higher-priced product has zero demand.*¹⁷

PROOF. Immediately follows from Table 1. □

The intuition for this result is as follows. If one of the prices is increased, the coordinator is trading off between the cost of the product and the changed expected utility of matching. The direct effect is that the higher price reduces the utility of the high-type consumers, and the coordinator’s preference for that product should decline. However, an increase in price also inhibits the low-type consumers from buying, which enhances the high-type consumer utility indirectly through the effect on the endogenous product value. This encourages the high-type consumers

to coordinate on that product more frequently. The above corollary states that whenever there is such a trade-off (i.e., whenever the low-type consumer demand for the product is positive), the effect of the higher expected matching utility always dominates the cost effect. This results in the high-type consumers coordinating on that product with a higher probability, but such that the demand from low-type consumers still decreases. This reasoning only fails to apply for the higher-priced product in the high-price area because in that area, the higher-priced product receives zero demand from the low-type consumers.

As we have noted before, together with the equilibrium where high-type consumers follow the recommendation, there is also an equilibrium where high-type consumers ignore it (i.e., technically, coordination failure is always an equilibrium). Could there also be an equilibrium in between, so that some but not all high-type consumers coordinate, or equivalently, high-type consumers follow the recommendation of the coordinator with probability $q \in (0, 1)$? In such an equilibrium, high-type consumers would have to be indifferent between following the recommendation and another choice. One can argue that such an outcome should not be expected because it is not stable in the following sense: if a slightly higher proportion of high-type consumers follows the recommendation, all high-type consumers strictly prefer to follow the same choice with probability 1. The same argument could be applied to a slightly lower proportion of consumers following the recommendation, in which case, the optimal could be to “do the opposite of the recommendation.” However, such an outcome could in a sense still be thought as following the recommendation once it is redefined to mean the opposite of what it states. The possibility of an equilibrium where high-type consumers are indifferent between following the recommendation and not is then based on a knife-edge balance between the fraction of consumers who end up following it and the fraction who respond to the recommendation in a precise way so as to counterbalance the incentive to follow.¹⁸ Whereas the existence of such a strategy is not easy to rule out, we show in the online appendix that there are no equilibria where some high-type consumers follow the recommendation and some do not

¹⁷ In the following section, we will prove that a pure-strategy equilibrium price never falls in Area 3 or Area 4.

¹⁸ Note that in the equilibrium of Proposition 1, high-type consumers strictly prefer following the recommendation to any other choice and thus will still prefer to do so if a small fraction of high-type consumers are made to deviate and not follow. On the other hand, in the equilibrium where nobody follows the recommendation although it is random according to Proposition 1, if a small proportion of high-type consumers could coordinate to follow it, they would strictly prefer to do so. In other words, the optimality of nobody following the recommendation is based on that exactly nobody follows it.

Table 1 Coordination Strategy and Low-Type Demand for $p_1 > p_2$ ($k = 1, 2; j = 3 - k$)

	Coordination strategy	Low-type consumer demand
Area 1	$\delta_k = \frac{p_k}{V(p_k + \alpha)}$	$x_k = \frac{\alpha(1 - \alpha - p_k)}{\alpha + p_k}$
Area 2	$\delta_k = \frac{1}{2} + \frac{(2 - V)(p_k - p_j)}{p_1 + p_2 + \sqrt{(p_1 - p_2)^2(V - 1)^2 + 4p_1p_2}}$	$x_k = \frac{\alpha V}{2p_k} - \alpha + \frac{\alpha V(2 - V)(p_k - p_j)}{p_k(p_1 + p_2 + \sqrt{(p_1 - p_2)^2(V - 1)^2 + 4p_1p_2})}$
Area 3	$\delta_1 = \frac{V - p_2 - V(p_1 - p_2)}{V(1 - p_1 + p_2)}$; $\delta_2 = \frac{p_2}{V(1 - p_1 + p_2)}$	$x_1 = 0; x_2 = \frac{\alpha(p_1 - p_2)}{1 - p_1 + p_2}$
Area 4	$\delta_1 = 0; \delta_2 = 1$	$x_1 = 0; x_2 = \max\left\{0, \frac{\alpha(V - p_2)}{p_2}\right\}$

follow it in the sense that they make their choice independently of the recommendation (i.e., although some do not follow, they do not modify their behavior as to in aggregate to counterbalance the incentive to follow).

5. Pricing Strategy and the Equilibrium of the Full Game

An interesting consequence of the total demand implied by Table 1 is that the trade-off between price and demand for the profit maximization of a firm in this model is not necessarily the usual negative relationship between price and demand. In this model, lower price may lead to a lower total demand. This is because as Proposition 1 states, in all but one region, a higher price increases the product's probability of being chosen although it decreases the demand from the low-type consumers. This is a result of fashion being a signaling device and its value endogenously coming from what it means in social interaction. When low-type consumers are buying more, signaling becomes more difficult, and hence the value of signaling decreases for the high-type consumers. Hence there is a tension between the demand from high types and that from low types, and the overall effect on demand is a priori not clear. Theoretically, it is possible that a higher price may create higher demand. For example, in the low-price region, when $V < \alpha$, the total demand would increase with the product's own price.

