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Research article

Ambiguity or transparency? A model for regulating native advertising, entertainment, and targeting decisions

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Abstract: Native advertising, a form of online advertising designed to blend seamlessly with the form and function of platform content, is increasingly favored by vendors and publishers. We analyzed how a vendor can use native ads on a platform to stimulate consumer search and purchases. Our model focuses on the vendor's key strategic levers—ad entertainment and targeting—and on how the platform's regulation of ad ambiguity affects these decisions. The study yielded three main findings. First, ambiguity affects the vendor's entertainment and targeting decisions in a region-dependent manner. In particular, although the effect of ambiguity on entertainment depends on the regulatory region, higher ambiguity may expand the vendor's targeted consumer base through the associated pricing decision: some consumers are drawn into search by ambiguity rather than entertainment, while pricing converts a broader set of searchers into buyers. Second, a platform that maximizes economic profit never regulates ambiguity; however, this result no longer holds when the platform considers reputational harm. When consumers have low aversion to advertising, deception costs dominate and the platform adopts strict regulation; when aversion is high, hassle harm dominates and the platform opts for lenient regulation. We further showed that standard contracts, such as profit-sharing and cost-per-click contracts, are generally ineffective in achieving the platform's goals, which explains why direct regulation is essential. Nevertheless, a cost-per-click (CPC) contract may coincide with the government's welfare objective in parameter regions where the CPC-induced ambiguity choice matches the welfare-maximizing boundary. Third, when native-ad content is restricted, stricter regulation can improve social welfare if the quality gap is sufficiently large.

Keywords: native advertising; ambiguity regulation; entertainment level; cost-per-click contract; social welfare
Mathematics Subject Classification: 90B60, 91A65

1. Introduction

In today's digital media environment, advertisers and publishers increasingly use native advertising to counter users' growing tendencies toward "ad avoidance" and "banner blindness" in traditional display advertising [1, 2]. Native advertising mimics the form, feel, and function of platform content and is intended to integrate seamlessly into the user experience, thereby enhancing engagement and the effectiveness of advertising messages [3, 4]. Global spending on native advertising continues to grow rapidly, making it a critical component of the digital advertising market, particularly in social media and mobile-app contexts [5, 6].

Two industry examples illustrate how this format works in practice. The New York Times T Brand Studio produced sponsored content for Netflix's *Orange Is the New Black*. Readers may initially believe they are reading a feature story about women inmates, although the content is sponsored by Netflix and promotes the series [7, 8]. In China, WeChat Moments ads appear in the same feed in which users browse posts from friends. Users may therefore believe they are browsing ordinary social content, although some posts are paid advertisements marked with an advertising label. These examples illustrate the basic feature of native advertising: the commercial message is presented as part of the platform's regular content.

This feature distinguishes native advertising from traditional banner ads. Banner ads are usually placed in separate advertising spaces and can be recognized before consumers process the message, whereas native ads are embedded in the content environment itself and may initially be treated as a news feature or a social post.

Thus, ambiguity is central to native advertising. It does not imply false content, but rather delayed or weakened recognition of the content's commercial nature. Such delayed recognition can increase consumer engagement, but it can also create reputational costs for the platform if consumers feel misled. Native advertising therefore involves a trade-off that is less central in traditional banner advertising. Studying this mechanism helps platforms balance advertising revenue against reputational harm and helps vendors understand how ambiguity may affect content presentation and pricing decisions. In this paper, ambiguity refers to the extent to which consumers fail to immediately recognize the commercial nature of a native ad before clicking. This recognition-based definition is consistent with prior work on native-ad ambiguity and is supported by empirical studies on disclosure design, consumer recognition, and publisher trustworthiness [3, 4, 9–11].

Despite native advertising's ability to attract users through its "native" characteristics, evaluating its effectiveness and impact is complex and involves significant ethical and regulatory controversies. The examples above show why recognition and disclosure are difficult in practice: the advertising message is designed to be processed as ordinary platform content before its commercial nature becomes salient. Consistent with this concern, many consumers struggle to accurately identify native ads as advertisements, even when disclosure labels are present [4, 12, 13]. This difficulty in recognition raises concerns about potential deception and directly affects consumers' trust, their experience with editorial content, and the platform itself [14]. Meanwhile, current regulatory frameworks focus narrowly on preventing individual consumers from making erroneous purchase decisions based on false or misleading information (i.e., "material deception"), while overlooking broader damage to platform reputation and credibility [1].

In the context of controversies surrounding such "implicit" persuasion, the consequences of native advertising are not determined solely by format; they are also shaped by the ad's presentation, content characteristics, display context, and users' individual motivational differences [2, 5, 6, 15]. In addition, vendor investment in advertising and its interaction with platform-matching strategies, such as the type of contract signed with the vendor, have become critical mechanisms influencing disclosure strategy and market equilibrium [16].

This paper studies how a vendor and a platform strategically choose advertising content, pricing, and disclosure ambiguity when consumers are uncertain about product quality [17]. We focus on three related questions. First, how should the vendor use entertainment investment and pricing to influence consumer search and purchase decisions? Second, how should the platform choose disclosure ambiguity under different contractual arrangements with the vendor? Third, how do regulatory objectives affect the optimal level of disclosure ambiguity? We consider a scenario in which, after production, a vendor sells products or services on an online platform. The vendor chooses the entertainment level and price, while the platform, as the advertising medium, determines the ad's disclosure strategy by choosing between more ambiguous and clearer disclosure. In Phase 1, consumers observe only the ad's entertainment level and decide whether to engage in search (e.g., by clicking a link to explore product details online or by experiencing the product offline). In Phase 2, consumers observe the price and true quality before deciding whether to purchase.

To capture the platform's trade-off between attracting more consumers to search and mitigating reputational damage, we endogenize the ambiguity of native advertising. To illustrate this trade-off, we consider two types of heterogeneous consumers. If consumers identify a native ad, their first-stage decision reflects the difference between expected quality and their level of ad aversion; if consumers mistake advertising for editorial content, their motivation is driven solely by entertainment. When the platform reduces ambiguity, fewer consumers are deceived into searching, but more consumers recognize the ad, which complicates platform behavior. This framework captures the platform's ethical and profit-driven dilemma between deception costs and the hassle harm generated by advertising. We confirm that native advertising buffers consumers' ad aversion [13], and even platforms with different preferences exhibit similar behavior: low ad aversion corresponds to low ambiguity, whereas high ad aversion corresponds to high ambiguity.

Our results are driven by how ambiguity regulation affects the vendor's entertainment level and pricing, which ultimately influence consumer decisions. High ambiguity mitigates ad aversion while reducing the vendor's entertainment investment costs, allowing the vendor to lower prices and target a broader consumer base. This leads to another key finding: in most cases, the vendor, platform, and government prefer the number of consumers who fail to identify ads to exceed the number who recognize them. Our third key insight is that the vendor benefits from profit-sharing contracts because such contracts align the vendor's interests with those of the platform. By contrast, cost-per-click contracts create a principal-agent problem by misaligning platform and vendor goals and increasing consumer search participation. This outcome may partially coincide with the government's social-welfare objective when the CPC-induced ambiguity boundary is the same as the welfare-maximizing boundary. When ad content is restricted and consumers who identify ads cannot ascertain true product quality, moderate ambiguity regulation may also yield this outcome, which contrasts with the empirical findings of [3].

The remainder of this paper is organized as follows. Section 2 briefly reviews related literature. Section 3 develops the model and analyzes the results. Section 4 extends the model further. Section 5 summarizes managerial implications and suggests directions for future research.

2. Related literature

Native-advertising spending has grown substantially across various platforms, including news websites, social media, and mobile applications, indicating its significant role in the current digital marketing ecosystem [18]. Advertisers and platforms use native advertising for several reasons, including overcoming ad avoidance and banner blindness [19, 20], enhancing user engagement relative to traditional display ads [6, 21], generating revenue for platforms in a challenging media landscape [1, 22], and delivering brand messages in a less disruptive format [23, 24]. Despite these benefits for advertisers and platforms, the nature of native advertising presents a significant challenge for consumers.

Among the empirical studies on native advertising, a robust finding is the challenge of ad recognition and its consequences [4, 25]. For example, using experimental data, Aribarg and Schwartz [3] found that native ads generate higher click-through rates due to the resemblance to editorial content, but lower brand recognition. Moreover, a growing volume of research has shown that format and context influence native-advertising effectiveness. LaBrecque et al. [15] found that in-feed placements yield higher clicks but also higher bounce rates than in-ad placements. Disclosure type and prominence also significantly affect recognition and reaction [11, 26]. Yoon et al. [6] showed that ad relevancy effects are moderated by the consistency of the surrounding media content.

To understand the mechanisms behind these empirical results, researchers draw on several key theories. The persuasion knowledge model [27] suggests that users employ knowledge about persuasion attempts to cope with advertising, thereby influencing their responses to less-obvious formats such as native ads. The covert advertising recognition and effects (CARE) model [28] specifically addresses factors that influence recognition of masked formats, distinguishing between antecedents (e.g., cognitive ability, motivation, and disclosure cues) and consequences (e.g., reactance and devaluation). Schema theory helps explain how format congruence influences processing fluency and attitudes [21, 29]. The limited capacity model explains how user motivation (information seeking vs. entertainment seeking) affects the cognitive resources available for processing ads [30]. These theories also help distinguish pre-click attention capture from post-click annoyance [2, 31].

Given the complexity of native advertising, theoretical studies offer various frameworks for understanding how market participants navigate this environment. Chatterjee and Zhou [22] modeled the strategic choice between native and traditional advertising in a two-sided market, accounting for advertiser preferences and consumer annoyance. Pricing models such as cost-per-click (CPC) and cost-per-action (CPA) have different implications for advertisers and publishers because native ads generate distinctive click and bounce patterns [32, 33]. Other studies examine how advertisers can optimize native-ad design through content choices (e.g., selling intent) and placement strategies [34, 35]. Regulation and self-regulation also play an important role in shaping disclosure practices and addressing ethical concerns [36, 37].

