Regulating the Influencers: Who Gains from FTC Regulation?*

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Abstract

Consumers increasingly rely on product reviews by influencers to make a purchase decision. As firms have an incentive to influence the reviewers through unobserved payments, it can be difficult to sustain market outcomes with informative independent reviews. Recent FTC regulations require mandatory disclosure of all paid advertising content so that buyers can differentiate between paid and independent product reviews. This paper investigates the impact of this disclosure policy on market outcomes when the influencer has the expertise to evaluate product quality and influence the beliefs of potential buyers. The results indicate that the disclosure policy decreases the prevalence of paid reviews, though they persist. Consequently, there is an increased likelihood of no reviews, which impedes the dissemination of valuable information regarding product quality to consumers, and an increased likelihood of independent reviews, which improves the quality of the information. The key implication is that the effectiveness of the disclosure regulation is non-existent or even negative when the regulatory concerns are at their maximum.

JEL Classification: D11, D42, D82, L12, L51, M37

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1 Introduction

In the current world of social media and blogging, the advertising of products has taken on a new, more creative form. Influencers are the "local" celebrities who post reviews of various products on social media platforms (such as Facebook, Twitter, Instagram) or their own blogs. Their followers rely on these reviews as sources of information about the product. Influencer advertising has gained prominence over other forms of advertising for various reasons. Each influencer has his/her own local network of followers (consumers), which leads to the diffusion of information.[1] It is also found that electronic word of mouth leads to a direct increase in sales.[2] Further, there is significant empirical evidence that social media platforms can strongly influence the beliefs and perceptions of their followers.[3]

However, there is a widespread concern that the influencers may be affiliated with the sellers of the product, in which case the influencer may post a biased or inflated review in exchange for payment. In that case, these reviews are a form of native advertisement; the followers may not observe the fact that it is a paid promotion.[4] Such advertisements are also deceptive, as illustrated by recent cases prosecuted by the Federal Trade Commission (FTC).[5] For example, an online company, Teami LLC, reportedly paid influencers to inflate their views about the weight loss characteristics of its herbal tea products without any clinical evidence.[6] A fashion retailer, Lord & Taylor, was charged for paying influencers to promote their dresses without disclosing the affiliation.[7] Similarly, Warner Brothers failed to disclose that they paid influencers to promote their new video game back in 2016.[8]

In response, regulatory bodies in several countries have made it mandatory for influencers to disclose if they have been paid to review a product. The FTC, the Competition Bureau in Canada, and the European Advertising Standards Alliance require a clear and prominent disclosure from the influencer of any "material" relationship with the seller.[9] This paper addresses the effect of this kind of regulation on the market outcome; in particular, it characterizes the nature of the market environments in which such disclosure policy is likely to have a positive impact as well as to characterize the economic environments where it is likely to be ineffective. Further, I analyze the equilibrium in terms of consumer beliefs about product quality, the biasedness of reviews by influencers, firm profits and consumer surplus.

I formulate a model where buyers are aligned with a social influencer according to their tastes and preferences. The influencer is an expert who can judge which products will appeal to his followers. The followers are the potential buyers for the seller and do not know the true quality of his product. The influencer's review provides a potential source of valuable information on product quality for the

[1] Kiss & Bichler (2008) and Hamami (2019)

[2] Godes & Mayzlin (2009); Rosario et al. (2016)

[3] Del Vicario et al. (2016); Alatas et al. (2019); Diehl et al. (2019); Muller & Schwarz (2020)

[4] https://www.nytimes.com/2016/07/25/business/sponsored-content-takes-larger-role-in-media-companies.html

[5] https://www.ftc.gov/news-events/press-releases/2016/07/warner-bros-settles-ftc-charges-it-failed-adequately-disclose-it

[6] https://www.ftc.gov/legal-library/browse/cases-proceedings/182-3174-teami-llc

[7] https://www.ftc.gov/news-events/news/press-releases/2016/03/lord-taylor-settles-ftc-charges-it-deceived-consumers-through-paid-article-online-fashion-magazine

[8] https://www.ftc.gov/news-events/news/press-releases/2016/07/warner-bros-settles-ftc-charges-it-failed-adequately-disclose-it-paid-online-influencers-post

[9] https://www.ftc.gov/tips-advice/business-center/guidance/disclosures-101-social-media-influencers; https://www.competitionbureau.gc.ca/eic/site/cb-bc.nsf/eng/04512.html; https://www.easa-alliance.org/news/easa/easa-launches-best-practice-recommendation-influencer-marketing-0

buyers.