If there is a negative relationship between price and demand, then the firm has to trade off between the two. Because the demand in our model is continuous (except for when prices are equal in Area 3), lowering or raising the price does not generate a discontinuous gain or loss of demand. In this case, the firm faces the nontrivial choice between charging a high price to create the premium image (or, in the model, increase the probability that the product will end up having a premium image) and charging a lower price to generate more sales. Note that this trade-off is not present in the absence of the

high-type consumers' ability to coordinate, as the absence of premium image would necessarily also imply the absence of consumer demand from either type. The consumer ability to coordinate effectively makes the image a continuous variable through the probabilistic coordination strategy.

5.1. Equilibrium Price

The equilibrium coordination and consumer strategies reported in Table 1 result in the firms' profits reported in Table 2. As we will show, as V decreases from infinity to 1, the equilibrium is in pure strategies with prices moving from the low-price area to the medium-price area defined in Proposition 1. For $V < 1$, the equilibrium is in mixed strategies with prices in the high-price region. A pure-strategy equilibrium cannot be in the high-price region because in that region, slightly undercutting the competitor's price is always better than pricing equally with the competitor.

To intuitively understand the driving forces leading to the equilibrium price strategies, observe that when V is high enough (Region 4 in Proposition 2), the medium- and high-price areas do not exist, and therefore the equilibrium is derived from the first-order conditions on the profits in Area 1. Slightly below that (Region 3 in Proposition 2), the solution to the first-order conditions comes up to the binding constraint $1 - \alpha$, above which the coordinator would prefer to give up on trying to separate the high- and low-type consumers and thus the price becomes $1 - \alpha$.

Table 2 Profit Functions Given Prices $p_1 > p_2$ ($k = 1, 2; j = 3 - k$)

	Profits
Area 1	$\pi_k = \frac{\alpha p_k(V + p_k - V p_k - \alpha V)}{V(\alpha + p_k)}$
Area 2	$\pi_k = \alpha \left(\frac{V}{2} - \frac{p_k}{2} + \frac{(2 - V)(p_k - p_j)(p_k + V)}{p_1 + p_2 + \sqrt{(p_1 - p_2)^2(V - 1)^2 + 4p_1p_2}} \right)$
Area 3	$\pi_1 = \frac{\alpha p_1(V + V p_2 - p_2 - V p_1)}{V(1 - p_1 + p_2)}$, $\pi_2 = \frac{\alpha p_2(p_2 + V p_1 - V p_2)}{V(1 - p_1 + p_2)}$
Area 4	$\pi_1 = 0, \pi_2 = \max\{\alpha p_2, \alpha V\}$

When V is lower (Region 2 in Proposition 2), the medium-price boundary crosses the boundary $p_1 = p_2 = 1 - \alpha$, and firm k 's incentives to decrease price p_k from $p_1 = p_2 = 1 - \alpha$ change. Specifically, the first-order conditions of the medium-price area suggest decreasing price while the first-order conditions of the low-price area suggest increasing price. Therefore, the equilibrium prices lie on the boundary between these two areas.

When V is even lower (Region 1 in Proposition 2 below), the first-order conditions of the medium-price range suggest a pair of prices strictly within the medium-price range. However, to make sure the first-order conditions of the medium-price region define the globally optimal responses, we also need to compare the profits given these prices to the profits from the optimal deviation to the high-price region, which is now not empty. That optimal deviation to higher price that makes the pair of prices rest in the high-price region results in lower profits when $V > 1$ and higher profits when $V < 1$.

Thus, when $V < 1$, responding to the solution of the first-order conditions of the medium-price area by a price in the high-price area is always better than responding by the optimal price in the medium-price area. As we stated before, a pure-price-strategy equilibrium cannot exist in the high-price region, and thus for $V < 1$, only a mixed-price-strategy equilibrium exists.

To understand the nature of this mixed-strategy equilibrium (for $V < 1$), consider the following process of price adjustment starting from the solution of the first-order equations in the medium-price area. First, the optimal response to such pricing is a higher price that puts the two prices in the high-price area. The optimal response to that high price is to slightly undercut it. The optimal response to the new price is to again slightly undercut it (still resulting in a pair of prices within the high-price area). The undercutting argument continues until one firm finds it better to charge a much higher price than to undercut (this condition is reached before the prices move to the medium-price area), but then the other firm will

undercut again, and the foregoing analysis repeats. This suggests that for $V < 1$, the equilibrium price is a mixed strategy within the high-price area. The explicit solution for the mixed-strategy equilibrium is not analytically tractable.

The following proposition formalizes the above considerations.

PROPOSITION 2. *Let $V_1 = 2 + \alpha/2 - \sqrt{\alpha^2 + 16\alpha}/2$ and $V_2 = 2 + \alpha/2 - \sqrt{\alpha^2 + 8\alpha}/2$. When $V > 1$, the symmetric equilibrium prices and profits are reported in Table 3, and the corresponding equilibrium editor's strategy (δ_k for $k = 1, 2$) and the low-type consumer demand are reported in Table 4. Furthermore, the equilibrium is unique unless $V \in (\max\{1, V_1\}, \min\{V_2, 2 - 2\alpha\})$, in which case there are also asymmetric equilibria. The equilibrium price decreases in V while equilibrium low-type consumer demand increases in V for $V \in [1, V_1] \cup [V_2, \infty)$, and the equilibrium price increases in V while the low-type consumer demand decreases in V in the symmetric equilibrium when $V \in (\max\{1, V_1\}, \min\{V_2, 2 - 2\alpha\})$. Restricting attention to the symmetric equilibrium, the equilibrium profit increases with V until $2 - \sqrt{2}\alpha$ and then decreases, thus achieving the highest value for $V \in (\max\{1, V_1\}, \min\{V_2, 2 - 2\alpha\})$. When $V < 1$, there are no pure-strategy equilibria.*

PROOF. See the online appendix. \square

Figures 2 and 3 illustrate the equilibrium prices and profits, respectively, as a function of V when $\alpha = 1/4$. The graphs for other parameter values are similar.