More specifically, research relevant to native-advertising regulation can be organized into three broad streams. The first stream examines the behavioral foundations of regulation by studying sponsorship disclosure and consumer recognition, showing how disclosure position, language,

salience, and timing affect whether consumers recognize advertising and activate persuasion knowledge [4, 11, 20, 24, 38, 39]. The second stream studies native-advertising regulation itself, examining disclosure obligations, deception risks, and regulatory challenges from legal, public-policy, and regulatory-practice perspectives [1, 10, 36, 37, 40, 41]. The third stream analyzes the market consequences that such regulation seeks to address, including the effects of native advertising on advertising effectiveness, publisher trust, website credibility, click-through rates, brand recognition, and consumer responses [2, 3, 6, 14, 15]. Closest to our paper, Wu et al. [41] analytically studied the regulation of native-advertising opaqueness. We build on this regulatory perspective but differ in two central ways. First, we distinguish consumers' pre-click aversion to recognized advertising from the post-click deception cost that arises when consumers realize that they have been misled. Second, whereas Wu et al. studied native-ad opaqueness in a media content market and treated opaqueness as a signal of publisher content quality, we examine a platform-mediated product market in which entertainment investment serves as the vendor's strategic signal; accordingly, ambiguity regulation affects the vendor's entertainment and pricing decisions.

Studies have focused on how vendors may use design and placement tools to influence clicks and engagement, but they often overlook the interplay among format, disclosure, consumer characteristics, and regulatory pressure [5, 15, 42, 43]. Our paper fills this gap by explicitly studying the interaction between native advertising and user context under existing regulatory frameworks. We show that the ambiguity of native-advertising formats depends on several factors, including consumers' expected quality and ad aversion, contractual arrangements between vendors and platforms, and the preferences of different regulatory bodies. As a result, less-overt formats may, under certain conditions, benefit vendors, platforms, and even the government [22].

Our work enters the ongoing debate over whether native advertising outperforms traditional display advertising, a question for which the literature offers mixed evidence. While native ads may attract more attention and clicks by blending into surrounding content, they may also reduce advertising recognition, brand recognition, and website trust once consumers realize the persuasive intent of the message [3, 15, 28]. Related research on online display advertising also shows that advertising effectiveness varies across behavioral metrics, such as browsing, clicks, and subsequent engagement [2, 44]. We address this inconsistency by modeling traditional advertising as a special case of native advertising with zero ambiguity. Following Wu et al. [41], we use ambiguity as the key differentiator: when ambiguity is zero, a native ad functions as a traditional ad. This allows us to analyze strategies driven solely by ad ambiguity. From an economic perspective, we argue that traditional advertising outperforms native advertising only when consumer ad aversion is low and the platform focuses solely on mitigating harm.

Consistent with research showing that entertaining content can increase engagement [6], our paper investigates this dynamic further. We model consumer engagement—operationalized as the click-through rate (CTR) in the digital context—as being jointly influenced by the ad's entertainment value and consumer characteristics [5].

Finally, this study deepens our understanding of how advertisers strategically use native-advertising formats, such as entertainment level and ambiguity, under asymmetric information about quality. By leveraging their informational advantage, advertisers blend advertising into noncommercial content through formats such as sponsored content, influencer marketing, and native advertising, which represents a key strategic shift in the digital era [22, 45]. The ambiguity of an advertisement—for instance,

its appearance as sponsored hyperlinks or sponsored content [46]—is central to this strategy because it may lower some consumers' guard. In response, regulatory bodies attempt to apply the "truth-in-advertising" principle to these new forms, primarily through mandatory disclosure [47]. However, mandatory disclosure for native advertising under information asymmetry is itself complex, because disclosure format and language significantly affect consumers' ad recognition [48]. Therefore, the success of an advertising strategy depends on the interplay among consumer characteristics [12], the regulatory environment designed to mitigate the information gap [1, 2, 49], and the advertising content as it interacts with platform characteristics [50, 51]. This research contributes by explaining how these dynamics converge to shape strategic outcomes, particularly when advertisements are designed to be highly inconspicuous.

Drawing on the vendor's perspective and consumer-characteristics theory, this paper extends the literature on native-advertising regulation and addresses the research gap concerning platform self-regulation.

3. Model

3.1. Problem formulation

We consider a representative vendor selling a product or service on a website platform, where the platform provides advertising-impression services to the vendor in exchange for commission fees. The platform offers two types of commission contracts: a profit-sharing contract (PSC), which splits revenues with the vendor, and a cost-per-click (CPC) contract, which settles payments based on total click-through rates[1]. For analytical convenience, we assume that consumers can become aware of the product only through the platform's advertising service, ensuring that all vendors must use the platform to reach market demand. We use advertising impression to measure the magnitude of advertising intensity. For example, in a website context, advertising impression is the ratio of the area occupied by the advertisement to the total area of the webpage; in a video context, it is the ratio of the time during which promotional elements appear to the total duration of the video.

Drawing on the consumer-attention literature [52–54], we assume that all consumers incur an attention cost when recognizing advertisements while browsing a website, and that these costs are uniformly distributed over $[0, 1]$. Attention costs reflect consumers' tolerance for ads or editorial content. For instance, a consumer idly waiting for a bus may have a low realized attention cost, whereas a consumer engaged in mobile payment may have a higher attention cost for intrusive website content. Consumers are divided into two recognition outcomes: *attentive* consumers and *inattentive* consumers.[2] The former refers to consumers who can accurately distinguish whether the target content is an advertisement or editorial content; the latter refers to consumers who mistakenly treat advertising content as editorial content.

The platform chooses an ad-format ambiguity level $x \in [0, 1]$. When $x = 0$, ads appear in fully transparent traditional formats. The relative proportions of these recognition outcomes are endogenous

[1]The commission rate is exogenous in this paper, and we detail this in Section 3.4.

[2]The terms "attentive consumers" and "inattentive consumers" are used for expositional convenience. They do not refer to fixed ex ante consumer types. Rather, they describe consumers' recognition outcomes before clicking: attentive consumers are those who recognize the content as native advertising before clicking, whereas inattentive consumers are those who fail to recognize its advertising nature before clicking. The ambiguity level x therefore affects the fraction, or probability, of consumers falling into these recognition outcomes, rather than changing consumers' intrinsic types.

rather than fixed ex ante: a higher ambiguity level x increases the share of consumers who fail to recognize the ad before clicking and therefore treat it as editorial content, while correspondingly reducing the $1 - x$ share of consumers who recognize it as advertising before clicking. This framework enables a deeper analysis of how platform ambiguity choices affect platform-vendor interactions.

Table 1. Key model notation.

Notation	Meaning
p	product (service) price
$x \in [0, 1]$	ambiguity of the advertising
$e > 0$	entertainment level
$\bar{x} \in [0, 1]$	regulatory constraint
x_j^*	the type-j platform's optimal choice of ambiguity level
x_P^*	the platform's optimal choice of ambiguity level under PSC
x_C^*	the platform's optimal choice of ambiguity level under the CPC contract
x_{PH}^*	the night-watchman platform's optimal choice of ambiguity level under PSC
x_{NP}^*	the balanced platform's optimal choice of ambiguity level under PSC
$r > 0$	consumer aversion to advertising
$y > 0$	advertising impression
q	true product (service) quality
$\hat{q}$	expected product (service) quality
Δq	$q - \hat{q}$
PH	platform harm caused by native advertising
NP	realized profit Π after deducting platform harm PH
π	the vendor's expected profit in the product-display period
SW	social welfare
Π	realized profit
e_i^*	optimal entertainment level induced by targeting scheme i
e_i	maximum entertainment level supporting targeting scheme i

*Note: The superscript $*$ denotes the optimal value of the corresponding decision variable.

After signing a commission contract with the platform, the vendor chooses an entertainment level e, which may involve hiring more renowned models, investing more effort in engaging copy, or carefully designing ad layouts. To ensure the existence of an interior solution, we assume that the entertainment cost is quadratic and given by $\frac{1}{2}e^2$. According to our setup, both types of consumers have the same preferences over the entertainment level e, so the same level of entertainment generates the same unit click-through rate within a fixed consumer type. The difference is as follows. When a consumer perceives the target content as editorial content (an inattentive consumer), the consumer evaluates the entertainment level and attention cost to decide whether to conduct a detailed search, i.e., $u_{1I} = e - C$. If $u_{1I} \geq 0$, the consumer clicks the link; otherwise, the consumer does not. When a consumer perceives the target content as an advertisement (an attentive consumer), the consumer first experiences aversion to the content, with aversion determined by the aversion coefficient r and the advertising impression y. A consumer then evaluates the match between the advertised product

(or service) and their needs, which we call expected quality $\hat{q}$. Thus, the click-through utility for an attentive consumer is $u_{1A} = e + \hat{q} - ry - C$, where e is the utility generated by the content and $\hat{q} - ry$ is the additional utility generated by the advertisement. In our analysis, the sign of $t = \hat{q} - ry$ is crucial because it determines the shape of the vendor's profit function. When $t > 0$, the consumer's aversion to the advertisement is low and product quality is high; we call this a "good" market state. Conversely, when $t < 0$, we call it a "bad" market state.

Because product or service quality q is determined during the production or design phase, we assume that quality is the vendor's private information and is unknown to the platform, consumers, and regulators during the sales phase. In the following analysis, we first consider the case in which attentive consumers know the true quality of the product, i.e., $\hat{q} = q$. We then relax this assumption in Section 4. We allow the vendor to engage in price discrimination by flexibly adjusting the price p after a consumer searches[3]. After a consumer clicks the link, the product-detail page displays the true quality q. The consumer decides whether to purchase based on whether the net utility $q - p$ is positive or negative[4]. We discuss the implications of this setup in detail in Section 3.4. Table 1 outlines the meanings of the main variables.