The seller has an incentive to influence the review process through payments that are contingent on favorable reviews as it can potentially allow the seller to charge a higher price and earn a higher profit. In particular, if buyers cannot observe that the review is paid for and believe that the influencer is independent, the seller has a very high incentive to enter into a paid arrangement and deceive the buyers. It is this incentive that creates the basic rationale for the disclosure regulation.

The influencer's type is determined on the basis of his skill level and trustworthiness. The skill level represents the expertise of the influencer and determines the degree of informativeness of the product review. The influencer's trustworthiness is dependent on his moral benefit from generating a genuine product review. The higher the weightage given to this moral benefit, the higher the trustworthiness of the influencer. This moral benefit is calculated as the increase in the consumer surplus due to the product review.

In the absence of regulation, consumers update their beliefs after observing a review and the corresponding price charged by the seller. When a disclosure policy is enforced, it requires that the influencer inform the consumers whether it is a paid promotion by the seller. Thus, consumers are able to update their beliefs on the basis of the review type as well as the review itself.

The results show that the equilibrium effect of the disclosure policy depends on various parameters that describe the influencer and the structure of imperfect information. The parameters describing the influencer are their level of expertise and how much they value information provision to their followers. The parameter governing the structure of imperfect information relates to the uncertainty of product quality.

It is found that the disclosure policy is ineffective in two types of market environments. First, an independent review outcome is sustained irrespective of the disclosure regulation if the influencer has a high level of expertise as well as trustworthiness. Second, a paid review outcome is sustained irrespective of the disclosure regulation if the influencer possesses high skill levels combined with low levels of trust or moderate skill levels combined with high levels of trust.

On the other hand, the regulation is effective when the influencer possesses a high skill level combined with an intermediate range of trustworthiness. In this setting, the disclosure regulation improves consumer surplus by changing the market outcome from a hidden paid review to a disclosed independent review. Surprisingly, in such economic environments, the disclosure regulation also increases the expected profit of the seller. In the absence of regulation, if buyers anticipate an independent review, the seller cannot help but secretly influence the review. When a disclosure policy is implemented, the affiliation is observable to the consumers and a paid review actually hurts the seller. As the seller can charge a higher price for an independent review due to its credibility, it is in the interest of the seller to lobby for such regulation.

From the perspective of positive economics, the results in the paper help us understand the kind of markets where disclosure regulation is likely to be most effective in leading to an independent (unsponsored) review. It also helps us to understand the settings in which the regulation is superfluous and therefore, any cost incurred by the society in the implementation of the regulation would be a deadweight loss. The results of this paper also explain the strong empirical evidence of the persistence of paid reviews even when the disclosure policy is in place, as shown by Ershov & Mitchell (2023).

The fact that the disclosure policy is ineffective when the expertise level of the influencer is high is somewhat surprising. Consumers value the opinion of an influencer with a high level of expertise and trustworthiness; his review will have a considerable impact on the consumers' beliefs. Such an influencer's review can generate a high level of economic value for the followers and therefore, the seller will have to pay a high level of compensation to introduce bias in the review. As a result, a paid review outcome cannot be sustained and the market outcome is one with independent review even if there is no disclosure regulation.[10]

Finally, when the influencer is of the type who is least concerned with the welfare of his followers, the regulatory concern is high as there is a high possibility of bias. The disclosure policy has a negative effect in terms of an increased incidence of no review outcome when the skill level is moderate. This leads to a fall in consumer surplus and seller's profit. The consumers do not have access to valuable information to make better decisions and sellers cannot afford to send out a paid review. In addition, when the skill level is high, the disclosure policy has no effect as the paid review outcome is sustained. The main implication is that the regulation could not protect the consumers when they are most affected by influencer advertising.

Several studies have contributed in the recent past to the growing field of influencer advertising. Particularly, Pei & Mayzlin (2022) model the relationship between the firm and the influencer with a focus on finding the optimal affiliation level under the disclosure policy. Their results show that the level of affiliation between the firm and the influencer depends on the consumer's prior beliefs and awareness about the product. However, in their framework, the prices are fixed and do not change with the influencer's review. As a result, the market outcome does not change significantly after the implementation of the disclosure regulation. In contrast, the endogenous price in this paper allows for a richer characterization of the equilibrium and allows us to obtain a clear comparison between the outcomes with and without the disclosure policy. Moreover, Mitchell (2021) presents a dynamic model that focuses on how the influencer maintains a long-term relationship with his followers and observes that the dynamic effect of the disclosure policy acts as a tax and may not have the desired effect. In contrast, I focus on the interplay of the influencer's relationship with both the firm and the followers. As the influencer maintains both relationships simultaneously, the effect of the disclosure policy can go either way.