Note that the equilibrium prices in Region 1 correspond to the medium-price area in Proposition 1, in which case neither is coordinated on with positive probability by the high-type consumers. The equilibrium prices in Region 2 lie on the boundary between the low-price and medium-price areas, and those in Regions 3 and 4 correspond to the low-price area. In the latter two areas, the high-type consumers always coordinate on one of the two products and the low-type consumers buy both. Note that when $\alpha > 1/3$, we have $V_1 < 1$, and therefore Region 1 does not exist. When $\alpha < 1/3$, Region 3 disappears.

Table 3 Equilibrium Prices and Profits ($k = 1, 2; j = 3 - k$)

Region of V	Prices	Profits
1. $[1, V_1]$	$p_k = \frac{V(2-V)}{2+V}$	$\pi_k = \frac{\alpha V^2}{2+V}$
2. $(\max\{1, V_1\}, \min\{V_2, 2 - 2\alpha\})$	$p_k = \frac{\alpha V}{2-V}$	$\pi_k = \frac{\alpha V(2-\alpha-V)}{2(2-V)}$
3. $[2 - 2\alpha, \max\{1 + \alpha, V_2\}]$	$p_k = 1 - \alpha$	$\pi_k = \frac{\alpha(1-\alpha)^2}{V}$
4. $[\max\{1 + \alpha, V_2\}, \infty)$	$p_k = \sqrt{\frac{\alpha(V-\alpha)}{V-1}} - \alpha$	$\pi_k = \alpha + \alpha^2 - \frac{2\alpha(\alpha + \sqrt{\alpha(V-1)(V-\alpha)})}{V}$

Table 4 Equilibrium Editor's Choice Probabilities δ_k and Low-Type Consumer Demand x_k ($k = 1, 2; j = 3 - k$)

Region of V	Editor's strategy	Low-type consumer demand
1. $[1, V_1]$	$\delta_k = 1/2$	$x_k = 1 - \alpha - V/2$
2. $(\max\{1, V_1\}, \min\{V_2, 2 - 2\alpha\})$	$\delta_k = 1/2$	$x_k = 1 - \alpha - V/2$
3. $[2 - 2\alpha, \max\{1 + \alpha, V_2\}]$	$\delta_k = \frac{1 - \alpha}{V}$	$x_k = 0$
4. $[\max\{1 + \alpha, V_2\}, \infty]$	$\delta_k = \frac{1}{V} \left(1 - \sqrt{\frac{\alpha(V-1)}{V-\alpha}} \right)$	$x_k = \sqrt{\frac{\alpha(V-1)}{V-\alpha}} - \alpha$

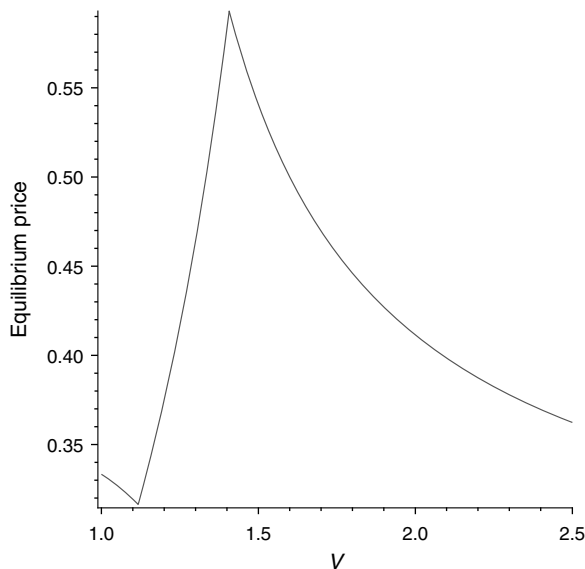
We now turn to the implications of Proposition 2. First note that it implies that there is a market for fashion for any V including $V > 2$. When $V > 2$, one could speculate that the low-type consumers could just buy both products while the high-type consumers buy one of them, even if the coordinator fully randomizes between the two products. This would imply that the high-type consumers are better off not buying anything, and the coordinator would always select neither. However, for a high V , the coordinator can still make the products worthwhile to the high-type consumers by choosing them with sufficiently low probability. In equilibrium, although the probability of the coordinator selecting one of the products tends to zero as V tends to infinity, the market (total demand) for fashion products actually expands as the lower expected demand from high-type consumers is more than compensated by the increased demand from the low-type consumers.