3.2. Game sequence

The sequence of events unfolds as follows. In Stage 0, the government first announces the regulatory constraint ($\bar{x}$), the product or service production/design phase concludes, the vendor learns the private information regarding true product quality (q), and the platform and vendor then select and operate under a specific type of commission contract.[5] In Stage 1, under the applicable contract, the platform selects the actual ambiguity level ($x_j \in [0, \bar{x}]$), $j = P, C, PH, NP$, to be implemented on the platform. The subscripts denote ambiguity under the PSC and CPC contracts and, under the PSC contract, two distinct platform preferences (see Section 3.6).

This timing implies distinct roles for regulation and contract form. In particular, the key object is $x_j^* = x_j^*(\bar{x}, \text{contract form})$: $\bar{x}$ determines the feasible set, while the contract form determines the platform's incentives within that set.

In Stage 2, after observing the platform's self-regulation choice, the vendor selects an entertainment level e, which captures aspects of product presentation or promotional effort. The click-through rate, a stochastic outcome influenced by q, e, and potentially x_j, is then realized and observed[6]. In Stage 3, the product price p is shown, and consumers make purchase decisions based on the available information. Table 1 reports the main variables and their meanings, and Figure 1 shows the timeline of the game.

[3]Traditional e-commerce pricing literature generally assumes that vendors set prices before placing advertisements (i.e., before Stage 3). However, in an era in which big data and artificial intelligence are widely used to analyze heterogeneous consumer preferences, vendors often track consumers' past purchase records and adjust preset prices to implement price discrimination. Although many countries have enacted laws to restrict this practice, vendors may still circumvent regulations by offering pop-up coupons after different consumers click on links [55, 56].

[4]If the vendor sets the price before Stage 3, then, because click volume has not yet been realized, the vendor cannot make a profit-maximizing pricing decision regardless of whether the consumer knows the price p. Meanwhile, to highlight the research focus, we assume that all consumers have the same preference for quality q.

[5]The contract form does not impose any prior constraint on the government's regulatory choice ($\bar{x}$). Government regulation determines the feasible set for the platform's ambiguity choice, whereas the contract form affects the platform's objective when choosing (x_j^*) within the feasible set ($[0, \bar{x}]$). Thus, the equilibrium analysis is conducted conditional on ($\bar{x}$) and the contract form.

[6]In Stage 2, consumers are initially divided into two recognition outcomes: attentive and inattentive.

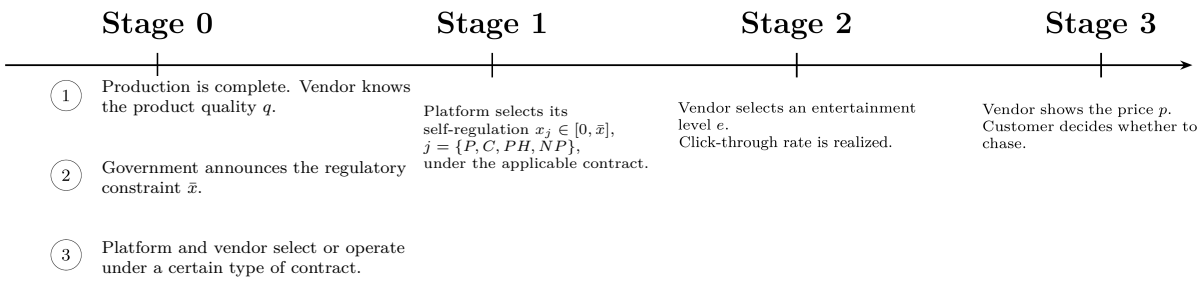


Figure 1. Timeline of the game sequence.

We depict an attract-click-purchase (ACP) process in Stages 2 and 3[7], where the attract phase is jointly determined by the government, platform, and vendor. Consumers have three options: click and purchase, click but not purchase, or not click. The vendor can flexibly decide the price because it fully understands the distribution of attention costs and the amount of entertainment investment made in the previous stage.

3.3. Vendor targeting decisions

In the following analysis, we solve the model by backward induction. We first consider the case $t < 0$, which represents a common market condition in which the individual consumer's expected quality $\hat{q}$ is lower than the consumer's advertising aversion ry, reflecting advertising overload[8]. For a given advertisement, if consumers do not recognize it in Stage 2, it reaches more consumers with higher attention costs, thereby generating a higher click-through rate.[9] The vendor makes pricing decisions after choosing the entertainment investment or, equivalently, the entertainment level.[10] Given market state t, the product price depends on true product quality q and the entertainment level e chosen by the vendor[11]. The vendor can target different consumer groups through different pricing strategies. Overall, there are three targeting schemes[12]: (i) Set a lower price to target all consumers in the market. (ii) Set a moderate price to target all attentive consumers and a fraction of inattentive consumers. (iii) Set a higher price to target a small fraction of both types of consumers. When consumers enter the product-detail page, three different profit scenarios may arise based on the above three targeting schemes. For clarity in the piecewise function below, let us define two terms representing profits from different sources:

$$A(p) = \frac{x}{e}p(q - p), \tag{3.1}$$

$$B(p) = (1 - x)p, \tag{3.2}$$

[7]In the context of e-commerce, "click" refers to the action of clicking on a link within a native advertisement. If the platform does not provide link information in the advertisement, the "click" stage refers to the consumer's search behavior triggered by interest in the brand name or other features highlighted in the ad. Our model applies not only to advertisements in web environments but also to video contexts. For example, before watching a YouTube creator's video or a movie, some consumers—through certain information channels—may already be aware of the vendor responsible for the embedded advertisement, while others may remain completely unaware of it.

[8]In what follows, we mainly consider the case where $t \leq 0$. The case where $t > 0$ is symmetric and is used only in the comparative analysis.

[9]This setting characterizes native advertising as having an appearance highly similar to platform content, which reduces consumer aversion before consumers click the link.

[10]To ensure a positive individual profit, the vendor chooses a suitable p such that $q > p$.

[11]We study the sales phase after the product has been manufactured, during which true product quality q is fixed. To avoid making the subsequent discussion trivial, we assume $q > e$, ensuring that product quality is sufficiently high for the vendor to adjust pricing decisions.

[12]High, moderate, and low pricing decisions represent the vendor's three targeting strategies.

Therefore, the vendor's expected profit π in the product-display period, after consumer click-through and revelation of the true quality q, can be expressed as:

$$\pi = \begin{cases} p, & 0 \le p \le q - e, \\ A(p) + B(p), & q - e < p \le \Delta q - e + ry, \\ A(p) + B(p) \cdot \frac{q-p}{e+t}, & \Delta q - e + ry < p \le q \end{cases} \tag{3.3}$$

Equation 3.3 divides sales revenue into two components. The first component comes from inattentive consumers and is denoted by π_I; the second component comes from attentive consumers and is denoted by π_A. When the vendor adopts targeting scheme (i), the price is lower. As long as consumers click the link, they purchase with certainty. In this case, the vendor's revenue conditional on the click-through rate is given by $xp + (1 - x)p$. When the vendor adopts targeting scheme (ii), the price is moderate. Attentive consumers purchase with certainty after clicking the link, but inattentive consumers may not. Notably, although inattentive consumers tend to incur higher attention costs, the price they find acceptable after clicking the link is low. In this case, the vendor's revenue is given by $x \int_0^{q-p} dF_I \cdot p + (1 - x)p$. When the vendor adopts targeting scheme (iii), the price is higher. In this case, the vendor's revenue is given by $x \int_0^{q-p} dF_I \cdot p + (1 - x) \int_0^{q-p} dF_A \cdot p$[13]. Lemma 1 describes the vendor's targeting strategy under different entertainment levels.

Lemma 1. *(Targeting strategies of the vendor) The vendor's pricing depends on the entertainment level. When the entertainment level is low, the vendor targets a broader set of consumers; when the entertainment level is high, the vendor targets a narrower set of consumers.*

$$p^* = \begin{cases} q - e, & 0 \le e \le e_1, \\ \frac{1}{2}(q + \frac{1-x}{x}e), & e_1 < e \le e_2, \\ \Delta q - e + ry, & e_2 < e \le \frac{q}{2} - \hat{q} + ry, \\ \frac{q}{2}, & \frac{q}{2} - \hat{q} + ry < e \le 1 \end{cases}$$

Lemma 1 describes the vendor's targeting strategy after consumers click the link. When the entertainment level is no greater than e_1, the price $q - e$ corresponds to targeting scheme (i), which is precisely the price that makes the marginal inattentive consumer willing to purchase. When the entertainment level lies between e_1 and e_2, the price $\frac{1}{2}(q + \frac{1-x}{x}e)$ corresponds to targeting scheme (ii), which is precisely the price that makes the marginal inattentive consumer willing to purchase. When the entertainment level lies between e_2 and $\frac{q}{2} - \hat{q} + ry$, the price $\Delta q - e + ry$ corresponds to targeting scheme (iii), which makes the marginal attentive consumer willing to purchase. The last interval guarantees that targeting scheme (iii) is feasible when consumers know the product quality. Notably, within each interval, there is no inherent correlation between price and entertainment level. Specifically, in the first and third segments, price decreases as entertainment increases, whereas the opposite pattern appears in the second segment. In the next section, we use three effects to explain the findings described above.

[13] F_I corresponds to inattentive consumers, while F_A corresponds to attentive consumers. As assumed earlier, consumers' attention cost C is uniformly distributed on $[0, 1]$, and consumers are divided into inattentive and attentive recognition outcomes. The click-through conditions for these two types are $u_{1I} = e - C$ and $u_{1A} = e + \hat{q} - ry - C$, respectively. Therefore, the subsequent integrals with respect to dF_I and dF_A are taken over the attention-cost distributions of the corresponding consumer types.

