An Economic Analysis of Rebates Conditional on Positive Reviews

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Abstract

Strategic sellers on some online platforms have recently been using a conditional-rebate strategy to manipulate product reviews under which only purchasing consumers who post positive reviews online are eligible to redeem the rebate. We develop a micro-behavioral model capturing consumers’ review-sharing benefit, review-posting cost, and moral cost of lying to examine the seller’s optimal pricing and rebate decisions. We derive three equilibria: the no-rebate, organic-review equilibrium; the low-rebate, boosted-authentic-review equilibrium; and the high-rebate, partially-fake-review equilibrium. We find that the seller’s optimal price and rebate decisions critically depend on both the review-posting and moral costs. Our results suggest that it is not always profitable for strategic sellers to adopt the conditional-rebate strategy. The conditional-rebate strategy does not always result in fake reviews, and it does not always hurt consumer surplus or social welfare. Our study sheds new light on the platform-policy debate about the fake-review phenomenon induced by conditional rebates.

Keywords: Online reviews, Fake reviews, Review manipulation

1. Introduction

Online reviews have been well documented as an important information source for consumers’ purchase decisions. Sellers often offer various incentives to encourage consumers to post reviews online. For example, after a consumer shops at Home Depot, the consumer is often invited to write reviews with the promise that he/she will have a chance to draw a lottery for some prize (e.g., an iPad), and Best Buy offers 25 reward points ($0.50 monetary value) to consumers who write reviews. In recent years, a new approach to encourage reviews has emerged. On Taobao.com, the leading online trading platform in China, many sellers offer purchasing consumers rebates redeemable only if the consumers post positive reviews online. This conditional-rebate strategy is different from the typical unconditional-rebate strategy because in some sense sellers bribe buyers for positive reviews rather than simply expanding the review pool using monetary incentives.

A typical conditional-rebate strategy on Taobao.com works as follows. When a buyer places an online order with a seller, the buyer is unaware of the existence or the amount of the rebate. When shipping the product, the seller might include a mail-in conditional rebate. The key conditions to redeem the rebate include leaving a five-star rating and writing reviews that meet some minimum length requirement. The distinctive feature of this type of rebate is that only those purchasing consumers who post positive reviews are eligible to redeem rebates. Once done, the consumer needs to take a screenshot or photo of the review and send it to the seller for verification. Afterwards, the rebate is honored by the seller through Alipay (a widely adopted mobile payment method and e-wallet).
Because the conditional rebates provide monetary incentives to bribe consumers for positive reviews, a key concern is that it can easily induce consumers to post fake reviews that might harm consumers and society. Recently, leading online platforms in the U.S. have developed various countermeasures and online-review policies to combat fake reviews. For example, Google has deployed a system that combines human intelligence with machine learning to detect fake reviews, and Amazon’s review policy clearly disallows “offering compensation or requesting compensation (including free or discounted products) in exchange for creating, modifying, or posting content.” However, strategic sellers often do not preannounce the rebate information on their web pages, and they bypass platform monitoring and regulation by secretly packaging the paper rebate cards in the same delivery as the purchased products. It is therefore very difficult for platforms and other consumers to distinguish manipulated from legitimate reviews. Motivated by the prevailing conditional-rebate practice and the incentivized-review phenomenon common on today’s e-commerce platforms, as well as the technical challenges of detecting online-review manipulation, this study aims to answer the following research questions: Under what conditions do strategic sellers prefer the conditional-rebate strategy? Under what conditions do fake reviews arise as an equilibrium outcome? How do conditional rebates affect sellers’ profits, consumer surplus, and social welfare?

2. Model
We consider an online seller selling a product to potential consumers. We distinguish two types of product properties—digital attributes and nondigital attributes. Digital attributes refer to the attributes that can be easily communicated to and assessed by consumers through the Internet before purchase. Nondigital attributes refer to those that are difficult to evaluate online, which can be determined only by trying, inspecting, or even consuming the product. For instance, size and color of a product are examples of digital attributes, and how well the product fits a consumer’s specific setting can be an example of a nondigital attribute (e.g., whether a jacket fits a consumer’s figure or whether a piece of furniture fits the consumer’s room design/style). We denote $X$ as the part of valuation associated with digital attributes and $Y$ as the part of valuation associated with nondigital attributes. A consumer’s valuation of the product is $X + Y$, determined by both the digital and nondigital attributes.

