

The Out-of-Stock (OOS) Effect on Choice Shares of Available Options[☆]

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Abstract

Prior research on product out-of-stock (OOS) has mainly focused on the consequences of OOS due to consumers not being able to select their target options. The present research explores how OOS noticed by consumers without a specific target option in mind affects their preference among the in-stock options. We find that consumers can draw social inferences from OOS about the desirability of product features. Consequently, in-stock options that share feature with the OOS option enjoys choice advantage. We show that this effect occurs only when the OOS condition is caused by consumer demand (as opposed to by logistical causes), and only for consumers who are not product category experts. Further, consumers' belief on others' expertise and shopping goal determines which specific feature they will identify as the key feature that drives the OOS. These findings provide a more complete picture for how consumers respond to OOS. They also offer insights into making more accurate demand estimation and suggest a potential new tool for in-store marketing.

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Product out-of-stock (OOS) is a universal issue for retailers. On average, at any point of time, about 8 percent of SKUs are OOS in a typical retail store (Gruen, Corsten, and Bharadwaj 2002). Traditionally, OOS is viewed as an operational challenge for retailers. Research has found that consumers who encounter OOS are likely to postpone their purchase, switch to a different store, switch to other options, or simply decide not to purchase anymore (Anderson, Fitzsimons, and Simester 2006; Campo, Gijbrecchts, and Nisol 2000, 2003; Emmelhainz, Emmelhainz, and Stock 1991; Fitzsimons 2000; Sloot, Verhoef, and Franses 2005), all of which contribute to adverse consequences, such as hurting the firm's profitability (Anderson, Fitzsimons, and

Simester 2006; Jing and Lewis 2011) and creating difficulties in demand estimation (Anupindi, Dada, and Gupta 1998).

A common premise of these findings is that the OOS option is what the consumer has initially decided to choose. In other words, the scope of this research is limited to consumers who have planned to buy a certain option but later find it OOS. Industry research, however, indicates that only about 30 percent of purchase decisions are made before consumers enter the store (Advertising Age 2008; POPAI 1995). Thus, more commonly, consumers do not enter a store with a specific target in mind, and their decisions are influenced by what they find in the store (Chandon et al. 2009; Inman, Winer, and Ferraro 2009).

The focus of the present research in understanding the effect that finding an option OOS has on in-store decision making when the consumer does not have an a priori preference. Drawing on the theory of social inference, we propose that OOS conveys information about others' preference for the OOS option, which, under specified conditions, can be attributed to the desirability of certain features of the OOS option. We investigate whether this feature desirability inference systematically affects choice for available options. We refer to the influence of an OOS option on choice shares of available options as the *OOS effect*. Because of its basis in social inference, the OOS effect occurs only when the OOS condition is caused by consumer demand (as opposed

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to by logistical causes), and only for consumers who are not product category experts. In contrast to the traditional view that OOS generally has negative impact on retailers, we propose that retailers can benefit from OOS by using it as a tool of category management to improve sales.

Background and Theoretical Development

The Impact of OOS

A consumer may notice a certain option OOS either *after* s/he has decided to choose that option (e.g., during transaction), or *before* any preference has been formed (e.g., during information search). Previous research has mostly focused on the former situation, and suggested that consumers who find their desired option OOS will defer purchase, cancel the order, or switch stores (Anderson, Fitzsimons, and Simester 2006; Fitzsimons 2000). Further, if consumers decide to choose an in-stock option as a substitute, they are likely to choose options similar to the OOS product, a behavior referred to as “product switching” (Campo, Gijsbrechts, and Nisoul 2000, 2003; Emmelhainz, Emmelhainz, and Stock 1991; Sloot, Verhoef, and Franses 2005).

OOS also affects a consumer’s satisfaction with the retailer. Fitzsimons (2000) finds that OOS lowers customer satisfaction in general, and even more so if the OOS option is in (as opposed to out of) the consumer’s consideration set. Similarly, Pizzi and Scarpi (2013) show that participants are more dissatisfied when they learn about the OOS after, rather than before, deciding. These works suggest that OOS has a greater negative impact when consumers have already formed their preference for a target option than when they do not.

In comparison, relatively little attention has been paid to situations in which consumers encounter OOS without a target option in mind. Of the few exceptions, Ge, Messinger, and Li (2009) and Kramer and Carroll (2009) both find that OOS in this situation creates a sense of urgency and accelerates purchase. No research has studied whether and how OOS affects consumer choice of in-stock options. We believe that such incidentally encountered OOS is likely to importantly affect consumers’ in-store decision-making.

In-store Decision Making

As noted, not all consumers enter a store with a specific purchase target in mind. Many purchase decisions are made or revised in the store (Advertising Age 2008; POPAI 1995). In-store decision making is inevitably affected by the information that consumers receive in the store, and the extent of its impact depends on how concrete the consumer’s shopping goal is (Bucklin and Lattin 1991; Lee and Ariely 2006). As has been extensively shown in prior research, consumers who do not have a concrete shopping goal are susceptible to in-store contextual factors such as promotion and in-store display (Bemmar and Mouchoux 1991; Christenfeld 1995; Drèze, Hoch, and Purk 1994).

Making decisions in these situations sometimes requires consumers to make inferences about competing options. We propose that an option’s being OOS may facilitate this process. Specifically, OOS provides information about the desirability of the features that are present or absent in the OOS option, and consequently affects a consumer’s judgment of the in-stock options. This information can be learned by consumers through social inference, and is usually not available through other in-store contextual factors such as promotion or display.