For markets with multiple influencers, Fainmesser & Galeotti (2020) show how a search technology, that matches the followers with those influencers who provide the highest utility, provides a better social outcome than a disclosure requirement. In contrast, my paper describes how disclosure can be effective under some circumstances and why regulation may be superfluous otherwise. Janssen & Williams (2021) study the impact of influencer advertising on market outcome through the channel of consumer search. Product recommendation from an influencer initiates consumers to start their search from that product. Their focus is on the influencer's strategy of whether to provide more informative recommendations by ranking products offered by various firms.

This paper is also related to Inderst & Ottaviani (2012). In their paper, firms pay commissions

[10]Influencers also receive payments from social media platforms (such as Instagram, TikTok, YouTube etc) on the basis of the number of followers and views. Such payments help influencers who are honest and/or expert in their fields to maintain the revenue stream in the long run.

and compete to influence an intermediary who is an expert and can advise the consumer to buy their product; the consumers know that the intermediary has a commercial relationship with the firms. The business-stealing effect of influencing the influencer's recommendation is absent in the monopoly setting in my paper. Instead, it focuses on the effect of disclosure of whether or not there is any commercial relationship between the firm and the influencer (without any disclosure of the actual payments). Also, in their frameworks, the intermediary does not internalize the effect of his recommendation on the price paid by the buyers (and, therefore, their surplus). In fact, firms set product prices before observing the recommendation of the intermediary.

The economic effects highlighted in this paper are also somewhat related to the product certification literature, where the certification intermediary can potentially misreport the true quality for certain compensation. For instance, see Choi & Mukherjee (2020) for a situation where the firm decides on whether to certify the product through the intermediary knowing the true quality of its product.

There is also a large literature on the manipulation of consumer reviews and ratings by the firm to improve the beliefs of future buyers, for example, Mayzlin (2006), Burguet et al. (2015) and Aköz et al. (2021). There is no parallel to the analysis of the impact of the disclosure policy in these papers. Moreover, the reviewers do not derive any payoff from informing the consumers about the product quality. Finally, my paper is related to the well-established quality disclosure literature, for example, Daughety & Reinganum (2008 a, b), Rayo & Segal (2010), Janssen & Roy (2015).

This paper outlines a clear comparison of the market outcome with and without the disclosure regulation while focusing on both sides of the strategic interaction of the influencer: with the seller and the consumers/followers. Elaborating more on the latter part, the influencer faces a key trade-off when thinking about accepting payment from a firm for their review. On one hand, the influencer values the payment as it is a source of revenue for them. On the other hand, the influencer knows that doing a paid review will ultimately lead to them producing a less accurate review that is biased towards the firm's product being high quality. This will happen at least probabilistically; otherwise, the firm would not get any benefit from paying the influencer for their review. Because influencers value the information they provide to their followers, the payoff of the influencer falls with a paid review. This trade-off ties together the equilibrium payment by the firm to the influencer and the extent of bias in the review provided by the influencer.

The paper is organized as follows: Section 2 presents the model. Section 3 solves the influencer's and firm's problems and fully characterizes the equilibrium outcome. Section 4 analyzes the impact of the disclosure policy. Section 5 concludes. The detailed proofs are contained in the appendices.

2 Model

Consider a one-period product market with three players: seller, influencer and a unit mass of buyers. There is a single seller who invests in the production process. The investment can either be successful, i.e., the seller produces a high-quality product or can be a failure, i.e., the seller produces a low-quality product. The seller does not observe the true product quality. The seller sets a price, p that maximizes his expected profit.

There is a unit mass of buyers, each with a unit demand for the product. All buyers are rational and sophisticated. They have a common valuation v for the low-quality product. For the high-quality product, valuations are uniformly distributed between v and $1+v$: $v_H \sim U[v, 1+v]$. Like sellers, buyers also do not observe the product quality. The common prior beliefs of the buyers are given by $Pr(H) = \eta_0$. A buyer's purchase decision is based on maximizing the following expected utility function:

$$EU = \eta_0 \cdot v_H + (1 - \eta_0) \cdot v - p$$

There is a single influencer active on a social-media platform. He incurs a cost c to review the quality of the seller's product. c represents the net cost to the influencer in terms of time, effort and money spent in trying out the product *minus* any payments received from the social-media platform[11]. It is assumed that all buyers follow the influencer on the given platform. The review process works as follows. The influencer consumes the product. He may have a positive or a negative experience with the product. Depending on his knowledge base and skill level, the influencer provides a quality review based on his experience with the product. Let the skill level be denoted by s. The higher the s, the higher the informativeness and quality of the review. If $s = 0$, the influencer has zero skill level and hence, does not provide any accurate information through the review. If $s = 1$, the influencer is an expert and provides the most valuable information. Further, Nature selects the value of s according to a probability density function $f(s)$ that is uniformly distributed on the interval $[0, 1]$.