3.4. Vendor entertainment and platform ambiguity decisions

In Stage 2, the vendor observes the platform's choice x_p and chooses its entertainment level e. The entertainment level of the advertisement, which may be presented as text, images, or videos, determines consumers' click-through probability. The vendor's realized profit depends on two conditions: whether the consumer clicks the link and whether the consumer makes a purchase. It can be represented as $\Pi = \int_0^e dF \cdot \pi_I + \int_0^{e+t} dF \cdot \pi_A$. The specific forms are as follows, where e_1 and e_2 are the entertainment thresholds that separate the three targeting regimes; their explicit expressions are provided in Appendix A.

$$\Pi = \begin{cases} (1-x)(q-e)(e+t) + ex(q-e) - \frac{e^2}{2}, & 0 \le e \le e_1, \\ \frac{1}{2}(1-x)(e+t)\left(\frac{e(1-x)}{x} + q\right) + \frac{1}{4}x\left(q^2 - \left(\frac{e(1-x)}{x}\right)^2\right) - \frac{e^2}{2}, & e_1 < e \le e_2, \\ (e+t)(-e+q-t) - \frac{e^2}{2}, & e_2 < e \le \frac{q}{2} - \hat{q} + ry, \\ \frac{1}{4}q^2(1-x) + \frac{q^2 x}{4} - \frac{e^2}{2}, & \frac{q}{2} - \hat{q} + ry < e \le 1 \end{cases} \tag{3.4}$$

Lemma 2 states that vendors adjust their entertainment strategies under different levels of regulatory intensity.[14] The effect of ambiguity on entertainment is region-dependent. Below, we use three effects to explain the vendor's entertainment-content presentation strategy in response to ambiguity.

Lemma 2. *(Entertainment strategies of the vendor) When the market state is bad ($t < 0$), the authorities may implement three distinct levels of regulation; the vendor's entertainment level e^* is as follows:*

(i) when the regulation is strict $\bar{x} \in [0, \bar{x}_1)$, $e^* = \frac{1}{3}(q - 2t)$;

(ii) when the regulation is moderate $\bar{x} \in [\bar{x}_1, \bar{x}_2)$, $e^* = \frac{qx}{1+x}$;

(iii) when the regulation is lenient $\bar{x} \in [\bar{x}_2, 1]$, $e^* = \frac{1}{3}(q - (1-\bar{x})t)$.

Strict ambiguity regulation significantly increases the entertainment level and retail prices. It is useful to distinguish the vendor's entertainment decision from its targeting decision. The entertainment level e captures the attractiveness of the advertising content, whereas the targeting decision is implemented through the vendor's pricing strategy. Lemma 2 shows that ambiguity affects entertainment in a region-dependent way: ambiguity and entertainment may be complementary in the moderate-regulation region, while ambiguity substitutes for entertainment in the lenient-regulation region. Accordingly, changes in the targeted consumer base should be interpreted separately from changes in entertainment: targeting is determined by the vendor's pricing strategy, whereas entertainment captures the attractiveness of the advertising content.

The two thresholds in Lemma 2 also have straightforward economic interpretations. In the baseline model, ambiguity x measures the share of consumers who fail to recognize the native advertisement before clicking, while $1 - x$ measures the share of consumers who recognize the content as advertising. Thus, $\bar{x}_1 = 1/2$ is the point at which the two groups have equal mass. When $x < 1/2$, consumers who recognize the content as advertising remain the larger group; when $x \ge 1/2$, misclassification becomes large enough to affect the vendor's entertainment and pricing decisions. The second threshold $\bar{x}_2$ separates the moderate-regulation region from the lenient-regulation region: in the former, ambiguity and entertainment still jointly support scarce clicks. Therefore, entertainment and ambiguity are complementary in this region. In the latter, ambiguity is high enough to substitute for costly entertainment. For $t < 0$, $\bar{x}_2 = \frac{q - \sqrt{q^2 - qt + t^2}}{t}$, where $-q < t < 0$.

[14]The realized profit Π is a continuous concave function of e, and the optimal entertainment level e^* changes with ambiguity x.

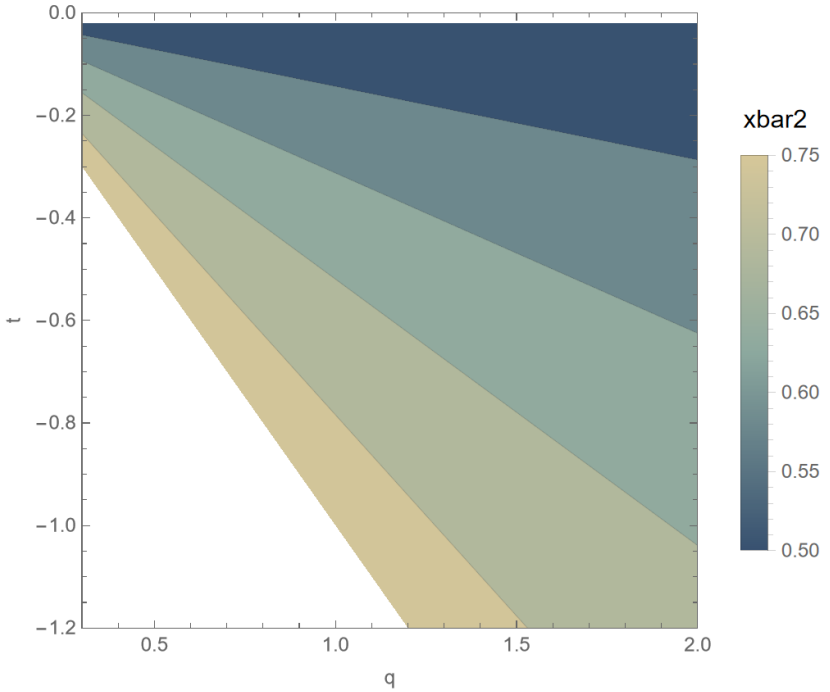


Figure 2. Sensitivity analysis of $\bar{x}_2$ with respect to q and t.

Figure 2 plots $\bar{x}_2$ over the feasible region $-q < t < 0$. Darker blue areas indicate values close to $\bar{x}_1 = 1/2$, whereas warmer yellow areas indicate higher values of $\bar{x}_2$. The white triangular region is excluded by the feasibility condition $-q < t < 0$. Holding t fixed, higher q lowers $\bar{x}_2$ because each induced click/search becomes more valuable; thus, the vendor needs less ambiguity before ambiguity can substitute for costly entertainment. Holding q fixed, a more negative $t = \hat{q} - ry$ means that the advertising-aversion burden is stronger relative to the expected product quality. Consumers who recognize the content as advertising are then less willing to click. Because ambiguity alone has difficulty offsetting the click-through loss caused by advertising aversion, entertainment remains complementary to ambiguity, so $[\bar{x}_1, \bar{x}_2)$ becomes wider. This interpretation helps explain why the substitution effect and the multiplier effect appear after $\bar{x}_1$, and why entry into the lenient-regulation regime shifts systematically with q and t. Economically, $\bar{x}_1$ marks the point at which ambiguity begins to interact with the vendor's entertainment and pricing decisions, whereas $\bar{x}_2$ marks the point at which ambiguity becomes strong enough to replace entertainment as the main click-inducing instrument.

We use three effects to explain why the entertainment level and prices change under different regulatory intensities, as shown in Lemma 1 and Lemma 2. The first effect is "focalism," which refers to which type of consumer generates more clicks under different market states. When $t < 0$, inattentive consumers can generate higher value. Therefore, vendors tend to create greater ambiguity, at which point attentive consumers play a secondary role in contributing to profits. Focalism directs the vendor's decisions toward inattentive consumers. When $t > 0$, focalism directs the vendor's decisions toward attentive consumers.

The second effect is the "substitution effect," which refers to the region in which ambiguity (x) substitutes for entertainment (e)[15]. In the substitutive region, greater ambiguity gives the vendor an opportunity to reduce entertainment investment, cut costs, and instead rely on higher ambiguity to attract consumers.

We use the "multiplier effect" to explain why ambiguity (x) and price (p) move in the same direction. When ambiguity (x) is constrained to a low level, the vendor can attract more clicks only by increasing the entertainment level[16], and simultaneously lowers the price to increase the purchase volume among consumers who have already clicked. Conversely, if ambiguity x is high, the vendor can rely on ambiguity to induce consumers to click the link[17], and simultaneously increases the price to screen for consumers with higher willingness to pay.

In the interval from $\bar{x}_1$ to $\bar{x}_2$, both the substitution effect and the multiplier effect are negative. In the interval from $\bar{x}_2$ to 1, both effects are positive. Figure 3 illustrates the intervals in which these two effects arise (i.e., when $x \geq \bar{x}_1$).

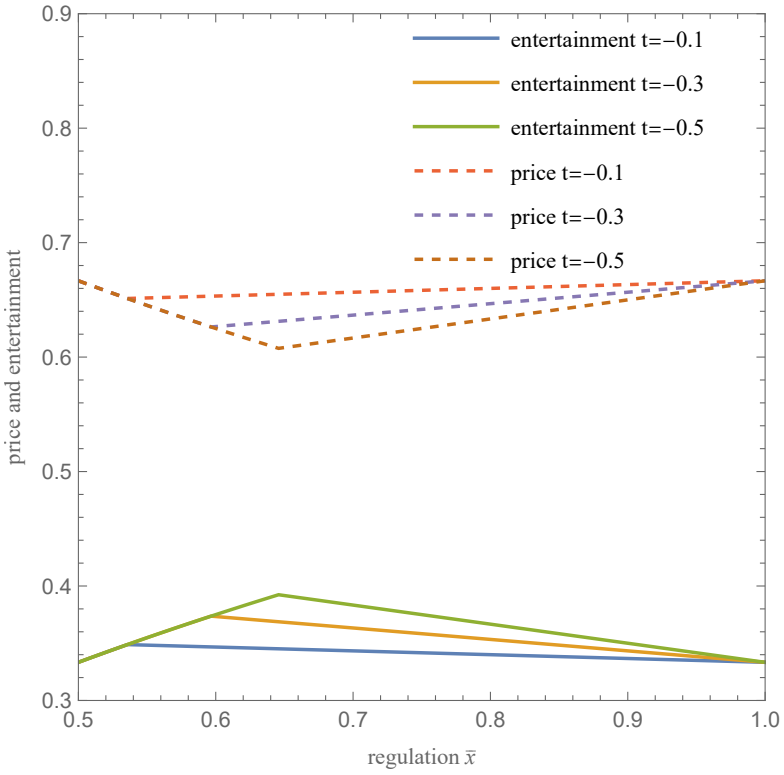


Figure 3. The substitution effect and multiplier effect when $\bar{x} \geq \bar{x}_1$.