Proposition 2 also implies that even without the restriction of symmetric equilibrium, the equilibrium

price is nonmonotonic in V since the unique equilibrium price is decreasing in V in Regions 1 and 4 and is higher at the upper end of Region 1 than at the lower end of Region 4. Since prices are equal to zero when $V = 0$, the equilibrium price first increases, then decreases, then increases again, and finally decreases asymptotically approaching $\sqrt{\alpha} - \alpha$ as $V \rightarrow \infty$ (see Figure 2 for an illustration for $\alpha = 1/4$). It is also interesting to observe that among all possible equilibria in Region 2, the symmetric one given in Proposition 2 is the optimal one for the industry in the sense that total industry profit is the highest among all potential equilibria. However, the symmetric equilibrium is not Pareto-optimal. In fact, whereas the lower-price firm is worse off in any asymmetric equilibrium than in the symmetric equilibrium, the high-price firm is not only better off than the lower-price firm but also better off than it would be in the symmetric case.

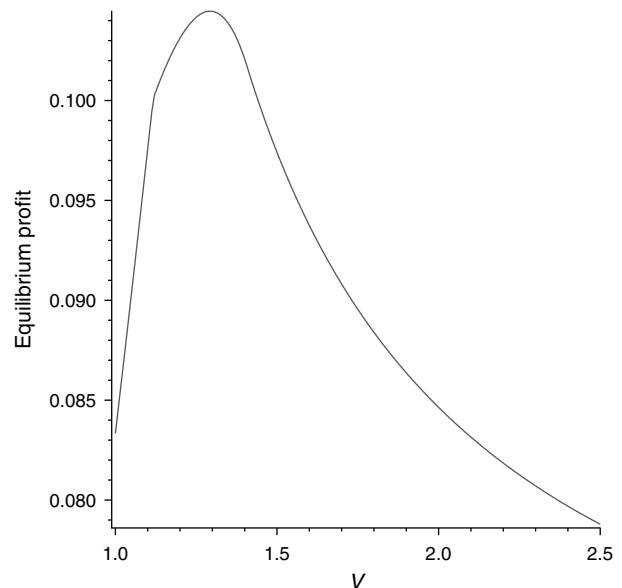
It could be interesting to compare the equilibrium prices to those preferred by the high-type consumers and the socially optimal prices. For this purpose, note that the preferred price of high-type consumers is $p_1 = p_2 = V/2$ when $V < 2(1 - \alpha)$, and the coordinator is indifferent between any prices otherwise. At

Figure 2 Change of Equilibrium Price with V When $\alpha = 1/4$



Notes. Before the first kink, the equilibrium price is in the medium-price area; it reaches the low-price area at the first kink, stays on the boundary between medium- and low-price areas till the second kink, and then is inside the low-price area (see Proposition 1 for the description of the areas).

Figure 3 Change of Equilibrium Profit with V When $\alpha = 1/4$



$p_1 = p_2 = V/2 < 1 - \alpha$, the coordinator will only pick the two products and randomize between them with equal probability. The low-type consumers buy neither product, but they are indifferent between buying and not buying. The above prices are the best for the high-type consumers as they prefer to have the cheapest "prestige" product that only the high-type consumers will buy. A socially optimal price is $p_1 = p_2 = V/2$ for $V < 1$ and $p_1 = p_2 = 0$ for $V > 1$. This is because when low-type consumers' matching utility is relatively low compared with that of the high-type consumers, it is socially optimal for them to be separated from the high-type consumers to ensure that the high-type consumers realize the highest matching utility (note that this separation coming at a price is not important for the consideration of social optimality because the price only results in wealth transfer and does not affect the sum of consumer surplus and the firms' profits). When the opposite is true, then the socially optimal outcome should ensure that the low-type consumers are matched with the high-type consumers as often as possible. Thus, for $V < 1$, the coordinator's preference is the same as the socially optimal outcome, but for $V > 1$, the high-type consumers prefer higher prices than socially optimal prices.

Thus, we find that equilibrium prices are lower, and more low-type consumers buy than what the high-type consumers would prefer. This reflects the tension between the high-type consumers (in a sense, the core demographics of the fashion firms) and the firms' interests. The high-type consumers would seem to prefer to exclude the low type consumers from adopting the it product, whereas firms want to attract the low-type consumers to increase sales and profit. The equilibrium prices are, however, higher than the socially optimal level. When $V > 1$, the socially optimal outcome requires that the low-type consumers be involved in pairing up with high-type consumers to the maximum extent. Yet in equilibrium, high-type consumers have a higher chance of pairing with high-type consumers than the low-type consumers have.

Although the preference structure specified in this model is different in nature from the one used in the classic pricing games, an upward shift in V could still be interpreted as an overall increase in consumer valuation. This increase, however, does not lead to a higher equilibrium price. This is because when the low-type consumers' valuation for signaling (V) increases, it becomes more attractive to the firm to sell to the low-type consumers, and the consumer value of the product declines. In fact, Proposition 2 implies that when V is sufficiently high, the equilibrium demand from the high-type consumers decreases but that from the low-type consumers increases.