Based on the experience with the product, the influencer decides on the message to be sent, $m \in \{0, 1\}$. $m = 1$ indicates that the influencer infers product to be high-quality after a positive experience with the product and $m = 0$ indicates that the influencer infers the product to be low-quality after a negative experience with the product. Here the message captures the online product review by the influencer. The seller and the buyers do not observe s; they only observe the message m. Upon observing the message, the buyers update their beliefs using Bayes rule to $Pr(H|m) = \eta_1$. Their expected utility function changes to:

$$EU = \eta_1 \cdot v_H + (1 - \eta_1) \cdot v - p$$

The influencer's message informs buyers about the quality of the product and helps them with their purchase decision, free of cost. This implies that the review improves the utility gained by the consumer and hence, generates an economic value for each consumer. This is denoted by EV – economic value of the message – and is calculated as the increase in the total consumer surplus due to the review. Further details on the calculation of EV are given later in this section. $a \in [0, 1]$ represents how much the influencer cares about his followers' welfare and therefore, how much weightage he assigns to the economic value. Nature selects the value of a according to a probability density function $f(a)$ which is uniformly distributed on the interval $[0, 1]$. Note that s and a together represent the influencer's type, which is unknown to the seller and the buyers. However, they assign a common prior belief about the

[11]Social media platforms calculate these payments on the basis of the number of followers of the influencer and/or views of the influencer's post. Such payment is deducted from the cost of reviewing products to capture the true payoff of the influencer.

influencer type. As s and a are independent, these prior beliefs are represented by a joint probability density function as follows:

$$f(a,s) = \begin{cases} 1 & if\ (a,s) \in [0,1] \times [0,1] \\ 0 & otherwise \end{cases}$$

The seller may offer an opportunity for paid advertisement to the influencer wherein the influencer posts a positive review, $m = 1$, in exchange for some payment $\tau(m)$.[12] The seller has the ability to commit to this contingent payment. If the influencer accepts such an offer, then he sends a message which is influenced by his secret affiliation with the seller. Such a message is a paid review (PR) which generates the following payoff:

$$EP_I = \tau(m) + a\left[\mathbb{E}\left(EV_{PR}\right)\right] - c$$

where $\mathbb{E}\left(EV_{PR}\right)$ is the expected economic value generated under a paid review.

If the influencer rejects the offer or was not made an offer, he can send a message without any affiliation with the seller. Such a message is an independent review (IR) which generates the following payoff:

$$EP_I = a\left[\mathbb{E}\left(EV_{IR}\right)\right] - c$$

where $\mathbb{E}\left(EV_{IR}\right)$ is the expected economic value generated under an independent review. Alternatively, he may not send any message which generates zero payoff.

The timeline of the game is as follows:

(i) Nature determines the influencer type, drawn from the joint probability density function $f(a,s)$. Only the influencer observes his type.

(ii) The seller invests in the production process. No one observes the true product quality.

(iii) The seller decides whether to make an advertisement offer to the influencer or not. If he makes such an offer, then he decides on a contingent payment contract to be made to the influencer.

(iv) The influencer decides whether to accept or reject the seller's offer. Based on his decision, a message m may be sent.

(v) Based on the influencer's decision, the seller sets a price, p, which maximizes his expected profit.

(vi) After observing the message sent by the influencer and the price set by the seller, buyers update their beliefs and make a purchase decision.

Finally, the above setup changes when a disclosure policy is in effect. Such a policy requires the influencer to disclose if the message was sent in affiliation with the seller. I denote the affiliation level by $\theta \in \{0,1\}$. If $\theta = 1$, the influencer is affiliated with the seller. If $\theta = 0$, the influencer has no

[12] This payment is a compensation offered by the sellers and is separate from the one by the social media platforms.

affiliation with the seller. This alters the posterior beliefs of the buyers, which is now dependent on the type of review and the review itself: $Pr(H|m,\theta) = \eta_1(m,\theta)$. The rest of the setup is unchanged. The solution concept is that of perfect Bayesian equilibrium in pure strategies satisfying the Intuitive criterion (Cho and Kreps, 1987).