Social Inference in a Retailing Context

In the absence of information that directly pertains to the target of judgment, people draw inferences from existing information. For example, consumers make inference about products and marketers from all kinds of cues in the decision context, such as price, market offerings, and marketing communication (Broniarczyk and Alba 1994; Chernev and Carpenter 2001; Sanbonmatsu, Kardes, and Sansone 1991; Zhang and Schwarz 2012). In particular, social inference involves observing others’ behavior and interpreting its meaning and implications for one’s own choices. People believe that the behavior of others results from sound reasoning and leads to desirable outcomes (Naylor, Lambertson, and Norton 2011). Therefore, others’ choices can serve as a source of information concerning the value of the options (Burnkrant and Cousineau 1975; Kelley 1967) and provide reasons for consumers to conform (Goldstein, Cialdini, and Griskevicius 2008; Zhang 2010).

Since most others’ choice behavior is not directly observable by each consumer, consumers usually view the stock level of an option as the trace of others’ choice. Specifically, scarcity suggests popularity, and hence better value than what is possessed by more plentiful options. As a result, consumers tend to choose products that are already low in stock (Parker and Lehmann 2011; van Herpen, Pieters, and Zeelenberg 2009). Such social inference saves consumers the effort of processing detailed product information, and therefore should play a prominent role in choice tasks on which consumers are unwilling or unable to spend time and effort to gather and process product information extensively, as in low involvement purchases (Beatty and Smith 1987; Celsi and Olson 1988; Suh and Youjae 2006; Zaichkowsky 1985).

Hypothesis

To introduce our hypotheses, we first describe the common settings of our experiments and the symbols we will use throughout the rest of this paper. We study how the OOS of a certain option impacts consumers’ preferences among other in-stock options. In all of our experiments, each option is defined on two attributes relevant to a consumer’s decision. Each attribute varies between two levels of value, referred to as features. We use A and B to denote the two features on attribute 1, and X and Y to denote the two features on attribute 2, yielding four possible options: AX, AY, BX, and BY. Without losing generality, the OOS option is denoted as AX, and we examine participants’ preference among AY, BX, and BY. Besides, in the rest of this

paper, wherever the term “consumers” may lead to confusion, we use *judges* to refer to consumers who encounter OOS and face a decision, and *others* to refer to previous consumers who may have made their choice and caused the OOS.

Prior research has demonstrated that options low in stock are perceived to be popular and have high value (Parker and Lehmann 2011; van Herpen, Pieters, and Zeelenberg 2009). OOS options are likely to be perceived in a similar way. This perception, however, is not directly informative to consumers who intend to choose among other in-stock options. Nevertheless, since the value of an option can be viewed as an aggregate of the values of its features (Lancaster 1966), it is reasonable to assume that consumers attribute the high value of the OOS product to its features. Specifically, when AX is OOS, consumers will infer that AX is a better option than AY, BX, and BY, because A is a better feature than B and X is a better feature than Y. Such inference should shift choice preference toward options that share either of these two features, namely, option AY and option BX. Formally, we hypothesize the OOS effect:

H1a. When option AX is out of stock, the choice share of options AY and BX will increase, and, accordingly, the choice share of option BY will decrease.

H1b. This choice shift is mediated by the relative evaluations of features A and B, and features X and Y.

These hypotheses will be tested by comparing the probability of BY being selected from among {AY, BX, BY}.

When consumers have extensive product knowledge, they have little need to infer feature desirability by observing the choices of others, just as they have little need to use peripheral cues to infer quality and value (Alba and Hutchinson 1987; Feldman and Lynch 1988; Raghurir and Corfman 1999; Rao and Monroe 1988). Hence, consumers with sufficient domain knowledge should be less likely to draw inferences from OOS. On this basis, we hypothesize that the OOS effect is moderated by judges' domain knowledge. Formally:

H2. When option AX is out of stock, the choice share of options AY and BX will increase, but only among judges with low domain knowledge and not among judges with high domain knowledge.

H1 and H2 predict choice advantage of either AY or BX, but do not speak to how consumers decide between these two options. Intuitively, the choice between AY and BX can be affected by the extent to which judges believe that feature A is better than B versus feature X is better than Y. In a social inference process, how differentially informative others' judgments are toward these features should play a role. We consider two factors that can affect the informational value of others' judgments: expertise and consumption goals. Specifically, (a) if others have expertise on evaluating dimension 1 rather than dimension 2, their ability to identify the better feature on dimension 1 is somewhat guaranteed while their ability to identify the better feature on dimension 2 is less clear; (b) if dimension 1 is more relevant to others' shopping goal than dimension 2, others' choices are more likely to be driven by the comparison of the

features on dimension 1 rather than the features on dimension 2. Both processes will make the judgment of “A better than B” more informative than that of “X better than Y,” leading to the choice of AY over BX. Formally:

H3. When others are considered to be experts on dimension 1 rather than dimension 2, judges will be more likely to base their choices on the advantage of A over B, leading to the choice advantage of AY over BX.

H4. When others are considered to have a shopping goal to focus on dimension 1 rather than dimension 2, judges will be more likely to base their choice on the advantage of A over B, leading to the choice advantage of AY over BX.