When x lies between $\bar{x}_1$ and $\bar{x}_2$, the click-through rate (CTR) remains scarce. Increasing ambiguity still fails to attract enough consumer clicks, so the vendor continues to increase the entertainment level. This increase in the CTR continues to impose entertainment investment costs on the vendor. At

[15]For expositional convenience, we refer to the negative substitution effect in the interval $[\bar{x}_1, \bar{x}_2)$ as the complementary effect because ambiguity and entertainment move in the same direction in this region.

[16] Attracting consumers through entertainment is costly. Therefore, after a consumer clicks, the vendor adopts a "low-margin, high-volume" strategy to avoid wasting this cost.

[17] Attracting consumers through ambiguity is costless, and many consumers with lower willingness to pay will click the link. To filter out this consumer segment, the vendor adopts a strategy of increasing the price.

the same time, because the CTR remains relatively low at this stage, the attracted consumers have a higher willingness to pay, allowing the vendor to adopt a "low-margin, high-volume" strategy (see footnotes 16 and 17).

When x lies between $\bar{x}_2$ and 1, ambiguity is high enough to attract sufficient consumer clicks. The vendor then reduces the use of entertainment elements in advertisements while increasing prices to exclude consumers with lower willingness to pay.

When $t < 0$, the marginal inattentive consumer always generates a higher click-through rate than the marginal attentive consumer, so the focalism effect is always present. Second, as shown in Figure 3, the substitution effect and the multiplier effect appear simultaneously. Under moderate regulation, both effects are negative; under lenient regulation, both become positive. This indicates that when x is in the moderate-regulation range, the click-through rate remains severely insufficient, and the vendor must increase the entertainment level e to boost click-through even when ambiguity increases. Finally, as t approaches 0^-, Lemma 2 implies that $\bar{x}_1 = \bar{x}_2 = \frac{1}{2}$, e is constant at $\frac{q}{3}$, and price p is also a constant related to q. Because focalism is absent when $t = 0$, the other two effects are absent as well. In addition, $\bar{x}_2$ is monotonic in t: the smaller the absolute value of t, the closer $\bar{x}_2$ is to $\bar{x}_1$, the narrower the moderate-regulation range, and the broader the scope of the three effects (see Figure 3).

After the regulation $\bar{x}$ is issued, the platform selects the ambiguity level x_p that is most beneficial to it within the permissible range. To examine platform behavior in greater depth, we introduce two commonly used contracts: the profit-sharing contract (PSC) and the cost-per-click (CPC) contract. Under a PSC, the vendor pays the platform a commission based on a proportion of the vendor's profit, which we assume is exogenous, as in the literature on platform-vendor contracts (see Avinadav et al. [57], Li and Tomlin [58], Li et al. [59], and Li and Liu [60]). The platform's goal is to maximize the vendor's profit and thereby maximize its own commission. Under a CPC contract, the vendor pays the platform a commission based on the total click-through rate, and the platform's goal is to maximize the total click-through rate, which has two components: $CTRs(x) = xe^* + (1 - x)(e^* + \hat{q} - ry)$. The first component is the click-through rate generated by inattentive consumers, and the second component is the click-through rate generated by attentive consumers.

Lemma 3. *(Ambiguity choice of the platform under a PSC) When the market state is harsh ($t < 0$), the platform and the vendor enter into a profit-sharing contract, and the authorities may implement three distinct levels of regulation; the platform's ambiguity choices x_p^* are as follows:*

(i) when the regulation is strict $\bar{x} \in [0, \bar{x}_1)$, $x_p^* \in (0, \bar{x}_1]$;

(ii) when the regulation is moderate or lenient $\bar{x} \in [\bar{x}_1, 1]$, $x_p^* = \bar{x}$.

Under a PSC, when the government adopts relatively moderate regulation $\bar{x} \in [\bar{x}_1, 1]$, the incentives of the platform and the vendor are aligned. The platform's adoption of a ceiling strategy maximizes its own profit while also maximizing realized profit.

In Lemma 4, we observe that a CPC contract leads the platform to adopt a saturation strategy (i.e., not continuously increasing advertising ambiguity), resulting in incentive misalignment between the platform and the vendor, and preventing realized profit from reaching its maximum.

Lemma 4. *(Ambiguity choice of the platform under a CPC contract) When the market state is harsh ($t < 0$), the platform and the vendor enter into a CPC contract, and the authorities may implement three distinct levels of regulation; the platform's ambiguity choices x_c^* are as follows:*

(i) when $0 < q < \frac{1}{2}$ and $q < ry < ry_{Small}$, $x_c^* = \overline{x}_1$ and when $ry_{Small} < ry < 2q$, $x_c^* = \overline{x}_2$;

(ii) when $\frac{1}{2} < q$, $x_c^* = \overline{x}_2$. ry_{Small} *increases in q, as defined by the condition* $f'(t) = 0$ *in the Appendix.*

Table 2 describes which effects dominate under different regulatory intensities. In the harsh state, focalism is always present. Under strict regulation, entertainment level and ambiguity are unrelated; vendors set high prices and target only a portion of consumers, and the click-through rate is already excessive, so the latter two effects do not apply. Under moderate regulation, entertainment level increases with ambiguity, the substitution effect is negative, and the price exactly targets the marginal inattentive consumer; hence, the multiplier effect is also negative. Under lenient regulation, entertainment level decreases with ambiguity, the substitution effect is positive, and the vendor sets low prices while targeting all consumers, so the multiplier effect is also positive.

Table 2. Regulations and effects under a PSC ($t < 0$).

	Focalism	Substitution	Multiplier
Strict Regulation	✓	-	-
Moderate Regulation	✓	negative	negative
Lenient Regulation	✓	positive	positive

The results indicate that when consumers have low expectations of product quality, high advertising exposure, and high advertising aversion, strict regulation leads to a higher entertainment level. Vendors then pass some entertainment costs on to consumers by raising prices, which reduces vendor profit and consumer surplus. By contrast, relaxed regulation leads platforms to consistently adopt a ceiling strategy (i.e., $x = \bar{x}$), which carries the risk of excessive ambiguity. Excessive ambiguity not only creates a crisis of public trust in the platform but also harms the interests of content creators on the platform. Therefore, when authorities regulate ambiguity, they must consider not only market conditions and contract types but also the trade-off between economic and social interests.

3.5. Realized profits under different states

Under a PSC, the incentives of the platform and the vendor are aligned, which maximizes sales profit. Only when $t < 0$ do the platform and vendor use native advertising to reduce consumer aversion to viewing ads in Stage 2, thereby increasing the overall click-through rate. Otherwise, transparent ads are preferable, and any level of regulation hinders economic profit. Figure 4 verifies the result of Lemma 3, which states that more relaxed regulation ensures that the platform's revenue does not decrease. Proposition 1 provides a detailed explanation of the differences in realized profit generated by a PSC when $t < 0$.

Proposition 1. *(Realized profit of the vendor) When* $t < 0$*, relaxing ambiguity regulation under a PSC can increase realized profit; under a CPC contract, relaxing ambiguity regulation can increase realized profit only when regulation is strict or moderate.*

Under a CPC contract, the platform aims to maximize the total click-through rate, which creates inconsistency with the vendor's incentives. Proposition 1 and Lemma 3 indicate that the area above the yellow line and below the green line is the profit zone that the vendor cannot attain; this is also the

only area in which the CPC contract and the PSC diverge. The realized profit that a vendor can obtain is always below the yellow line. The blue shaded area represents the set of highest possible profits that the vendor could achieve under all possible moderate regulations. Proposition 2 states that when $t > 0$, the CPC contract and the PSC are completely equivalent.

Proposition 2. *(Realized profit of the vendor) When $t > 0$, transparent-format ads maximize realized profit and the click-through rate.*

When $t > 0$, attentive consumers have a higher probability of clicking the link, while increasing ad ambiguity reduces the number of attentive consumers, ultimately restricting the vendor's pricing and reducing realized profit. At the same time, we can verify that the click-through rate $CTRs(x)$ is monotonically decreasing in x, which indicates that the platform chooses a transparent-format ad under both a CPC contract and a PSC.

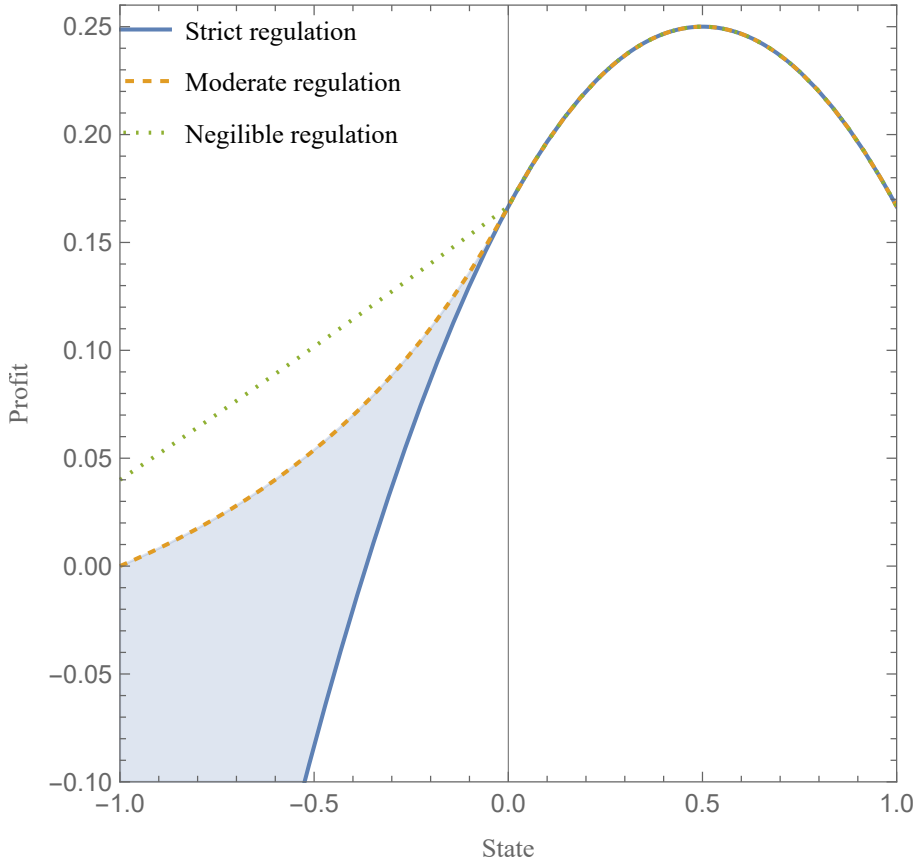


Figure 4. Realized profit.