Demand Curve

Given the prior beliefs of the consumers and the valuation structure described above, maximizing the expected utility function generates a linear demand curve as shown in Figure 1. For any price p, $\left(1 + \frac{v-p}{\eta_0}\right)$ fraction of consumers wish to purchase the product. Given this demand curve, the seller maximizes his profit to determine the optimal price. In case of no review, the price charged by the seller is based on the prior beliefs[13]:

$$p = \frac{\eta_0 + v}{2}$$

When a review is posted, the consumers evaluate the message on the basis of their beliefs about the influencer type. After such an evaluation, consumers update their beliefs about product quality. The linear demand curve generated is shown in Figure 2. For any price p, $\left(1 + \frac{v-p}{\eta_1}\right)$ fraction of consumers wish to purchase the product. The price maximizing the seller's profit depends on whether the review is positive or negative and is given by:

$$p = \frac{\eta_1(m) + v}{2}$$

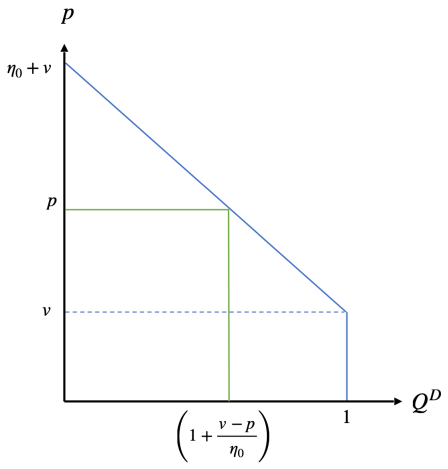

Figure 1: Demand Curve under no message

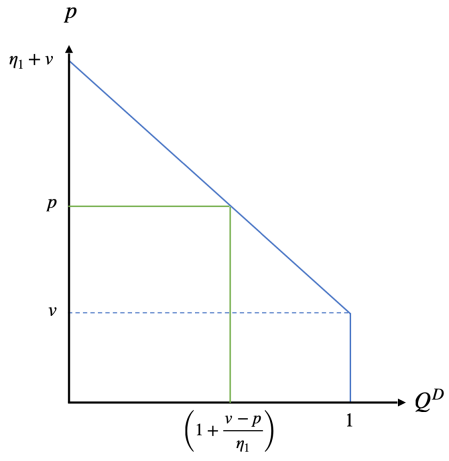

Figure 2: Demand Curve after a message is sent

[13] A "no review" signals to the consumers some information about the influencer type but no information about the product quality.

Economic Value of the Message

EV is the change in the utility of the consumers after a review is posted. It is measured by the difference between the consumer surplus when a review is generated and the consumer surplus in the absence of a review. In this section, I provide the economic intuition behind the calculation of EV. A detailed mathematical calculation is given in Appendix A.

When the seller makes an advertisement offer to the influencer, he needs to accept or reject before consuming the product. Therefore, the influencer decides on the basis of the *expected* economic value that can be generated from his review. If the influencer rejects the offer, he posts an independent review which generates the following economic value:

$$\mathbb{E}\left(EV_{IR}\right) = \eta_0 \cdot EV(m=1) + (1-\eta_0) \cdot EV(m=0) \tag{1}$$

EV generated from a positive review, $m = 1$, is shown in Figure 3. A positive review is posted if the influencer infers high quality after consuming the product. Upon observing a positive message, the consumers incorporate this information in their purchase decision. This does not mean that they are certain that it is a high-quality product. They now believe that the product is of high quality with a higher probability than their prior beliefs. This leads to an increase in their willingness to pay for the product. Therefore, the demand curve rotates upward. The seller charges a higher price due to this positive change in the perceptions of the consumers. The new demand curve determines the total demand generated at this price. Despite paying the higher price, more consumers are able to consume a high-quality product than under the no-review case. Therefore, the increase in consumer surplus and the EV are positive.