Next, we test these hypotheses in four lab experiments and a field experiment. **H1** will be tested in studies 1 and 2; **H2** will be tested in study 3; and **H3 and H4** will be tested in studies 4 and 5, respectively. We will conclude with a discussion of situations in which the OOS effect is most likely to occur, and how understanding the OOS effect can help retail management.

Study 1

Method

The purpose of study 1 is to test **H1a**, the OOS effect, and **H1b**, the mediating role of feature evaluation.

Three hundred and sixty-six participants from Amazon Mechanical Turk participated in this study in exchange for five cents. Participants were asked to choose among four laundry detergents. The options differed from each other in form (powder vs. liquid) and scent (Bella Flora vs. Ocean Pearl). Participants were randomly assigned into one of the three conditions: baseline, OOS, and absence. In the baseline condition, all four options were available, and participants were asked to choose one of them. In the OOS condition, the option that featured “powder” and “Bella Flora” (“AX”) was marked as “out of stock,” and participants were asked to choose among the three remaining options. In the absence condition, the information about AX was completely absent; participants were only provided with options AY, BX, and BY, and were asked to choose one of them. In other words, the difference between the OOS condition and the absence condition was whether participants were informed of the existence of an OOS option AX.

After indicating their choice, all participants were asked to rate on 7-point scales how desirable they thought these product features were, with the end points labeled “*Bella Flora is more desirable*” and “*Ocean Pearl is more desirable*” for the first question, and “*powder form is more desirable*” and “*liquid form is more desirable*” for the second question.

For the OOS effect, we test whether the choice share of in-stock products differed between conditions. Also of interest is whether OOS shifted the desirability of features A and X (relative to B and Y, respectively), and whether this desirability mediated participants' choices.

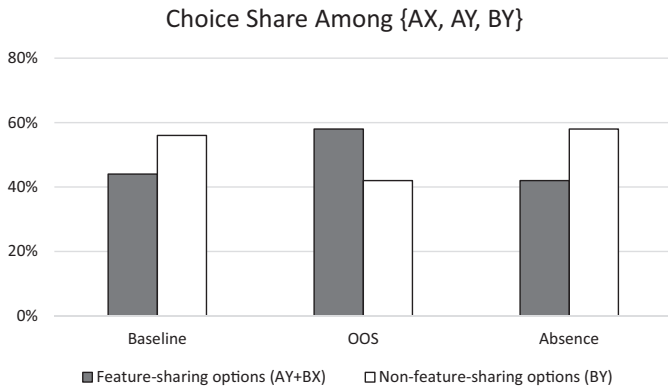


Fig. 1. Choice outcome of study 1.

Results

Choice shares. The results relevant to our hypothesis are presented in Fig. 1 (for the complete results, see Appendix 1A). We compare the choice share of BY, the non-feature-sharing product, among {AY, BX, BY} across all conditions. In the baseline condition, among the participants who selected AY, BX or BY, the choice share for BY was 56 percent. When AX was presented as OOS, as predicted, the choice share of BY dropped to 42 percent (Fisher's exact test $p < .04$). However, in the absence condition where only AY, BX, and BY were presented, the choice share of BY was 58 percent, which did not differ from the baseline condition but was higher than the OOS condition (Fisher's exact test $p < .02$). Contrasting the OOS condition to the baseline and absence conditions (Rosnow and Rosenthal 1996) revealed a significant difference ($Z = 2.7$, $p < .01$). H1a is therefore supported. For the purpose of mediation analysis, the baseline and absence conditions are combined and named as the non-OOS condition.

Mediation. The desirability ratings of the features are coded as 1–7, where low numbers mean that the features contained by AX (i.e., “powder” and “Bella Flora”) were more desirable than the features absent in AX. In the OOS condition, the ratings of the two attributes were 5.6 and 4.4, respectively. Both numbers were lower than the non-OOS condition (5.8 and 4.8, respectively; $F(1, 364) = 4.0$, $p < .05$, $\eta^2 = .11$), suggesting that the OOS information increased the desirability of the two features contained by AX. The two ratings are averaged to reflect the general desirability of the features contained by AX. A mediation analysis is conducted following Preacher and Hayes (2008). With 5,000 iterations, the indirect path is significant with 95 percent CI (.09, 1.17), suggesting that the desirability judgment on features mediated the OOS effect. H1b is therefore supported.

Discussion

In this study, we show that OOS increases the choice share of the options that shares features with the OOS option. The mediation analysis provides evidence for the underlying process: the preference shift is a result of increased evaluation of the features of the OOS option. These results speak against an explanation of the OOS effect, namely, judges simply choose products that

are similar to the OOS option. If that were the case, the OOS information should not have affected the rating of the features, and the change in ratings should not have mediated the judges' choices.

Moreover, our findings highlight the importance of the OOS information. Not surprisingly, participants who did not know that the OOS option had ever existed could not draw any inference regarding any features; hence, the OOS effect was not observed when the information of the OOS option was completely absent.

Study 2

The OOS effect occurs because, by default, OOS is considered to be a result of others' preference for the OOS option. Accordingly, OOS should be uninformative about the option if it is caused by factors irrelevant to its desirability, for example, a warehouse burning down in an accidental fire or the supplier quitting the market in response to new regulations. In other words, the OOS effect should be eliminated if judges are aware that the OOS is not caused by others' preference for the product. In study 2, we test this boundary condition in a real choice task.