As Proposition 2 indicates, the profit implications of an increase in low-type consumer valuation V of pairing with high-type consumers are also not straightforward. Equilibrium profit of each of the two firms, increases in V when $1 \leq V \leq V_1$. This is because in that area, although higher V leads to lower price, the larger demand resulting from more low-type consumers buying more than offsets the profit effect of the lower price and overall profit increases. On the other hand, when $V > V_2$, an increase in low-type's valuation for signaling is detrimental to the firms. As low-type consumer valuation for matching with the high-type consumers increases, it becomes more and more difficult for the coordinator to keep low-type consumers from buying, and as a result, low-type demand for each product increases in V . A consequence of this is a decrease in the potential value of the product to either consumer type at any given pair of prices and results in the optimal price declining so that the price decline effect dominates the market expansion effect, and thus the profit of each firm decreases. In Region 2, the equilibrium price increases in V but total demand decreases in V . These two opposing forces first lead to an increase and then to a decrease in profits as V increases.

5.2. The Role of Consumer Coordination

To understand the role played by consumer coordination in the fashion industry, let us compare the above results to the results we would obtain in the model if consumers were not allowed to set up a coordination mechanism. The model of the latter case is the same as the main model except that Stage 2 does not exist. The timeline of the game then becomes the following:

Stage 1. Firms 1 and 2 simultaneously set prices.

Stage 2. All consumers make purchase decisions.

Stage 3. The "matching game," in which consumers with the same product are randomly matched into pairs and utility of matching is realized is played.

If we keep the assumption that using a product not used by anybody else results in zero payoff, then nobody buying any product is always an equilibrium for any V and any prices. However, as we will show, allowing a small number of high-type consumers to coordinate on an option would result in positive equilibrium demand for some V .¹⁹ This assumption is equivalent to the assumption that each

¹⁹ Conceptually speaking, allowing low-type consumers to coordinate is not useful because both high- and low-type consumers try to stay away from low-type consumers. If one uses the interpretation of the consumer value as coming from trying to convince other consumers that she is of high type rather than deriving this value from the matching game, an argument in the spirit of intuitive criterion can be used instead to rule out the belief that off-equilibrium-path product use can be by a low type when $V < 1$; i.e., the assumption we made can be partly justified by signalling arguments.

possible consumer-choice option $k = 0, 1,$ and 2 is "seeded" with a demand from high-type consumers; i.e., there is a zero mass of high-type consumers who (nonstrategically) choose this option in the matching game, which we will adopt. As we mentioned above, in the absence of this assumption, the set of equilibria expands even further, and thus our point that without the consumer coordination mechanism it is not possible to predict equilibrium firm payoffs remains valid. This assumption ensures that consumers will always have a match regardless of the product he or she uses in the matching game and seems to be the strongest assumption one can make to reasonably restrict equilibria in the above game. With this assumption, we have the following lemma.

LEMMA 1. *In the model with no consumer coordination mechanism, and assuming that each consumer choice option is "seeded" with zero mass of high-type consumer demand, we have the following:*

1. When $V > 1$, in equilibrium, there is no market; i.e., in equilibrium, each product receives zero demand regardless of price.
2. When $1 - \alpha < V < 1$, any price $p_k \in [1 - \alpha, 2 - \alpha - (1 - \alpha)/V]$ may have positive demand in equilibrium. If prices are equal and within this range, any split of market share is an equilibrium one. No market is also an equilibrium outcome.
3. When $V < 1 - \alpha$, $p_1 = p_2 = V$ with any split of market share is an equilibrium outcome.

PROOF. See the online appendix. \square

In other words, without a coordination mechanism, the market either does not exist or the market shares and profits are not predicted by the equilibrium. As a corollary to the Lemma 1 and Proposition 2, we have the following result.

PROPOSITION 3. *Without a coordination mechanism, in equilibrium, the market for fashion may not exist for some parameter values (e.g., when $0 < V < 1$), but with the high-type coordinator, in equilibrium, the market for fashion exists for any $V > 0$.*

PROOF. See the online appendix. \square

In the model without a coordination mechanism, the market may not exist when the low-type consumer valuation for signaling is high because of the difficulty of keeping the low-type consumers from buying the same product as the high-type consumers. High-type consumers setting up a coordinating mechanism solves this problem. Thus, for $V > 1$, consumer coordination may be viewed as ensuring the existence of the market for fashion given the assumption that the high-type consumers (relative to the low-type consumers) have a superior access to their coordinator. To take advantage of this informational difference, the

high-type coordinator must not choose its recommendations deterministically. Indeed, although too wide a difference in prices could technically counterbalance the above incentive to randomize, we have shown that in equilibrium, the prices are neither high enough nor sufficiently different from each other to make a deterministic coordination strategy optimal.

PROPOSITION 4. *In the model with a coordination mechanism, in a pure-price-strategy equilibrium, there will always be randomness in the selection of fashion hits.*

PROOF. This claim immediately follows from Proposition 2. \square

Because the high-type consumers follow their coordinator's choice, the fashion hit will also appear random. This is consistent with the popular observation that fashion hits materialize randomly. Our model suggests, however, that hits are not arbitrary in the sense that they are random because the high-type consumers intentionally adopt a coordination strategy that randomizes according to a uniquely defined rule. If the coordination strategy were deterministic, the low-type consumers could expect the outcome and purchase the product that is slated to become the "it thing." The outcome would be the same as in the case without the coordinating mechanism and would not be optimal for the high-type consumers. Thus, the optimal coordination strategy must not be deterministic. Because the utility of the high-type consumers is directly affected by the number of low-type consumers who use the same product, the coordinator attempts to reduce the low-type consumer purchases of the hit product through randomizing. This exact formula for this randomization is unique and depends on the product prices. In other words, there is a method behind the seeming madness of fashion whimsy.