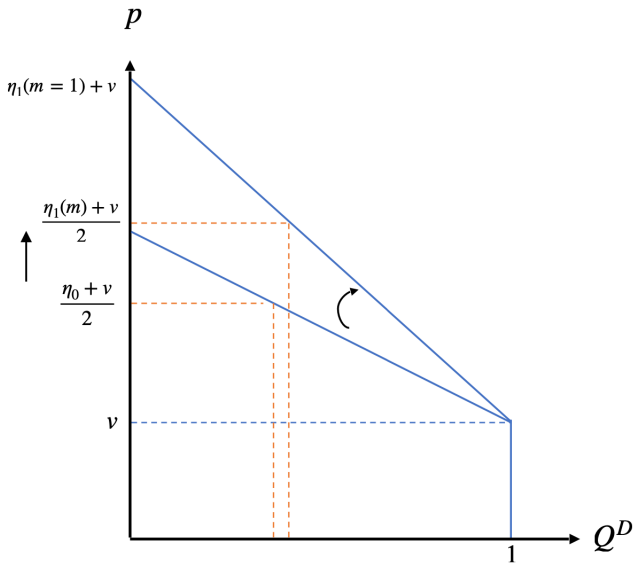

Figure 3: Calculation of EV when a positive message is sent

EV generated from a negative review, $m = 0$ is shown in Figure 4. A negative review is posted if the influencer infers low quality after consuming the product. Upon observing a negative message, the consumers update their beliefs. They are not certain that it is a low-quality product but they now believe that the product is of high quality with a lower probability than their prior beliefs. This leads to a decrease in their willingness to pay for the product. Therefore, the demand curve rotates downward. The seller charges a price that is now lower than the no-review case due to the negative perception of the consumers. The new demand curve determines the total demand generated at this price. The consumers are now paying a lower price for a low-quality product than under the no-review case. This fall in price leads to an increase in consumer surplus. Therefore, the EV is positive.

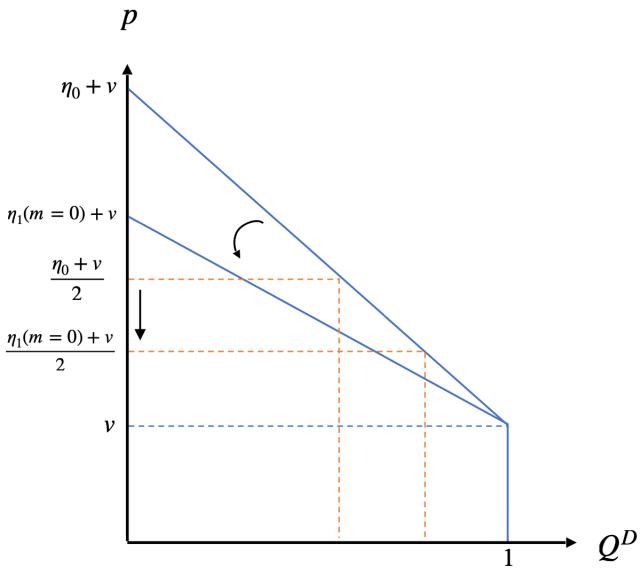

Figure 4: Calculation of EV when a negative message is sent

The consumers' perception of the review is dependent on their prior beliefs about the influencer type. The amount of the shift in the demand curve and the final value of the price charged are determined by the skill level, s. The higher the informativeness of the review, the higher the shift in the demand curve. As s is not known to the consumers, the shift depends on the beliefs about the skill level of the influencer. Therefore, EV is a function of s. When consumers are aware that the influencer's review is independent (as is the case when disclosure regulation is implemented), they completely trust it. However, when the consumers are unaware about the type of review (as is the case when no regulation is in place), the trustworthiness of the review depends on their prior beliefs about the influencer type in terms of a. The higher the weightage given to the welfare of consumers, the higher the trustworthiness of the review. Therefore, EV is a function of a. Hence, the shift in the demand curve and the resulting change in consumer surplus are dependent on the beliefs about influencer type.

If the influencer accepts the seller's offer, he posts a paid review which generates the following

economic value:

$$\mathbb{E}\left(EV_{PR}\right) = \eta_0 \cdot EV(m=1) + (1-\eta_0) \cdot EV(m_b=1) \tag{2}$$

where $m_b = 1$ is the biased review posted after a negative experience with the product. The change in demand curve is the same as that in Figure 3.

In this scenario, the influencer will continue to post a positive review when he had a positive experience with the product. The EV generated is the same as in the case for $m = 1$ mentioned above. However, the influencer will post a positive review even when he had a negative experience with the product. This results in consumers making a purchase decision on the basis of a biased/inflated review. This implies that more consumers purchase the low-quality product at a high price compared to no-review case. This results in a negative consumer surplus and hence, negative EV. The final amount of the expected value generated depends on the prior beliefs.

3 Market Outcome

In this section, I characterize the equilibrium outcome with and without the disclosure policy. I provide an informal description of the equilibrium outcome for the various ranges of the parameter space. A formal description of the equilibrium outcome is given in Appendix B. Further, I derive the range of parameters for which the disclosure policy is effective and range for which the disclosure policy is ineffective.