Method

Eighty-two students from a private East Coast university were approached on campus by a research assistant and were invited to participate in a 10-min online survey. In return, they were promised to receive a gift card for at least \$5. At the end of the survey, they were instructed to go to a lab room to pick up their gift cards, where the actual choice experiment took place.

Upon arrival at the lab, participants were randomly assigned into one of three conditions: OOS-supplier, OOS-default, and baseline. In the lab, four piles of gift cards were arranged on a large board placed on a table (Appendix 2): Starbucks regular gift card, Starbucks e-card, Amazon regular gift card, and Amazon e-card. The regular gift cards were plastic cards ordered from the merchandiser, whereas the e-cards were simply printouts of redemption codes. Thus, the four options differed in brand (A: Starbucks vs. B: Amazon) and form (X: regular vs. Y: e-card). Pretest suggests that the regular gift cards are much more attractive than the e-cards of the same face value; we therefore set the e-cards to be \$1 more than the regular cards to avoid potential ceiling effect in choice.

Next to each pile, the labels of the gift cards were printed on the board. In the baseline condition, in which all four options were available, participants were simply asked to choose a gift card as their reward for completing the survey. In both of the OOS conditions, the Starbucks regular gift card (i.e., AX) was absent, leaving an empty spot with the label “\$5 Starbucks Card” on the board. Depending on conditions, the experimenter told participants: “Sorry! We used to have four options, but [the OOS-default condition:] the \$5 Starbucks card is currently out of stock (vs. [the OOS-supplier condition:] the RA forgot to bring the \$5 Starbucks cards today). But we still have the other three options

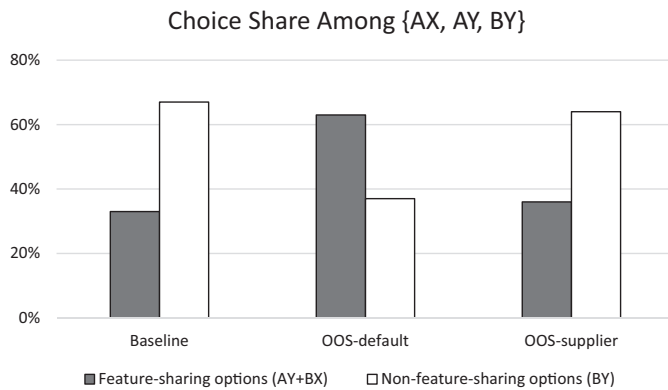


Fig. 2. Choice outcome of study 2.

available. Please choose one.” The number of cards in each pile was kept roughly same throughout the course of the experiment.

Results

To test the OOS effect, we again compare the likelihood of selecting BY from among {AY, BX, BY} across the three conditions. The result relevant to our prediction is presented in Fig. 2 (for the complete results, see Appendix 1B). In the baseline condition, among the participants who selected AY, BX or BY, the choice share for BY was 67 percent. In contrast, in the OOS-default condition, this probability dropped to 37 percent (Fisher’s exact test $p < .04$). However, in the OOS-supplier condition, the choice share of BY was 64 percent, which was not different from the baseline condition and was higher than the OOS-default condition (Fisher’s exact test $p < .1$).

Discussion

This study replicates the OOS effect in a task involving real choice. Moreover, the null result in the OOS-supplier condition indicates a necessary condition of the OOS effect: the OOS should be caused by consumer demand as opposed to by logistical causes. This result rules out possible alternative accounts for the OOS effect, such as scarcity (Cialdini 2009) and target salience (Farquhar and Pratkanis 1993). Together with study 1, these studies suggest that the preference shift is not simply due to the change of the structure of the choice set, but due to attribute-level inference drawn from an option’s being OOS.

Study 3

Methods

The purpose of study 3 is to test H2, the moderating role of domain knowledge on the OOS effect.

The study was conducted in China. We built a kitchen accessory store on taobao.com, a major Chinese online shopping platform. We listed four models of cutting boards in our store. The models differed in their material – made in wood versus bamboo, and their shape – square versus round. We then uploaded pictures as well as product descriptions of the cutting

boards consulting other stores that were selling similar products (see Appendix 3 for an example).

We recruited 124 participants through Chinese social media platforms. Each participant was randomly assigned to a condition in which one of the four cutting board models was OOS. For each condition, the name of the OOS model was grayed out and marked “sold out” on the store page whereas the names of the in-stock models were displayed in the normal dark color. Thus, what participants saw in our study largely matched what they would have encountered in a real shopping trip on taobao.com.

For the ease of study management and data collection, we showed participants the screenshots of the product description pages. Participants were then asked to indicate their choice, followed by how familiar they were with kitchen accessories (1 = not at all; 7 = very much). The latter question served as the measure of participants’ familiarity with the product category.

Results

Of interest is whether participants’ familiarity with kitchen accessories predicts their likelihood of choosing AY or BX. To answer this question, we code the choice of AY or BX as 1, and the choice of BY as 0. Then, we regress this 0–1 variable on participants’ familiarity using logistic regression. Since the four conditions did not get exactly same number of participants, we also include the condition (i.e., which model is OOS) as dummy variables to control for the difference in the inherent attractiveness of these models. The result of the logistic regression is consistent with our hypothesis. The coefficient is negative and significant ($\beta_1 = -0.33$, Wald statistic = 5.55, $p < .02$), meaning that the more the participant was familiar with kitchen accessories, the less likely s/he was to choose AY or BX.