Thus far, we have reached a straightforward conclusion: From the regulator's perspective, encouraging the use of PSC and adopting the most-relaxed regulation can always maximize realized profit regardless of market conditions. However, in practice, native advertising is not completely ambiguous, which indicates that governments regulate ad ambiguity. We also show that a CPC contract has its own advantages.

3.6. Net profit and platform self-regulation

In the remainder of the paper, we distinguish three private objectives and one public objective. A utilitarian platform maximizes realized profit, a night-watchman platform minimizes platform harm, and a balanced platform maximizes net profit, defined as realized profit minus platform harm. By contrast, the government maximizes total social welfare. Organizing the analysis around these objectives clarifies why different ambiguity thresholds appear in the subsequent propositions.

A PSC generates Pareto efficiency, so we mainly analyze the PSC in this section. Increasing ambiguity raises the click-through rate of inattentive consumers, and when $t < 0$, focalism leads inattentive consumers to dominate the behavior of both the platform and vendors. Inspired by the "funding awareness" and "transparency" effects [61], our model offers a detailed framework for how ad ambiguity affects different consumers. We conceptualize *platform harm* as the negative utility consumers experience, which arises from two distinct sources: *deception* and *hassle harm*[18]. This setup is rooted in the persuasion knowledge model, which posits that consumers form a knowledge base about persuasion tactics and activate it when they recognize a persuasion attempt, often triggering skepticism and negative affect [27]. Building on this foundation, our theoretical framework decomposes this general "negative affect" into two specific harm pathways: "deception" and "hassle harm."

First, deception cost arises from a failure of ad recognition. When ad ambiguity prevents consumers from immediately recognizing persuasive intent and leads them to realize only afterward that they were misled, they develop a more negative evaluation of the publisher (i.e., the platform) [4]. This provides key evidence for our setup: the harm exists and is directed at the platform because it stems from a feeling of being fooled and from a breach of trust. This mechanism explains the negative utility experienced by "inattentive consumers" after deception occurs.

Second, "hassle harm" refers to platform-level harm generated by the cognitive cost consumers incur after recognizing an ad and deciding whether to filter, process, or ignore it. When attentive consumers face incoming content, the process of evaluating, discerning, and ultimately deciding whether to ignore it consumes finite cognitive resources by activating their persuasion knowledge [62]. Hassle harm captures the cost borne by consumers even when they are not deceived, arising simply from the cognitive effort required to identify the ad. We summarize the two sources of platform harm as follows:

- Deception occurs when a consumer clicks a link believing it is editorial content, only to discover it is an advertisement.
- Hassle harm is generated by the cognitive cost incurred by consumers who successfully identify an ad and choose to ignore it.

The manifestation of these harms depends critically on the consumer's level of attention. We analyze two consumer types. First, for inattentive consumers, native ads are initially indistinguishable from editorial content. These consumers primarily experience deception-based harm: those who click the link are unpleasantly surprised, leading to aversion. By contrast, those who do not click remain unaware of the ad and thus feel no aversion. Second, attentive consumers can identify native ads upfront. They face a different trade-off. If they choose not to click, they incur a cognitive cost from filtering content. If they do click, they feel no aversion because they have made a fully informed choice based on interest in the ad's content and the product itself.

[18]We normalize the unit price of platform harm to 1.

Therefore, in our analysis, the platform-harm function is $PH(e, x) \equiv ry\{xe + (1 - x)[1 - (e + \hat{q} - ry)]\}$. The first term captures platform harm caused by inattentive consumers and the second term captures platform harm caused by attentive consumers. We assume that the platform experiences harm from inattentive consumers immediately after their clicking or searching behavior, regardless of whether they purchase the product in Stage 3. This is because, as described in Section 3.1, the consumer's purchase decision in Stage 3 is based solely on net utility and does not account for advertising aversion. Net profit, denoted by $NP(e, x) \equiv \Pi(e, x) - PH(e, x)$, represents realized profit after deducting platform harm.

We consider three types of platforms with different preferences. A platform that aims to maximize realized profit is referred to as a *utilitarian* platform. A platform that seeks to minimize platform harm is called a *night-watchman* platform; for example, an ambitious platform in its growth phase may minimize harm to enhance its reputation regardless of the realized profit. A platform that maximizes net profit is referred to as a *balanced* platform.

Based on Proposition 1 and Figure 4, when $t < 0$, the utilitarian platform imposes no regulation at all (i.e., $\bar{x} = 1$). If the individual aversion level (ry) is sufficiently high, platform harm (PH) increases in ry. Thus, the higher an individual consumer's aversion to ads, the greater the platform harm.

Proposition 3. *(Ambiguity regulation of a night-watchman platform) When* $\frac{3}{2} < q \le ry < 3q - 3$*, the night-watchman platform always regulates its ambiguity. (i)* $ry \in \mathcal{S}, x^*_{PH} = 0$*; (ii)* $ry \notin \mathcal{S}, x^*_{PH} = x_M$*, where* $\mathcal{S} = \{(q, ry) \mid \frac{16}{7} \le q \le ry \le 3q - Z_1\}$*,* $x_M = \frac{\sqrt{3}q}{\sqrt{q(2q+t-1)}} - 1$.

Proposition 3 provides a harm-minimization benchmark. Because the night-watchman platform ignores realized profit, it regulates ambiguity solely to reduce platform harm. The formal boundary set $\mathcal{S}$ is useful for the proof but is not needed for the main graphical comparison. For this reason, Figure 5 abstracts from the internal structure of $\mathcal{S}$ and retains only the main switching logic that motivates the later comparison with the balanced platform and the government.

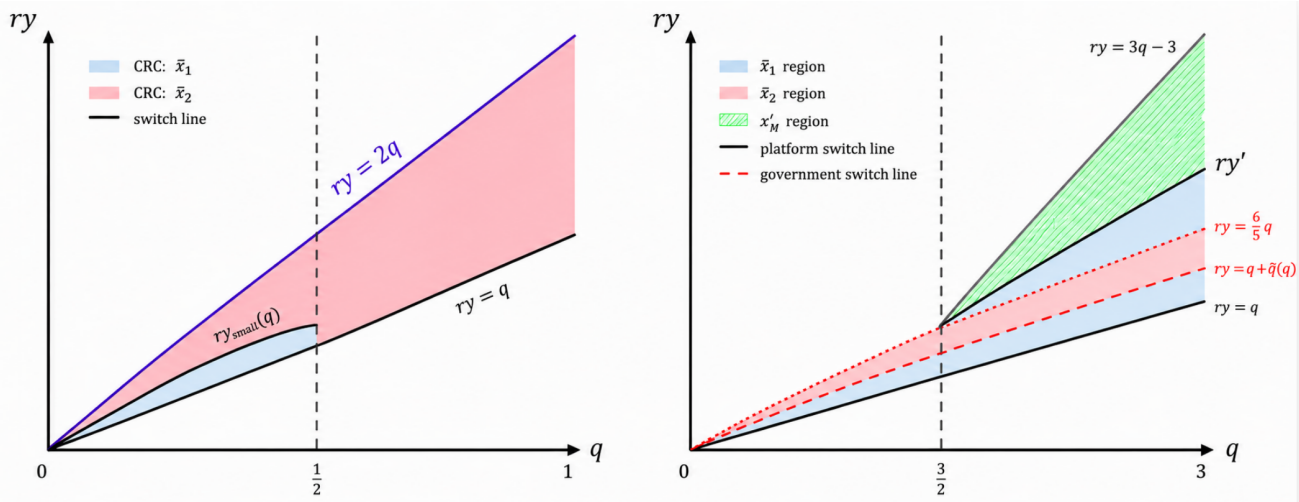


Figure 5. Switching regions for ambiguity regulation.

Proposition 4. *(Ambiguity regulation of a balanced platform) (i) When* $q < \frac{3}{2}$*, or* $q > \frac{3}{2}$ *and* $3q - 3 < ry$*, the balanced platform does not impose any regulation on the ambiguity level.*

(ii) When $q > \frac{3}{2}$*:*

(a) If $q < ry < \min\{ry', 3q - 3\}$*, the balanced platform sets the ambiguity level* $x^*_{NP} = \overline{x}_1$.

(b) If $\max\{q, ry'\} < ry < 3q - 3$*, the balanced platform sets the ambiguity level* $x^*_{NP} = x'_M$*, where* x'_M *and* ry' *are defined in the Appendix.*

Proposition 4 highlights that a balanced platform does not behave as it would under a CPC contract. Under a CPC contract, the platform maximizes click-through, whereas a balanced platform trades off realized profit against platform harm. Hence the balanced platform switches between the lower ambiguity boundary $\bar{x}_1$ and the higher ambiguity level x'_M, with ry' as the relevant switching threshold. When advertising aversion is moderate, deception concerns dominate and the platform prefers the lower ambiguity level. When advertising aversion becomes sufficiently high, hassle harm dominates and the platform is willing to tolerate a higher ambiguity level.