5.3. Effect of Competition

Let us now examine the effect of competition on the fashion industry. To do this, we consider a monopoly firm offering two products in the same market and compare the results to the duopoly market above.

Because this game following the price-setting stage is the same as the one in the main model, the analysis of the consumer coordination and purchase strategies applies to this game. The only difference is that when solving for the optimal prices in Stage 1, the objective function of the firm is the sum of the two products' profits rather than the profit from just one product. This leads to the following result.

PROPOSITION 5. *If both products are managed by a monopolist, when $1 \leq V < 2 + \alpha/2 - \sqrt{\alpha^2 + 8\alpha}/2$, the monopolist sets prices $p_1 = p_2 = \alpha V/(2 - V)$. These prices are lower than in the competitive market, and the coordination strategy involves randomizing between the two*

products with equal probability. The profit of the monopoly is $\alpha V(1 - \alpha - V)/(2 - V)$. When $V \geq 2 + \alpha/2 - \sqrt{\alpha^2 + 8\alpha/2}$, the optimal monopoly price is the same as the competitive one.

PROOF. See the online appendix. \square

Note that in this model, the monopoly charges such prices that the demand from low-type consumers for both products is positive. We know from Proposition 1 that an increase in the own price of a product means it will be chosen with higher probability. Because the coordinator has to trade off between the two products, this will inevitably lead to the other product being coordinated on with lower probability and earning lower profit. This will hurt the total profit of the monopoly firm, which hence finds it optimal to keep prices at a lower level. This is the intuition for the result that when V is small and therefore prices are in Region 1, competition drives up the equilibrium prices. One may find this result surprising, as normally one would expect competing firms' incentives to increase their own market share to lead to a lower price. In this model, on the contrary, it is in the best interest of the industry to keep prices lower than the competitive incentives would suggest, because an increase of one product's price hurts the profitability of the other product. Note that compared with the competitive case, the monopoly case is further away from what is desired by the high-type consumers ($p_1 = p_2 = V/2$), but if $V > 1$, it is closer to the socially optimal outcome ($p_1 = p_2 = V/2$).

Another somewhat surprising observation from the comparison of the results of the monopoly and competitive cases is that they lead to exactly the same outcomes in Regions 2–4. In other words, when V is relatively large, firms essentially do not compete in prices. The intuition for this is that when V is large, the only relevant case is the low-price region. In this case, the revenue from a product does not depend on the price of the other product. Therefore, firms are effectively competing with the neither option instead of competing with each other, and therefore the outcomes of the competitive and industry-maximizing strategies are the same.

6. Robustness

Several assumptions in the model warrant further consideration. Given the notion that high-type consumer coordination plays an essential role in this model, let us consider the assumptions we made about the coordinator construct. The following questions may arise: (1) What are the possible recommendation choices? (2) What is the objective of the coordinator? And (3) is the coordination essentially accomplished by one monolithic entity, or is there a role for multiple coordinators of the same kind? In this section, we consider

relaxing the assumptions we have made on each of the above points.

6.1. Restricting the Coordinator Recommendations to Products

When the role of coordinator is played by a single agent, such as a fashion magazine editor, one may argue that abstaining from recommendations is either practically difficult or technically not a valid action.

There are several reasons the null recommendation (i.e., the recommendation not to buy) could be a viable outcome of the coordination. One is that if the coordination is performed by a group, it may fail to converge to a single opinion. Failure to convey the consistent report of agreement, i.e., different recommendations coming from different fashion mavens, could be interpreted as a null recommendation. In the case of a single coordinating agent, such as a fashion magazine editor, one may argue that null recommendation could be implied by certain choices of the editor—e.g., a recommendation of style instead of a product or a recommendation of multiple products as equally desirable. Also, multiple editors working together could implement a null recommendation by recommending different products (see §6.3 for further discussion of the potential roles of multiple coordinators).

At the same time, it is also interesting to consider how the results would change if a null recommendation is not feasible. For that purpose, note that in some parameter value range (small enough V), in equilibrium, neither is never recommended. Therefore, restricting the recommendation space in that cases results in no change in the outcomes. When the equilibrium involved recommending neither with positive probability, the coordinator was indifferent between a null recommendation and a product recommendation. Because restricting the editor not to make a null recommendation would "tip off" low-type consumers to the higher probability of a product recommendation, it would increase low-type demand (assuming high-type consumers always follow the recommendation) and thus decrease the expected payoff of the high-type consumers. Therefore, the high-type consumers would then strictly prefer that the recommendation is not followed. This could lead to high-type consumers following the recommendation no longer an equilibrium and the market for fashion disappearing. Because such an outcome is not optimal for the firms, they would then have the incentive to avoid setting prices that make a null recommendation optimal. As Proposition 1 implies, this would require prices to be higher. However, when V is sufficiently high, the price required becomes so high that it is optimal for high-type consumers not to buy, and therefore, the market does not exist for high enough V .