Discussion

Judges who are familiar with the products of interest may have well established evaluations for the features; consequently, they are less likely to seek information from outside sources, such as the preference of others. In contrast, judges without much domain knowledge are likely to seek information outside of themselves. Consequently, these participants infer that feature A and X have higher value than B and Y, respectively. This result is consistent with our theory that others’ choices provide information about the OOS option.

Study 4

Method

In study 4, we test H3, namely, how a judge’s belief about the expertise of others affects their choice between AY and BX.

One hundred and sixty-two participants from Amazon Mechanical Turk participated in this study in exchange for 10 cents. They were asked to imagine that, on a vacation trip, they stayed in a hotel that offered each guest a wine-and-cheese basket as a check-in gift. All participants were presented a

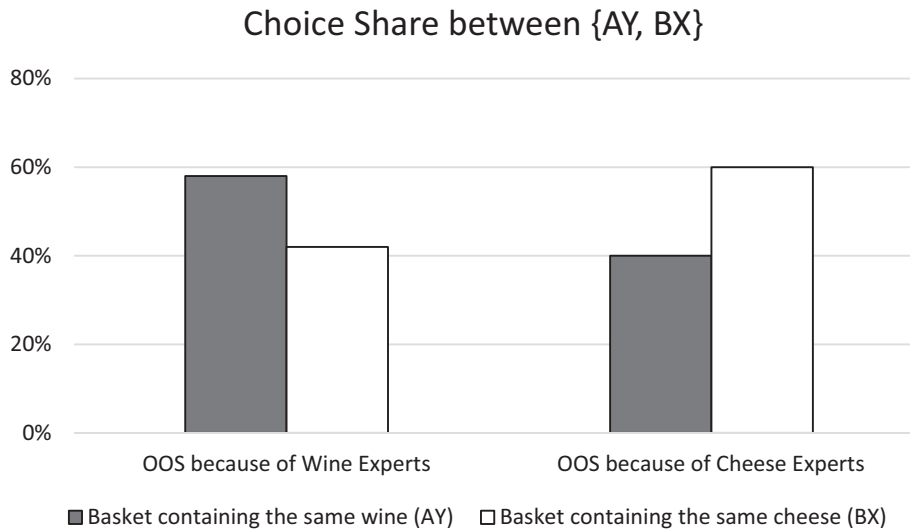


Fig. 3. Results of study 4.

list of three options (Appendix 4): Banylus wine + Vacherin Cheese (AX), Banylus wine + Derby cheese (AY), and Pinotage wine + Vacherin cheese (BX), among which AX was OOS. As the manipulation, half of the participants learned that “a large group of guests who are attending the national conference of the American Wine Society have just claimed their gifts.” The other half of the participants learned the same information except that the guests were said to be from the American Cheese Society. All participants were asked to choose between the remaining two gift options.

Results

The results are presented in Fig. 3. When AX was OOS due to the popularity among a group of wine experts, AY, which shared the same wine, received 58 percent choice share, whereas BX, which shared the same cheese, was chosen by only 42 percent participants. In contrast, when AX was OOS because of the popularity among a group of cheese experts, the choice shares of AY and BX became 40 percent and 60 percent, respectively (Fisher’s exact test $p < .03$).

Discussion

In this study, we demonstrated two key elements of the underlying mechanism of the OOS effect. Judges’ choice being affected by others’ expertise suggests that the underlying process is social inference; the fact that others’ expertise are attribute specific (i.e., on wine vs. cheese) provides evidence that the inference occurs at the attribute level (as opposed to at the option level).

Note that the choice sets were identical across the two conditions. Again, this result speaks strongly against the potential alternative explanation that judges simply choose what is most similar to the OOS option. After all, others’ expertise could

alter neither the actual nor the perceived similarity between the options.

Study 5

In study 5, we examine the external validity of the OOS effect by running a field experiment at a restaurant. In addition, we explore another determinant of judges’ choice between AY and BX, namely, others’ consumption goal (H4). We provide restaurant diners with lunch options (combos of food and drink), and manipulate one option to be OOS. Considering that the experiment was conducted in a restaurant during lunch time, others’ main consumption goal is likely to be having good food rather than having a good drink. Therefore, judges should infer that a combo is extensively chosen by others because it has a great food component. Consequently, they should choose the combo that shares the same food rather than the same drink.

Method

We conducted this field experiment in a small restaurant in downtown Nanjing, China. The study lasted for four weeks. Every weekday during the course of the experiment, the restaurant offered a lunch special menu, containing four options of meals (Appendix 5). Each meal consisted of a portion of food, either seafood rice (A) or tuna pasta (B), and a drink, either tea latte (X) or white coffee (Y). Each meal was given a unique name, implying that no substitutions were allowed within a combo. The meals had never been offered (as combos) in this restaurant before. All combos were priced at 29 Yuan (~\$4.50), about 40 percent off the original price if the two components were ordered separately. It was also specified on the menu that each combo was limited to 10 orders per day.