We now focus on the switching regions for ambiguity choices under a CPC contract, balanced-platform self-regulation, and the government benchmark. Panel (a) summarizes the CPC-induced ambiguity choice in Lemma 4. The light-blue region denotes $x^*_C = \bar{x}_1$ and the light-pink region denotes $x^*_C = \bar{x}_2$. The lower black line is $ry = q$, the upper purple line is $ry = 2q$, and the black switch line labeled $ry_{\text{switch}}(q)$ corresponds to $ry_{\text{Small}}(q)$ in Lemma 4. Panel (b) compares the government benchmark and the balanced platform's self-regulation. The lower light-blue band denotes the government's $\bar{x}_1$ region, the light-pink band above it denotes the government's $\bar{x}_2$ region, the upper light-blue wedge denotes the balanced platform's $\bar{x}_1$ region, and the green hatched wedge denotes the balanced platform's x'_M region. The red dashed line is $ry = q + \tilde{q}(q)$, the red dotted line is $ry = \frac{6}{5}q$, the black line labeled ry' is the balanced platform's switching threshold, and the upper gray line is $ry = 3q - 3$. Blank areas indicate parameter regions outside the case partitions highlighted in the figure.

Figure 5 summarizes the switching logic behind Lemma 4, Proposition 4, and Proposition 6 in a self-contained way. Panel (a) shows the CPC-induced ambiguity choices across parameter regions. In the low-q harsh-market region, the platform under a CPC contract selects the lower ambiguity boundary $\bar{x}_1$ when $q < ry < ry_{\text{Small}}(q)$, but switches to $\bar{x}_2$ once ry exceeds the switching threshold. In the higher-q region shown in the panel, the platform under a CPC contract chooses $\bar{x}_2$. Thus, the platform under a CPC contract follows a saturation logic: ambiguity is increased only when doing so is useful for maintaining click-through incentives.

Panel (b) compares two decision rules. The government benchmark is represented by the two lower bands: the government chooses $\bar{x}_1$ when $q < ry \le q + \tilde{q}(q)$ and switches to $\bar{x}_2$ when $q + \tilde{q}(q) < ry \le \frac{6}{5}q$. Above these regions, the balanced platform's self-regulation is represented by the two upper regions: the platform chooses $\bar{x}_1$ when advertising aversion is moderate and switches to the higher ambiguity level x'_M once ry exceeds the switching threshold ry'. Taken together, these switching patterns reflect a common economic intuition: when advertising aversion and the associated hassle harm become stronger, full transparency may impose a greater cognitive burden on consumers who recognize the content as advertising, thereby preventing them from entering the search stage. As a result, the relevant decision-maker may tolerate a higher ambiguity boundary to preserve search participation. The figure therefore makes clear that the threshold under the CPC contract, the balanced-platform threshold, and the government welfare threshold are distinct. They may coincide in some parameter regions, but they generally do not.

The blank regions also have a clear interpretation. In both panels, the blank area below $ry = q$ corresponds to the good-market case $t > 0$. In this region, consumers' expected product quality exceeds their advertising aversion, so the harsh-market switching results highlighted in the figure do not apply. In

Panel (a), the blank area above the displayed feasible region under the CPC contract indicates parameter values for which the CPC contract is less advantageous than the PSC for the platform. In Panel (b), the blank area above $ry = 3q - 3$ corresponds to a region in which the balanced platform does not regulate ambiguity under Proposition 4(i).

Proposition 5. *(The path of the ad impression strategy) As quality improves, a balanced platform always increases the number of advertising impressions while strictly controlling it at the minimum feasible level. Specifically, (i)* $\frac{q}{y} \le r < r', y^* = \frac{q}{r}$*; (ii)* $r' \le r, y^* = \frac{h^{-1}(q)}{r}$.

Given the consumers' advertising-aversion index r, Proposition 5 establishes a one-to-one correspondence between product quality and the platform's advertising impression, which serves as the platform's reaction function to the vendor's quality improvements. Regardless of the aversion index, the platform consistently increases advertising exposure as quality improves. However, as consumers' aversion index increases, the platform reduces advertising exposure. In our framework, advertising impression is an "adverse decision" that does not lead to higher sales but does reduce click-through rates in Stage 2. Accordingly, when $r < r'$ ($r > r'$), the platform lowers (raises) ambiguity to capture more attentive (inattentive) click-through rates while mitigating deception harm (hassle harm). Proposition 5 states that the balanced platform always increases advertising impression while strictly controlling it at the lowest possible level as the vendor's quality improves.

3.7. Social welfare and government regulation

The previous section studied self-regulation under private objectives. We now turn to a rule-maker that maximizes total social welfare. Unlike the platform, the government does not choose ambiguity to maximize click-through or platform net profit. Instead, it evaluates how ambiguity affects consumer surplus, search participation, targeting, and realized transactions. This distinction implies that the welfare-switching threshold need not coincide with either the threshold under the CPC contract or the balanced-platform threshold.

Proposition 6. *(i) If* $q < ry \le q + \tilde{q}$*, the government chooses* $\bar{x}_1$ *to maximize social welfare. (ii) If* $q + \tilde{q} < ry \le \frac{6}{5}q$*, the government chooses* $\bar{x}_2$ *to maximize social welfare (see the Appendix for* $\tilde{q}$*).*

Proposition 6 shows that welfare maximization does not always require the strictest ambiguity regulation. When advertising aversion is relatively low, the government chooses $\bar{x}_1$. When advertising aversion is higher but still within the welfare-relevant range, the government switches to $\bar{x}_2$, because some ambiguity can induce search by consumers who would otherwise exit before learning product quality. This expands consumers' market participation and improves the welfare of the involved parties. The critical point is that the welfare-switching boundary $q+\tilde{q}(q)$ is generally different from the switching threshold under the CPC contract and from the balanced platform's switching threshold ry'.

Table 3 complements Figure 5 by showing more explicitly when the CPC-induced ambiguity boundary coincides with the government's welfare benchmark and when the two diverge.

Table 3 formalizes the limited overlap between the CPC contract and the welfare benchmark. In some regions, the platform under a CPC contract and the government choose the same ambiguity boundary; in others, they diverge because click-through maximization and welfare maximization respond to different margins. Figure 5 and Table 3 therefore deliver the same message: contract-induced regulation can partially mimic public regulation, but only in restricted parameter regions.

The analysis so far assumes that consumers who recognize the content as advertising can obtain product-quality information from the ad. In practice, however, the limited length, space, or duration of advertising content may make it difficult for consumers to acquire sufficient quality information before entering the search stage. We next relax this setting and consider whether the same regulatory logic continues to hold when the informational role of advertising content is restricted.

Table 3. Comparison between CPC-induced ambiguity and socially optimal regulation.

Comparison	Condition	CPC contract	Government	Result
Low-q, low aversion	$0 < q < 1/2,\ q < ry \le \min\{ry_{\text{Small}}, q + \tilde{q}\}$	$\bar{x}_1$	$\bar{x}_1$	Align
Low-q, threshold mismatch	ry lies between ry_{Small} and $q + \tilde{q}$	Switches at ry_{Small}	Switches at $q + \tilde{q}$	Diverge
Low-q, higher aversion	$0 < q < 1/2,\ \max\{ry_{\text{Small}}, q + \tilde{q}\} < ry \le \frac{6}{5}q$, if non-empty	$\bar{x}_2$	$\bar{x}_2$	Align
High-q, low aversion	$q > 1/2,\ q < ry \le q + \tilde{q}$	$\bar{x}_2$	$\bar{x}_1$	Diverge
High-q, higher aversion	$q > 1/2,\ q + \tilde{q} < ry \le \frac{6}{5}q$	$\bar{x}_2$	$\bar{x}_2$	Align

4. Restricted advertising content

In this section, we discuss how a vendor, after completing production and obtaining sufficient market information about product quality, makes decisions about entertainment level and pricing, and responds to changing levels of ambiguity. In the previous analysis, we assumed that advertising provides sufficient quality information; that is, attentive consumers can discern product quality after identifying the advertisement, while inattentive consumers must still search to learn it. However, because native advertising can be deceptive and the advertisement itself has limited duration and space, it is difficult for all consumers to learn product quality during Stage 2, when they read the advertisement.[19]

We focus on the case of limited quality information, i.e., when $\hat{q} \neq q$, and examine the resulting changes in entertainment level and ambiguity. For simplicity, we assume two product types, $q, \hat{q} \in \{H, L\}$. We also assume a pessimistic belief structure, i.e., the off-equilibrium-path belief is $\Pr(H|e \neq e^*) = 0$, where e^* is the vendor's action on the equilibrium path.[20] To ensure equilibrium uniqueness and Pareto efficiency, we use the lexicographic maximum sequential equilibrium (LMSE)[21] to refine multiple equilibria. Proposition 7 shows that when native-advertising content is restricted, the separating equilibrium increases the total entertainment level on the platform.

Proposition 7. *To differentiate themselves from low-quality vendors, high-quality vendors always invest more in entertainment.*

The analysis in Proposition 7, together with the previous section, shows that the increase in the

[19] If consumers already know product quality before reading the advertisement, then the analysis returns to the setting in the previous section.

[20] Alternative off-equilibrium beliefs mainly shift the boundary between pooling and separating regions; the qualitative-signaling mechanism remains unchanged.

[21] We use the LMSE rather than the Intuitive Criterion because the restricted-content extension characterizes how the quality gap and ambiguity regulation determine the transition between pooling and separating outcomes. In our model, entertainment investment is both a quality signal and a real demand-creation decision that affects consumer search and vendor profit, rather than a purely dissipative signal.