We assume that before purchase, each consumer learns her digital-attribute value based on information provided by the seller, such as product description. In the baseline model, we assume consumers derive the same value $x$ from the digital attributes; that is, $X = x$. In the extension, we allow for heterogeneity in digital-attribute value. In contrast, before purchase, consumers cannot exactly know their nondigital-attribute value $y$ or its distribution, although they may have some expectation based on the available information such as online reviews. For ease of exposition, we assume that ex post $y$ can be either high or low: Consumers derive a high value if the product fits their needs well; otherwise, they derive a low value. Without loss of generality, we assume the high value to be $2y$ and normalize the low value to 0; that is, $Y = 2y$ and $Y = 0$, respectively. As a result, consumers are either satisfied or unsatisfied after their purchase. We assume that consumers are equally likely to be satisfied or unsatisfied. In other words, they can derive high or low value from the nondigital attributes with equal probability, and the expected value is $y$.

We consider a two-period model and assume an independent consumer group of size 1 in each period. In the first period, consumers make purchase decisions based on price and expected product
valuation without online reviews. At the end of the first period, purchasing consumers make their review-posting decisions. In the second period, consumers observe the online reviews, based on which they update their expectations on the product valuation and make purchase decisions.

In the first period, upon weighing the review-posting benefits and costs, satisfied consumers may post positive reviews about the product, and unsatisfied consumers may post negative reviews. One important reason for consumers to post reviews is that consumers have the desire for sharing. We thus assume that, on the one hand, consumers derive value $v$ from sharing their true opinions, which follows a uniform distribution over $[0,1]$. On the other hand, consumers incur a cost $c$ ($c \geq 0$) for posting reviews due to the time and effort required. Without additional incentive, whether a consumer posts reviews is determined by her review-sharing benefit and the review-posting cost.

To motivate more consumers to post positive reviews, the seller may offer a monetary incentive. Following the common practice on Taobao.com, we consider that the seller gives a rebate $s$ ($s \geq 0$) to each purchasing consumer who posts positive reviews online. When the rebate is zero, this setting reduces to the classical pricing problem. Consistent with common practice, we assume that the seller does not preannounce the rebate information (including the existence and amount), and the rebates (if any) are offered privately to buyers. Also note that this rebate is conditional on posting positive reviews. Although the monetary incentive naturally motivates more satisfied consumers to share their true opinions (i.e., provide positive reviews), the effect of this incentive on unsatisfied consumers is more nuanced. We assume consumers who lie would incur an intrinsic moral cost of lying $m$ ($m \geq 0$). Therefore, when unsatisfied consumers post positive reviews, although they can enjoy the rebate, they not only fail to derive the value $v$ from sharing their true opinions, but also suffer from the moral cost of cheating. To focus on more general cases, we assume that the maximum value that consumers may derive from nondigital attributes is not too high (i.e., $y \leq 1$); otherwise, the seller would always have incentive to offer a rebate.

In the second period, consumers make their purchase decisions based on their expected product valuation, which can be influenced by online reviews. In our baseline model, we assume that consumers are naïve: They do not factor in the effect of the rebate on reviews in their expectations, because they are unaware of the possible review manipulation at the time of purchase. We denote $\lambda$ as the perceived proportion of satisfied consumers among those who purchased the product, and consumers think that with probability $\lambda$ they will be satisfied as well (i.e., derive high value from the nondigital attributes). We denote $n_g$ as the numbers of purchasing consumers who post positive.

We denote $p_1$ and $p_2$ as the prices charged by the seller in the first and second periods, respectively. We denote $D_i$, where $i \in \{1,2\}$, as the respective demand. The seller’s expected profit across the two periods is as follows:

$$\Pi(p_1, p_2, s) = p_1D_1(p_1) + p_2D_2(p_2) - sn_g(p_1, s)$$  \hspace{1cm} (1)

where the first and second terms on the right-hand side are the revenue from the purchasing consumers in the first and second periods, and the third term represents the cost of rebate to those consumers who post positive reviews. The marginal production cost is assumed to be zero. The seller chooses its product prices and rebate to maximize profit.
The timing of the game is as follows. In the first stage, the seller first announces price $p_1$ in the absence of online reviews, and then consumers make purchases decisions based on price $p_1$ and expected product valuation $x + y$. Subsequently, the seller sends products to the consumers, possibly with a rebate $s$ attached, and then consumers make their review-posting decisions, based on the realized nondigital-attribute value, review-sharing benefit, review-posting cost, rebate (if any), and moral cost. In the second period, in the presence of online reviews, the seller first announces price $p_2$, and then consumers make purchases decisions based on price $p_2$ and expected product valuation $x + 2\lambda y$. In each period, if the price is no greater than the expected valuation, consumers make purchases.