Upon arrival, customers were informed about the lunch specials by the waiter, but they were also able to order from the regular menu. The customers who ordered the lunch specials

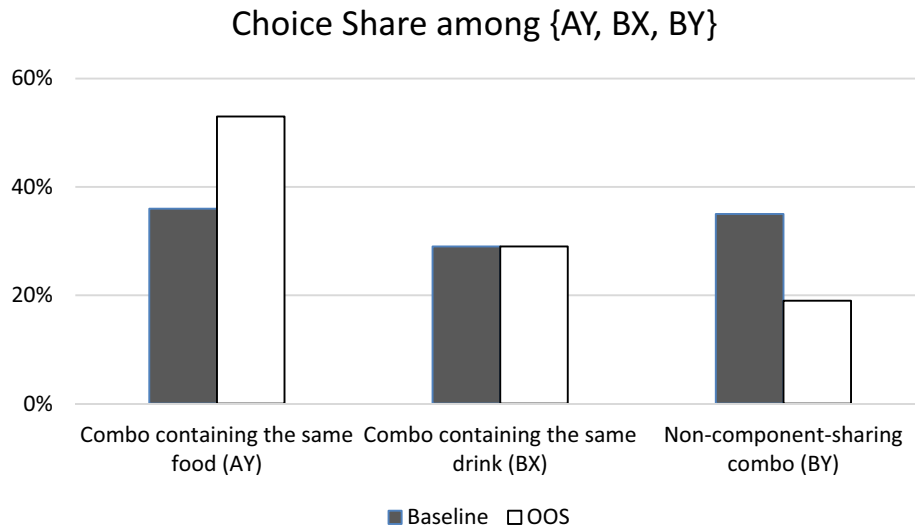


Fig. 4. Results of study 5.

became the participants of our field experiment. The lunch specials were available from 11 am to 2 pm every weekday. The service started with all four options available. At 12:15 pm, the menus in the restaurant were switched to the OOS version, on which the seafood rice + tea latte combo (AX) was marked as “sold out,” while the other three combos continued to be available. The customers of this restaurant were mostly young professionals who worked in the neighborhood. There is no reason to believe that those who arrived at the restaurant before and after 12:15 had different taste preferences.

Pretest

The purpose of the pretest is to confirm people’s lay belief that lunch diners are more likely to have a goal of having good food than of having good drink. To test this assumption, we surveyed 36 undergraduate students in a marketing class at a large university (also in Nanjing). We presented to them the same lunch menu used in the field experiment. Participants were asked to imagine that AX (seafood rice + tea latte) was sold out and were asked to select what they believed would be the most plausible reason. The results show that 56 percent of the participants believed that the OOS would be because the seafood rice was great, whereas only 6 percent thought that it would be because the tea latte was great (binomial test $p < .001$). Other participants suggested reasons irrelevant to the hypothesis of this study. Consistent with our prediction, participants considered that diners would choose the combo because of its food component.

Results of the Field Experiment

During a total of 20 days of experimentation, 193 diners ordered from the lunch special menu, among whom 120 came before 12:15 pm (the baseline condition) and 73 came after 12:15 pm (the OOS condition). To test our hypothesis, we

compare the choice share of AY, the option that shares the same food component as the OOS option, across the OOS and the baseline condition.

The results relevant to our hypothesis are presented in Fig. 4 (for the complete results, see Appendix 1C). In the baseline condition, among the participants who selected AY, BX or BY, AY received 36 percent of choice share; in the OOS condition, its choice share increased to 53 percent (Fisher’s exact test $p < .03$). The choice share of BX remained unchanged across the two conditions (29 percent vs. 29 percent).

Discussion

The results of the field experiment confirm that the OOS effect can be observed in an actual retail context involving real purchase. The observed preference shift to AY, but not to BX, adds support to the hypothesized inference process: informed by their belief about others’ consumption goal, judges were able to identify the determinant reason that caused AX to be OOS. Accordingly, it gave choice advantage to AY but not to BX. Limited by the setting of the field experiment, judges’ belief about others’ consumption goal was neither manipulated nor measured but was simply assumed. However, the pretest provides support for this assumption, and the finding in the field is consistent with our hypothesis.

General Discussion

In this paper, we conceptualize and demonstrate how OOS impacts consumers who are considering the product category without a specific target option in mind. We find that OOS shifts the preferences of these consumers to the options that share features with the OOS option. Consequently, choice shares of in-stock option are systematically affected by the OOS option.

This effect is different from the “switching” behavior documented in prior research in two ways. First, we study decisions of consumers who do not have a specific purchase target to begin with, so the need for switching to a substitute simply does not exist. Second, whether a “substitute” will be chosen depends on the social context (studies 2 and 4), suggesting that the underlying mechanism of OOS effect goes beyond simply choosing a similar option.

Implications

Our findings have important implications to marketers and retailers. Knowing how choice shares of in-stock options are likely to be affected by OOS gives retailers leverage over managing inventory contingent on OOS. Previous research on demand estimation and inventory management under OOS typically takes into consideration that consumers choose other options as substitutes of the OOS option (e.g., Anupindi, Dada, and Gupta 1998; Musalem et al. 2010). However, options that share features with the OOS option will gain choice share not only from consumers who switch from the OOS option, but also from consumers who switch from other in-stock options that do not share the features – these consumers would not have evaluated these features highly if no option were OOS. Accordingly, when a certain option is OOS, the inventory of the feature-sharing options may actually drop faster than if they are merely considered as substitutions, and the inventory of the non-feature-sharing options could drop even more slowly compared to when the focal option is not OOS. Thus, the OOS effect is an important factor to incorporate into demand estimation.