3.1 Equilibrium without Disclosure Policy

In a scenario with no regulation of any kind, the consumer is not aware whether it is a paid or an independent review. They update their beliefs about the product quality with respect to the review and their beliefs about the influencer type. In case of a positive review, consumers update their beliefs on the basis of the influencer type. In case of a negative review, consumers completely trust the review as the seller would never pay for a negative review. The impact of review and beliefs about influencer type on the demand curve and EV are described in Section 2.

The influencer makes the decision about the type of review to generate. This decision depends on the seller's decision to make an advertisement offer and the comparison of payoff from different review types. If there is no advertisement offer from the seller, he has the option to post an independent review. An independent review is generated if it is feasible for the influencer, i.e., if the cost to post the review, c, is low enough to generate a positive payoff. Otherwise, he does not post any review, i.e, the no-review outcome. Therefore, the influencer type who is indifferent between independent review and no review is denoted by the following equation:

$$a \cdot \mathbb{E}\left(EV_{IR}\right) - c = 0$$

$$\Rightarrow \quad a \cdot \mathbb{E}\left(EV_{IR}\right) = c$$

where $\mathbb{E}\left(EV_{IR}\right)$ is given by (1). This expression denotes all those influencer types who receive zero payoff from an independent review and is denoted in Figure 5. The influencer type on the right of this indifference line has a decent skill level combined with high consideration for the consumer welfare generated from his review. Therefore, such an influencer type is willing to review the product independently. The influencer type on the left of this indifference line does not have a high enough skill level or consideration for the consumer welfare to generate valuable information. Therefore, such an influencer type does not post an independent review.

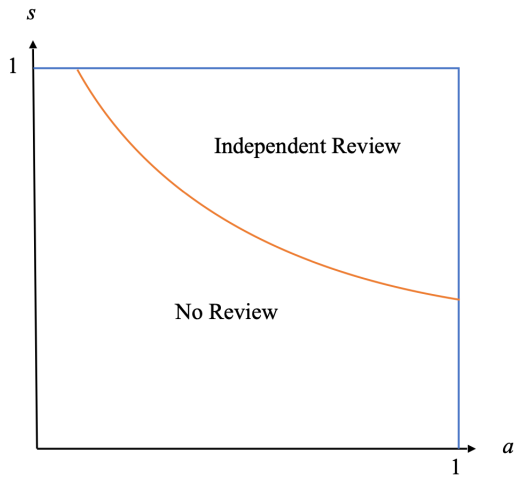

Figure 5: Indifference Line between Independent Review and No review

In the event that the seller makes an advertisement offer, the influencer needs to decide on accepting the offer (paid review) or rejecting the offer (independent review or no review). Define an indifferent influencer type who receives equal payoff from either scenario. An influencer type who is on the right of equation (3) is indifferent between the two outcomes iff:

$$a \cdot \mathbb{E}\left(EV_{IR}\right) - c = \tau\left(m\right) + a \cdot \mathbb{E}\left(EV_{PR}\right) - c$$

$$\Rightarrow \quad a \cdot \left[\mathbb{E}\left(EV_{IR}\right) - \mathbb{E}\left(EV_{PR}\right)\right] = \tau\left(m\right)$$

An influencer type who is on the left of equation (3) is indifferent between the two outcomes iff:

$$\tau\left(m\right) + a \cdot \mathbb{E}\left(EV_{PR}\right) - c = 0$$

$$\Rightarrow \quad \tau\left(m\right) = c - a \cdot \mathbb{E}\left(EV_{PR}\right)$$

The decision depends on the payment amount, $\tau(m)$. Just like the consumers, the seller does not observe the influencer type. Thus, he must make a common offer that no influencer type can reject. When $a = 0$, the influencer does not care about the consumer welfare and only values monetary gains. If the seller makes this least-caring influencer type indifferent about accepting the advertisement offer, then all of the types on the left of the indifference curve will accept the offer. Hence, $\tau(m) = c$. Out of the influencer types on the right of the indifference curve, offer will be accepted iff:

$$a \cdot [\mathbb{E}(EV_{IR}) - \mathbb{E}(EV_{PR})] = c \tag{3}$$

Hence, the following contingent payment is offered:

$$\tau(m) = \begin{cases} c & if\ m = 1 \\ 0 & if\ m = 0 \end{cases} \tag{4}$$

Given this payment offer, the influencer types who accept the offer are on the left of equation (4) and shown in Figure 6. On the basis of the strategies of the consumers and influencer, the seller decides to make an advertisement offer on the basis of the *expected* profit generated.