The above consideration leads to the following outcomes when the neither recommendation is not possible (formal proof is in the online appendix): (1) when $1 < V \leq \min\{V_2, 2 - 2\alpha\}$, the equilibrium is the same as in the main model; (2) when $V_2 < V \leq 2 - 2\alpha$, in equilibrium, prices are $p_1 = p_2 = \alpha V / (2 - V)$, i.e., higher than the ones predicted by the original model; and (3) when $V > 2 - 2\alpha$, there is no demand for either product (regardless of price).

6.2. Coordinating vs. Predicting the Best Seller

In the model, we introduced the coordinator as an abstraction of the coordinating process of the high-type consumers. Within the model assumptions, it is also possible to interpret the coordinator as an arbitrarily chosen representative of the high-type consumers (because they are homogeneous). On the other hand, if the coordinator is a person, she might have other incentives. For example, fashion magazine editors and fashion mavens could strive to correctly predict the future outcomes. Let us consider what happens if we add the latter motivation to the objective function of the coordinator.

For this purpose, note that because in equilibrium where the recommendation matters at all, the high-type consumers are likely to follow the recommendation, the only way for the recommendation of a product not to also be a correct prediction of the product with the higher demand is for the demand from low-type consumers for one of the products to exceed that of the other product by more than the market size of the high-type consumers. Because the low-type consumer demand decreases in price, this could happen when the price difference is high enough and the coordinator recommends the more expensive product. If the coordinator's desire to predict demand in such a case is high enough (relative to her desire to maximize the high-type consumer utility), she would then recommend the cheaper product. But this would mean that the recommendation is no longer unpredictable for the low-type consumers, and therefore, the outcome is equivalent to the outcome of the model without a consumer coordination mechanism. In other words, when $V > 1$, the market does not exist. Because such an outcome is not optimal for the firms, in equilibrium, each firm would prefer to set its price close enough to the competitor's, and thus the equilibrium price of the original model is still the only equilibrium as long as the coordinator always recommends one of the products.

If the original model predicted a null recommendation with positive probability, the coordinator was indifferent between a null recommendation and a recommendation of a product. In this case, adding to the coordinator's objective function any incentive to

predict a product would mean that the coordinator would always recommend a product rather than neither.

Thus, the result of adjusting the coordinator's objective function to include an incentive to predict a product's dominant market share correctly results in the same outcome as in the above-considered model where the null recommendation is not allowed: conceptually, the only difference is that the market no longer exists for high enough V .

6.3. Multiple Coordinators

One may argue that the reality of the fashion marketplace is that there are multiple coordinators who rarely recommend the same product. How can this be reconciled with the assumption of a single coordinating entity, or can the model accommodate multiple coordinators? Because our assumption of a single high-type consumer segment was a simplification of the real marketplace, a simple answer could be that different coordinators serve different high-type segments. A more challenging objective is to allow multiple coordinators to serve the same high-type segment.

One possibility is the following. Suppose, for example, the recommendations are observable by all consumers at the same time. In the case of one coordinator, the information asymmetry between consumer types then disappears. Multiple coordinators, however, allow restoring information asymmetry and the results of our model. Specifically, it could be that high-type consumers, covertly from low-type consumers, coordinate on one of the coordinators. Note that if the coordinators act independently, sometimes their recommendations would coincide, and then low-type consumers would know what the "real" recommendation to the high-type consumers was. This would then depress the high-type consumers' willingness to pay for the recommended product. On the other hand, if coordinators could coordinate with each other, they would then be interested in coordinating on *opposite* recommendations, whether they know which one of them is picked by high-type consumers. This is because of randomization; they are indifferent between different recommendations but should strictly prefer to keep the recommendation unknown to the low-type consumers. Note that because the assumption of information asymmetry between high- and low-type consumers is essential to our model, the observation that it is difficult for an outsider to see the "common denominator" of the recommendations could be viewed in evidence of support of our model.

7. Further Discussion and Conclusion

It is a common adage that the fashion industry is fast-changing and highly unpredictable. Although in

many markets the consumer value of a product or service is slowly changing through time, the value of a potentially fashionable item may drastically change from month to month. Understanding this industry is further complicated by the significant influence of fashion mavens, celebrities, and fashion magazine editors. In this paper, we presented an equilibrium analysis of a competitive and intrinsically random fashion market explicitly modeling a consumer coordination mechanism. As a result, we are able to understand the role and regularities of random fashion changes and suggest how firms' strategy in a fashion market where consumer coordination is important is different from strategies in more steady status good markets.

The first consequence of the presence of consumer coordination is that in equilibrium, fashion selection is always probabilistic as opposed to deterministic. This is because when deterministic strategy could work, one firm undercutting the other's price by a small amount would lead it to gain market share significantly larger than a half. This would not happen without a coordinating mechanism: as Pesendorfer (1995) and Bagwell and Bernheim (1996) show in such a case, there is a point reducing price below which leads to the loss of all sales as the product can no longer signal status. However, when the coordination is possible, some status value of such a product is preserved by the optimal recommendation strategy that picks this product with a lower probability.