In traditional retail practice, having empty shelves is considered disadvantageous and is therefore to be avoided by retailers (Breugelmans, Campo, and Gijbrecchts 2006; Verhoef and Sloot 2005). However, our findings indicate that, to consumers who are still searching product information, OOS may have managerial advantages as a tool of category management. Manufacturer-owned retail stores could increase category sales by promptly responding to OOS situations and directing consumers’ attention to the feature-sharing options. For example, offline stores could give more shelf facings to the feature-sharing options, and online stores could present these options as recommendations on the webpage of the OOS option.

Marketers could possibly even create artificial OOS situations to promote the sales of higher margin products. For example, suppose at the same price, bamboo cutting boards have higher margin than wood cutting boards. Although the retail stores need to carry both models to maintain assortment size, they could increase the share of bamboo cutting boards by creating additional models of them which are always OOS. This should potentially create a perception among customers that bamboo is a more desirable feature than wood and thus gives choice advantage to the bamboo cutting boards.

Smart competitors could also take advantage of our findings to promote their products when the category leader is known for strategically restricting its own supply (Balachander and Farquhar 1994). In this case, competitors whose own products

have key features similar to the features of the leading brand can play up these common features. For example, they can preemptively emphasize these features on product packaging or through in-store marketing, with the expectation that the leading brand may often be OOS.

These tactics are likely to be effective because using OOS to communicate the desirability of a product feature is more persuasive compared to marketers explicitly promoting the feature. Marketer’s persuasion can activate consumers’ persuasion knowledge and lead to counter arguments (Campbell and Kirmani 2000). In comparison, OOS is less explicit about the marketer’s intention and hence less intrusive. After all, consumers are more likely to trust their own inference (from OOS) than marketer’s direct persuasion about the product.

Context Effects

Consumer choice is constructed and highly context dependent (Bettman, Luce, and Payne 1998; Payne, Bettman, and Johnson 1992). A large body of context effects such as the compromise effect, the asymmetric dominance effect, and the phantom decoy effect, share a common characteristic: merely presenting or removing an option can shift the *relative* choice share among the other options. The OOS effect demonstrated in the present research adds another piece to this literature – the information that an option is OOS can shift choice share among in-stock options. However, the OOS effect is substantially different from these context effects in terms of its underlying mechanism. The compromise effect is explained by loss aversion and local concavity (Kivetz, Netzer, and Srinivasan 2004), and the asymmetric dominance effect and the phantom decoy effect are explained by range frequency theory and justifiability (Ariely and Wallsten 1995; Highhouse 1996), all of which are considered to be some sort of pure cognitive processes. The present research suggests that context effects should *not* be considered in a social vacuum. The presence or absence of a certain option could be the outcome of someone’s choice, which reflects their judgment and evaluation. Such inference could be informative about other options in the choice set. Clearly, context effects driven by these considerations highly depends on the social context, which deserves researcher’s attention.

When is the OOS Effect Likely to Occur in the Real World?

While the OOS effect was demonstrated and replicated across five studies using a wide variety of product categories (e.g., laundry detergents, gift cards, cutting boards, food baskets, meal combos), it would be important to outline the real-world conditions under which the OOS effect is most likely to occur.

First, the OOS effect is more likely to occur in shopping environments where the relative availability of the various options are easy to notice. Such an effect is, of course, likely to occur in traditional grocery stores where the neat and ordered shelf display with product tags make it easy to spot which options are OOS. It is even more likely to occur in online shopping environments. Keeping OOS products (especially those sold out temporarily) still viewable is a common practice of many online

retailers. Consider how many online stores clearly notify consumers when an item is OOS; consider also how many online stores display the inventory that is left for each SKU (e.g., “96 percent offers has been claimed” in Amazon’s Lightning Deals). In all these situations, consumers are likely to more easily notice that a particular SKU is either OOS or about to be OOS, thus making inferences about the focal product features. Further, online stores typically allow consumers to filter options based on specific features, making it easier for consumers to use their inferred information to find their desired options. Thus, OOS effect could be more influential in online retailing than in traditional retail contexts.

Second, the OOS effect is more likely to manifest itself when consumers possess weak priors about the product category that they are browsing through, as suggested by the moderating effect in study 3. For example, product categories that a consumer has low knowledge about (e.g., first time buyers, new product) are ripe candidates for the OOS effect. Specific examples of such product categories clearly depend on the individual-level of knowledge and involvement; however, often developments in the product market might also engender the OOS effect. Consider as an illustration, examples of product categories that went through a sudden burst of innovation and differentiation (Simonson 1993). Up until recently, many product categories like diaper bags, baby bottles, trash cans, dish racks, hand washing detergents, and paper towel dispensers, to name a few, were primarily sold on price and volume attributes. In the last decade, however, companies like Skip Hop (diaper bags, baby bottles), Simplehuman (trash cans, dish racks), Method (detergents), have revolutionized their respective product categories introducing

consumers to previously unheard of attributes (e.g., diaper bags: spill proofing, antimicrobial/odor-reducing lining, contrast lining, stroller attachments, messenger bag styling; trash cans: self-compacting, pedal powered, stainless steel finish). Such categories are also ripe for the OOS effect. Imagine a first-time father browsing skiphop.com looking for diaper bags, and finding that the diaper bags with the “contrast lining” feature are OOS. Would this father’s valuation of the “contrast lining” feature, and the remaining options that have that feature, increase? We believe that in such low-knowledge situations, the OOS effect is highly likely.