3. Equilibrium Analysis

We first can analyze consumers’ review-posting decisions. Anticipating their review-posting behavior, the seller maximizes its profit in Equation (1) by optimally choosing prices and rebate. The following proposition summarizes the optimal decisions in equilibrium.$^1$

**Proposition 1.** The seller’s optimal first-period price is $p_1^* = x + y$; the optimal second-period price and rebate are

$$
(p_1^*, s) = \begin{cases} 
(x + y, 0) & \text{if } m \geq \hat{m}(c) \text{ and } c \leq \hat{c} \\
(x + y + \frac{(c+y-1)y}{4}, \frac{c+y-1}{2}) & \text{if } m \geq \hat{m}(c) \text{ and } c > \hat{c} \\
(x + y + \frac{(-m+2y-1)y}{2}, \frac{m+2y-1}{2}) & \text{if } m < \hat{m}(c) \text{ and } m \leq \bar{m}(c) \\
(x + y + cy, c + m) & \text{otherwise},
\end{cases}
$$

where $\hat{c} = 1 - y$, $\bar{m}(c) = 2y - 1 - 2c$ and

$$
\hat{m}(c) = \begin{cases} 
(\sqrt{2y} - 1)^2 & \text{if } c \leq \sqrt{2y} - 1 \\
\frac{(2t-c-1)c}{1+c} & \text{if } \sqrt{2y} - 1 < c \leq \hat{c} \\
\frac{c(6y^2-5c^2-(1-y)^2)}{4(c+1)} & \text{if } \hat{c} < c.
\end{cases}
$$

The proposition shows that the seller’s optimal second-period price and rebate decisions critically depend on both the moral and review-posting costs. As illustrated in Figure 1, there are three equilibrium rebate strategies (no rebate, low rebate, and high rebate), corresponding to three review outcomes (organic reviews, boosted authentic reviews, and partially fake reviews). Only when the moral cost is low and the review-posting cost is not too high would the seller offer a high rebate to both motivate more satisfied consumers to post positive reviews and induce unsatisfied consumers to post fake positive reviews (the high-rebate, partially-fake-review equilibrium). When the review-posting cost is high or when it is intermediate and the moral cost is high, the seller prefers to offer a low rebate to motivate more satisfied consumers to post positive reviews (the low-rebate, boosted-authentic-review equilibrium). When the review-posting cost is low but the moral cost is high, the seller prefers not to offer a rebate, resulting in organic reviews in the absence of any monetary incentive (the no-rebate, organic-review equilibrium).

The intuition is as follows. A conditional rebate can benefit the seller by boosting consumers’ perceived expected valuation, but it comes with a cost. When the moral cost is high, it is very

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$^1$ The literature review, extensions, and proofs are omitted because of the page limit and are available upon request.
costly to induce unsatisfied consumers to lie and post fake positive reviews. As a result, the seller has no incentive to bribe unsatisfied consumers but only considers motivating satisfied consumers. There are two distinct cases: low review-posting cost and high review-posting cost. If the review-posting cost is low, a sizable proportion of satisfied consumers voluntarily share their true opinions and post positive reviews in the absence of a monetary incentive. If the seller offers a rebate, a large number of satisfied consumers who would otherwise have posted positive reviews without monetary incentive also redeem the rebate, representing a high cost to the seller. As a result, the seller chooses not to offer any rebate, yielding the no-rebate, organic-review equilibrium. On the other hand, if the review-posting cost is high, the number of consumers who voluntarily share their true opinion and post reviews is relatively small. Therefore, the benefit of inducing additional positive reviews using monetary incentives can outweigh the cost of offering the rebate. Consequently, the seller prefers to offer a low rebate to elicit more positive reviews from satisfied consumers, thus the boosted-authentic-review equilibrium.