A separate but related implication of the role of consumer coordination is that competition may lead to prices that result in a strictly positive demand from the low-type segment. At first glance, this may seem counterintuitive; given the assumed two-segment structure of the market, the preferred solution for the high-type consumers is likely to be the cheapest status good that would fully separate them from the low-type consumers (Pesendorfer 1995, Bagwell and Bernheim 1996). Within our model, this outcome is feasible when $V < 2$ ($p_k = V/2$). Because one could expect firms to try to raise prices, one can understand how prices could become higher. Why would the presence of the coordinator acting on behalf of high-type consumers lead instead to lower prices than the best prices for high-type consumers? The intuition for this result is that if one of the two prices is reduced, the coordinator cannot commit to choose the higher-priced product with higher probability. If low-type consumers believed that the editor would do so and abstained from buying, the editor would then choose the cheaper product with probability 1. Therefore, for the price reduction not to be optimal, the equilibrium low-consumer demand for the cheaper product must be positive, and the result is that both products receive positive expected demand from high- and low-type consumers.

We also find that with consumer coordination, the fashion market may exist regardless of the relative value the high- and low-type consumers may place on projecting the image of the high type. This is in contrast to the result that the market may not exist in the model without consumer coordination when low-type consumers' valuation for signaling is too large. The reason for this result is again that by not choosing either product most of the time, the coordination still allows the products to play the role of status symbols in the remaining instances.

Supporting the notion that fashion hits are random, our model also implies that fashion hits are not completely arbitrary but are set according to a unique probability distribution and affected by firms' pricing strategies. In particular, this allows us to show that whenever the demand from low-type consumers for a product is positive, an increase in the price of that product always leads to higher probability of becoming the it product but lower demand from the low-type consumers. This suggests that for the coordinator's decision of which product to recommend, reducing the demand of the low-type consumers is a more important consideration than the price of the product.

Combining the result about the uniqueness of the equilibrium coordination strategy with the existence of the market, we see that while appearing arbitrary or frivolous, coordination in fact plays a stabilizing role in the fashion industry. Understanding the process of fashion hit selection allows us to further consider and predict firms' profits and their profit-maximizing strategies. For example, we observe that in some range of the low-type consumers' valuation for signaling, competition between firms drives up market price. Furthermore, the equilibrium price zigzags in the low-type consumers' valuation for signaling when the low-type consumer valuation for signalling increases from zero to infinity, as firms trade off between attracting the increased demand of the low-type consumers and increasing the expected status of their products. In particular, the equilibrium price is also nonmonotonic in the fraction α of the high-type consumers. The equilibrium profit first increases and then decreases in V , implying that there is an optimal-for-the-industry value of low-type consumer valuation of signalling. When V is large enough, the monopoly and competitive cases lead to the same equilibrium outcomes, as firms are competing with the outside option rather than with each other. As V tends to infinity, the equilibrium price asymptotes to $\sqrt{\alpha} - \alpha$, and profits asymptote to $(\sqrt{\alpha} - \alpha)^2$, so that for large V , the optimal-for-the-industry amount of high-type consumers in the market approaches $1/\sqrt{2}$.

There are a few considerations for further research. For the sake of simplicity, we abstracted away from all firm actions that could influence the emergence of fashion hits except for the price. Whereas one point of view, that the whimsical opinion of fashion editors such as the one famously portrayed in the movie *The Devil Wears Prada* may be far more important for setting the trend than the firm's promotional efforts, another is that firms can actively affect consumer coordination through marketing efforts. It would be natural to consider what role advertising may play in the emergence of fashion hits.²⁰ One could see advertising as potentially having at least one of the following two roles. First, it could increase the awareness of a product among high-type consumers, therefore reducing the probability of miscommunication in disseminating the outcome of the high-type consumer coordination. In this role, clearly, firms would have incentive to advertise and advertising could increase the probability of the coordinator selecting the product. This would be especially true when the coordinator is not indifferent between a recommendation of a product and a recommendation not to buy, i.e., when low-type consumer valuation of projecting a high-type image is not too high. Second, one could alternatively assume that high-type consumers can learn the coordination outcome perfectly but that advertising increases product awareness among low-type consumers. Even in this case, one can show that in equilibrium, firms would advertise. The intuition is that, as we have shown, firms do have an incentive to achieve positive sales to the low-type consumer segment.

Other simplifying assumptions we made were consumer within-segment homogeneity, complete unobservability of consumer type, and the perfect correlation between consumer desirability (type) and consumer access to the recommendation. As we have shown, in equilibrium, for each product, some but not all low-type consumers buy it. If their valuation V for projecting the high-type image would be heterogeneous, then consumers with higher valuations would be the ones buying the products. We would then observe that some lower-valuation, low-type consumers do not buy either product and some high-valuation consumers buy both. The difference with the main model would be that now the demand from the low-type consumers would be determined by the V of the indifferent consumer. As price decreases, the relevant V will also decrease, but the conceptual implications would remain the same. Imperfect

access of high-type consumers to the recommendation would increase the benefit of not buying (because some high-type consumers would then not buy) and thus decrease the demand for products. Furthermore, if some consumer desirability attributes are observable without product use, then the model should be thought of as applicable within each "slice" of consumers according to the desirability attribute. In other words, the effects of product use could be considered conditional on its observable characteristics. Again, the more consumer desirability is observed, the less incentive consumers would have to buy products for the purpose of projecting an image.

Electronic Companion

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²⁰ For example, Wernerfelt (1990) assumes that advertising affects the probability of a product being adopted as an image product, and Dukes and Liu (2010) consider how advertising could play a role in coordinating a channel with competing manufacturers.

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