Conclusion

The majority of purchase decisions are made in-store where consumers do not have strong a priori preferences to start with. Therefore, product OOS does not only affect consumers who are unable to choose the particular option due to OOS, but can also affect consumers who are browsing the offerings and incidentally notice an option being OOS. These consumers are likely to infer that OOS is informative about the desirability of product features: features contained by the OOS option are likely to be more desirable. Such inference gives choice advantage to options that share features with the OOS option. These findings provide a more complete picture of how consumers respond to OOS, offer insights into making more accurate demand estimation, and suggest a potential new tool for in-store marketing.

Appendix 1. Compete Results of Studies 1, 2, and 4

1A
The complete results of study 1.

| | Options | | | |
|--------------|---------------|-------------------------|---------------------------------------|--------------------------------------|
| | AX* | AY | BX | BY |
| Attributes | | | | |
| Form | Powder | Powder | Liquid | Liquid |
| Scent | Bella Flora | Ocean Pearl | Bella Flora | Ocean Pearl |
| Choice share | | | | |
| Baseline | (4 percent)** | 12 percent (11 percent) | 32 percent (31 percent) | 56 percent ^c (54 percent) |
| OOS | – | 18 percent | 40 percent | 42 percent ^d |
| Absence | – | 11 percent | 31 percent | 58 percent ^c |
| | | | B&C Combined: 44 percent ^a | |
| | | | B&C Combined: 58 percent ^b | |
| | | | B&C Combined: 42 percent ^a | |

a versus b and c versus d significant at .05 level based on planned contrast.

* Marked as “out of stock” in the OOS condition.

** Numbers in the parentheses are the raw choice share for the baseline condition (calculated based on all four options).

1B
The complete results of study 2.

| | Options | | | |
|--------------|----------------|-------------------------|---------------------------------------|--------------------------------------|
| | AX* | AY | BX | BY |
| Attributes | | | | |
| Brand | Starbucks | Starbucks | Amazon | Amazon |
| Form | Plastic | E-card | Plastic | E-card |
| Choice share | | | | |
| Baseline | (10 percent)** | 22 percent (20 percent) | 11 percent (10 percent) | 67 percent ^c (60 percent) |
| OOS-default | – | 30 percent | 33 percent | 37 percent ^d |
| OOS-supplier | – | 18 percent | 18 percent | 64 percent ^c |
| | | | B&C Combined: 33 percent ^a | |
| | | | B&C Combined: 63 percent ^b | |
| | | | B&C Combined: 36 percent ^a | |

a versus b and c versus d significant at .05 level based on planned contrast.

* Informed to be “out of stock” in the OOS-default condition, and “RA forgot to bring” in the OOS-supplier condition.

** Numbers in the parentheses are the raw choice share for the baseline condition (calculated based on all four options).

1C
The complete results of study 5.

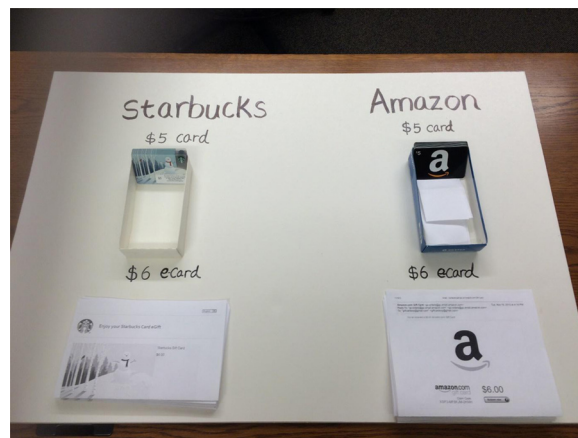
| | Options | | | |
|--------------|----------------|-------------------------|---------------------------------------|--------------------------------------|
| | AX* | AY | BX | BY |
| Attributes | | | | |
| Food | Seafood Rice | Seafood Rice | Tuna Pasta | Tuna Pasta |
| Drink | Tea Latte | White Coffee | Tea Latte | White Coffee |
| Choice share | | | | |
| Baseline | (25 percent)** | 36 percent (27 percent) | 29 percent (22 percent) | 35 percent ^c (26 percent) |
| OOS | – | 53 percent | 29 percent | 19 percent ^d |
| | | | B&C Combined: 65 percent ^a | |
| | | | B&C Combined: 81 percent ^b | |

a versus b and c versus d significant at .05 level.

* Marked as “sold out” in the OOS condition.

** Numbers in the parentheses are the raw choice share for the baseline condition (calculated based on all four options).

Appendix 2. The Option Layout in Study 2 (Baseline Condition)



Appendix 3. The Sample Screen Shot of the Product Description Page in Study 3 (in Chinese)



Appendix 5. The Menu in Study 5 (Baseline Condition; in Chinese)



Appendix 4. The Stimuli Used in Study 4

| Gift Basket A (Out of Stock) | Gift Basket B | Gift Basket C |
|---|---|---|
| Banylus Wine | Banylus Wine | Pinotage Wine |
|  |  |  |
| + | + | + |
| Vacherin Cheese | Derby Cheese | Vacherin Cheese |
|  |  |  |

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