In contrast, when the moral cost is very low, unsatisfied consumers are easily induced to post fake positive reviews with a monetary incentive. Therefore, offering a high rebate to engage both satisfied and unsatisfied consumers might become a valuable option to the seller. In general, fake positive reviews would lead to upward bias of consumers’ perceived valuation of the nondigital attributes of the product, which is beneficial to the seller, especially when the valuation of the nondigital attributes is high. Meanwhile, satisfied consumers who would otherwise have posted positive reviews without monetary incentive also redeem the rebate, a high cost for the seller. In the presence of high valuation of the nondigital attributes, when the moral cost is very low, the total rebate cost can be compensated by the total benefit from the inflated positive reviews and consumers’ increased perceived product valuation. Thus, offering a high rebate to induce fake reviews is more profitable than offering no rebate. Notice that an alternative strategy is to offer a low rebate, and its value critically depends on the review-posting cost. As discussed, if the review-posting cost is low, a sizable proportion of satisfied consumers who would otherwise voluntarily post positive reviews in the absence of any monetary incentive redeem the rebate, a high cost to the seller. The total benefit of inducing more positive reviews can be outweighed by the total rebate cost. As a result, offering a low rebate is not profitable. Therefore, if the moral cost is low and review-posting cost is not too high, offering a high rebate to induce fake reviews is optimal, leading to the high-rebate, partially-fake-review equilibrium.
Nevertheless, when the review-posting cost is high, offering a low rebate becomes profitable because the total number of organic reviews is not large and thus the total benefit of eliciting more reviews can outweigh the total rebate cost. The seller must trade off the high-rebate strategy against the low-rebate strategy. As the review-posting cost increases, the seller needs to increase the rebate to entice consumers to post reviews. The increase in total rebate cost under the high-rebate strategy is more significant than that under the low-rebate strategy because of a larger volume of rebate redemption in the former. As a result, when the review-posting cost increases, the seller becomes less likely to offer a high rebate (i.e., \( \bar{m}(c) \) decreases in \( c \)). Further, when the review-posting cost is high enough, the seller gives up bribing unsatisfied consumers and only offers a low rebate to compensate satisfied consumers to post reviews, resulting in the low-rebate, boosted-authentic-review equilibrium. Corollary 1 summarizes the conditions under which offering a high rebate cannot be an equilibrium.

**Corollary 1.** (a) When the review-posting cost increases, the seller becomes less likely to offer a high rebate; (b) When the review-posting cost \( c \geq \bar{c} \), the seller would never offer a high rebate to induce unsatisfied consumers to post fake positive reviews, where

\[
\bar{c} = \begin{cases} 
2y - 1 & \text{if } y \leq 2/3 \\
(3y - 1 + 2\sqrt{y^2 + y - 1}) & \text{if } y > 2/3.
\end{cases}
\]

This corollary and Proposition 1 imply that fake positive reviews can be induced by a high rebate in equilibrium only if the moral cost is low and the review-posting cost is not too high. To induce unsatisfied consumers to post fake positive reviews, the seller needs at least to offer \( m + c \) to compensate their moral and review-posting costs. Because this offer increases in review-posting cost, when the review-posting cost is high (even if the moral cost is low), the rebate offer can be high. Further, this high rebate will also be redeemed by satisfied consumers who post reviews. Therefore, when the review-posting cost is high enough (i.e., \( c \geq \bar{c} \)), the cost to induce fake positive reviews can be too high to be justified by its benefit, and the seller has no incentive to offer a high rebate. Instead, a low rebate to motivate satisfied consumers to post positive reviews can be desirable—the high review-posting cost limits the number of unsatisfied consumers who post negative reviews, and thus the overall effect of additional positive reviews can be significant to offset the monetary incentive offered to the satisfied consumers.

### 4. Conclusion

Today, manipulated reviews have become a common problem and major concern on many online platforms. Although advanced technologies are increasingly capable of detecting accounts with unusual activity or fake users, strategic sellers turn to bribing legitimate users into leaving positive reviews by, for example, providing underhanded conditional-rebate offerings offline in the form of mail-in rebates. This study analyzes the seller’s optimal pricing and rebate strategies and their impact on consumers’ review-posting behavior and social welfare. We have the following important findings.

First, it is not always profitable for strategic sellers to adopt the conditional-rebate strategy. Second, the conditional-rebate strategy does not always result in fake reviews. In our full model analysis, we further show that offering a conditional rebate might be socially beneficial. Our findings provide important new insights to inform future platform management and review policies.