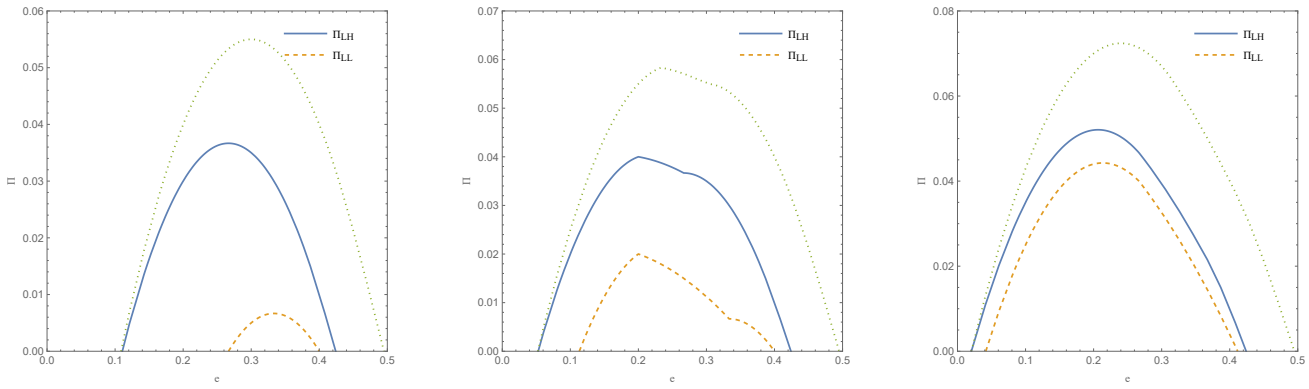
entertainment level of ads on the platform stems from two main reasons. First, when product quality is insufficient ($t < 0$), stricter ambiguity regulation matters. Second, when ads cannot convey quality information, high-quality vendors increase their entertainment level. Proposition 8 indicates that when q_L is moderate and $t < 0$, relaxing ambiguity regulation generally reduces the total entertainment level on the platform. In other parameter ranges, the entertainment-level decisions of H-type vendors are difficult to predict.

Proposition 8. *Let $t_H = q_H - ry$ and $t_L = q_L - ry$, with β_2 and β_3 defined in the Appendix. When $\underline{q}_L \le q_L \le \bar{q}_L$, in the separating equilibrium, as regulatory intensity decreases, the H-type vendor increases its entertainment level, while the L-type vendor first increases and then decreases its entertainment level, where*

$$\bar{q}_L = \min\left\{\frac{\beta_2 - (1-x)t_H}{2}, \frac{2ry(1+x)}{1+4x}, \frac{\beta_3 - (1-x)t_H}{2}\right\}, \qquad \underline{q}_L = \frac{(1-x)ry}{3-x}.$$

Notably, Proposition 7 holds under the condition that the gap between q_H and q_L is significant (similar to Proposition 9). When the gap between q_H and q_L is small, restricted advertising does not increase the total entertainment level on the platform.

Proposition 9. *When $q_H - q_L < \Delta$, where $\Delta = 2\min\{\sqrt{\Delta_1}, \sqrt{\Delta_2}, \sqrt{\Delta_3}\}$, in the pooling equilibrium, as regulatory intensity increases, both types reduce their entertainment levels (see the Appendix for Δ_1, Δ_2, and Δ_3).*



(a) Profit under strict regulation **(b)** Profit under moderate regulation **(c)** Profit under lenient regulation

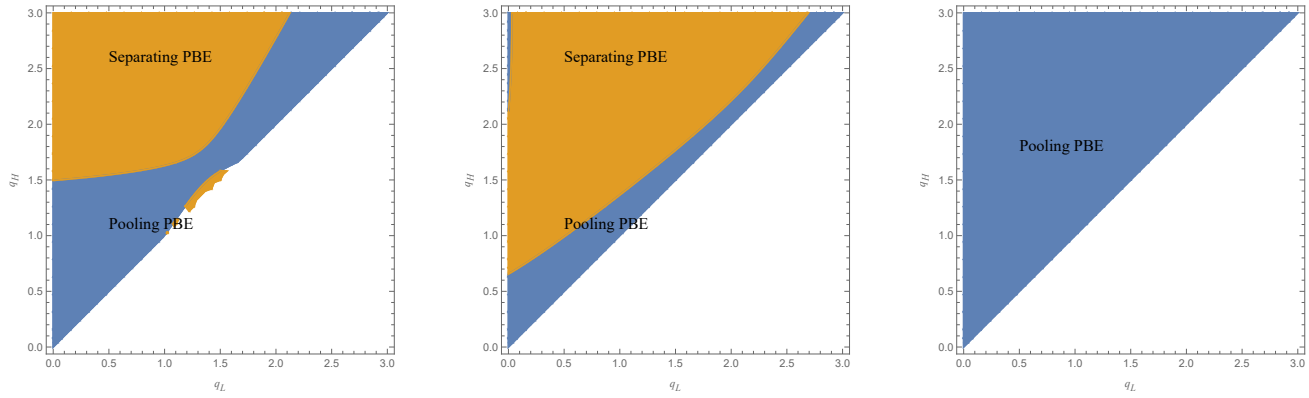
Figure 6. Profit under restricted ad content.

Remark 1. *When advertising content is restricted: (i) H-type vendors suffer a decrease in profit, while L-type vendors experience an increase in profit, and (ii) the entertainment level of ads on the platform increases, and the number of consumers entering the search phase also rises.*

When advertising content is restricted (e.g., by playback duration, frequency, or display area), H-type vendors always suffer profit losses, whereas L-type vendors do not. As a result, H-type vendors attempt to signal product-quality information on websites or in videos during Stage 2, before consumers begin searching. This signaling behavior increases the number of searching consumers, thereby increasing the L-type vendor's profit while reducing the H-type vendor's profit because of the additional entertainment investment. In practice, platforms often impose restrictions on advertising content because such

restrictions do not necessarily reduce platform commission. When the quality gap between products is small or ambiguity regulation is lenient (as shown in Figure 6), L-type vendors can increase profit by increasing the entertainment level and achieving a pooling equilibrium, which in turn increases the platform's commission under a PSC.

Meanwhile, when advertising content is restricted, adopting a CPC contract always increases the platform's revenue because more consumers enter the search phase than when quality information is displayed. However, this increase in the click-through rate does not stem from consumer interest in the product itself; rather, it stems from the H-type vendor's motivation to signal product quality. Counterintuitively, similar to Lemma 4 and Proposition 6, if the refined PBE selects a separating equilibrium, restricted advertising content increases the total entertainment level on the platform. This occurs because a higher entertainment level stimulates more consumer search, expands participation by each agent type, and thereby enhances social welfare. However, if the refined PBE selects a pooling equilibrium, social welfare does not necessarily increase and instead depends on consumers' prior beliefs about product quality. When prior beliefs are low, a pooling equilibrium may reduce social welfare. Figure 7 illustrates the refined equilibrium under the LMSE refinement: with lenient ambiguity regulation, only a pooling equilibrium is possible; with strict or moderate regulation and a sufficiently large quality gap, a separating equilibrium may emerge. Because Proposition 7 also requires a sufficiently large quality gap, our analysis suggests that when advertising content is restricted, the government should avoid lenient regulation, and a larger quality gap is conducive to improving social welfare.



(a) Strict regulation **(b)** Moderate regulation **(c)** Lenient regulation

Figure 7. Equilibrium under restricted advertising.

5. Conclusion

We consider a scenario in which a vendor uses native ads delivered by a platform to attract consumers to search for and purchase products, with the platform's ambiguity policy endogenously affecting consumers' search costs. Our focus is on how agents with different preferences choose regulatory strategies that affect the vendor's targeting and entertainment level, particularly when ad exposure is saturated or quality is insufficient.

Our analysis reveals a chain reaction triggered by ambiguity choices, which depends on the platform's preferences and on whether the government intervenes through regulation. By incorporating an

entertainment-before-search stage, we isolate the attraction effect from ambiguity itself, complementing existing literature on native ads that emphasizes the use of ambiguity to capture consumer attention and its signaling role [18, 41]. The findings indicate that agents with different preferences adopt distinct ambiguity policies, driven by consumers' advertising aversion and product quality. We examine three types of platforms and find that, in most cases, the two market-based contract types fail to achieve the platform's objectives and coincide with the government's social-welfare objective only under specific parameter conditions.

The motivations for different ambiguity-regulation strategies stem from three effects that sequentially affect the vendor's entertainment and pricing decisions. In our main model, *focalism* means that inattentive consumers generate higher CTRs for the vendor and for platforms using a CPC contract. Building on this, the *substitution effect* applies in the region where ambiguity substitutes for entertainment, rather than implying a globally monotonic relationship between ambiguity and entertainment. The *multiplier effect* enables price reductions when ambiguity increases and entertainment decreases. The underlying *focalism* ensures that the platform always adopts the lowest advertising impression when the vendor's product quality improves. We also consider scenarios in which advertising content is restricted, preventing quality disclosure in the initial advertisement. In such cases, the entertainment level of advertisements on the platform almost always increases relative to the main model, but decreases as ambiguity rises.

Our study offers several key implications for platforms with varying preferences and for the government. First, adopting a *PSC plus ambiguity ceiling strategy* maximizes the combined profit of the platform and vendor, but platforms should engage in appropriate self-regulation to mitigate reputational damage. Second, the government's objectives are not generally aligned with those of any platform, and a CPC contract should be viewed as a conditional and complementary self-regulatory mechanism rather than as a general replacement for government regulation. A CPC contract can facilitate the government's welfare objective only when the ambiguity level induced by the CPC contract coincides with the welfare-maximizing boundary; when the private threshold under the CPC contract differs from the welfare threshold, direct government regulation remains necessary. Third, when vendor quality is insufficient, platforms should reduce the number of advertising impressions. Finally, we verify the existence of focalism and substitution effects under restricted advertising content, suggesting that when quality information cannot be disclosed, the entertainment level should increase to signal quality, although this increase can be moderated under lenient ambiguity regulation.

Future research could explore advertising strategies in the data era, such as how designers target native ads based on consumer information collected by platforms and whether such changes affect government and platform ambiguity choices. In addition, empirical studies based on real platform data could further validate the behavioral descriptions of platforms with different preferences presented in this paper.

Author contributions

Yafei Yu: Conceptualization, methodology, formal analysis, validation, investigation, visualization, writing – original draft, writing – review and editing; Decheng Wen: Supervision, resources, funding acquisition, writing – review and editing; Xiao Chen: Supervision, resources, validation, project administration, writing – review and editing.

Use of Generative-AI tools declaration

The authors used ChatGPT and Claude to assist with literature searching and partial synthesis in the literature review, as well as language polishing and formatting throughout the manuscript. All AI-assisted material was reviewed and verified by the authors, who take full responsibility for the final content.

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Conflict of interest

The authors declare that there is no conflict of interest.

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