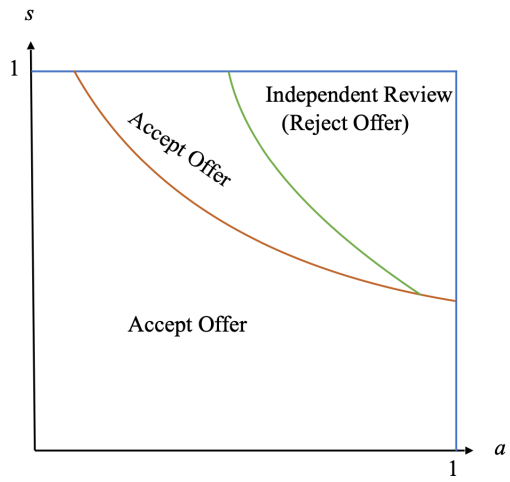

Figure 6: Influencer Types who Accept Seller's Advertisement Offer

The expected profit generated depends on the prior beliefs about the influencer type. As long as the payment made to the influencer is lower than the increase in expected profit, the seller is willing to make an advertisement offer. The increase in profit is dependent on the skill and trustworthiness of the influencer. Keeping a constant, a higher s implies a higher shift in the demand curve and a higher price, resulting in higher profit. This implies that there is a threshold level for s, dependent on a, below which the seller does not find it profitable to advertise the product through the influencer.

If a is low, the consumers may not incorporate the review in their decision-making. However, if low a is compensated by a high skill level, then it can lead to an increase in profit minus the payment. For higher values of a, lower skill levels can achieve the same increase in profits. Therefore, the seller's expectation of profit after an advertisement through the influencer is directly dependent on the prior beliefs about the influencer type. The seller will make an offer to the influencer if the increase in profits is higher than the payment:

$$\mathbb{E}\left(\pi_O\left(a,s\right)\right) - \mathbb{E}\left(\pi_{NO}\left(a,s\right)\right) \geq c \tag{5}$$

where $\mathbb{E}\left(\pi_O\left(a,s\right)\right)$ is the expected profit when the advertisement offer is made and $\mathbb{E}\left(\pi_{NO}\left(a,s\right)\right)$ is the expected profit when the offer is not made. If the seller believes that the influencer is of the type (a,s) which satisfies equation (6), then the seller makes an offer to the influencer. Depending on equation (3), this offer may be accepted leading to a paid review or rejected leading to an independent review. If the seller believes that the influencer is of the type (a,s) which does not satisfy equation (6), then no offer is made and the outcome is no review. Figure 7 depicts the market outcome. The seller who is indifferent between making an offer and not making an offer is denoted by an indifference line, which lies below the influencer's indifference line. The results are summarized in Proposition 1. A formal proof is contained in Appendix B.

Proposition 1 *A unique perfect Bayesian equilibrium satisfying the Intuitive criterion exists. It is characterized as follows:*

(a) When $a \cdot \left[\mathbb{E}\left(EV_{IR}\right) - \mathbb{E}\left(EV_{PR}\right)\right] \geq c$*, an independent review is posted. The influencer rejects the seller's offer of* $\tau\left(m=1\right) = c$*. A fraction* $\left(\frac{\eta_1(m)+v}{2\eta_1(m)}\right)$ *of buyers purchase the product at a price* $p = \frac{\eta_1(m)+v}{2}$*.*

(b) When $a \cdot \left[\mathbb{E}\left(EV_{IR}\right) - \mathbb{E}\left(EV_{PR}\right)\right] \leq c \leq \mathbb{E}\left(\pi_O\left(a,s\right)\right) - \mathbb{E}\left(\pi_{NO}\left(a,s\right)\right)$*, a paid review is posted. The influencer accepts the seller's offer of* $\tau\left(m=1\right) = c$*. A fraction* $\left(\frac{\eta_1(m=1)+v}{2\eta_1(m=1)}\right)$ *of buyers purchase the product at a price* $p = \frac{\eta_1(m=1)+v}{2}$*.*

(c) When $c \geq \mathbb{E}\left(\pi_O\left(a,s\right)\right) - \mathbb{E}\left(\pi_{NO}\left(a,s\right)\right)$*, no review is posted. The seller does not make an offer. A fraction* $\left(\frac{\eta_0+v}{2\eta_0}\right)$ *of buyers purchase the product at a price* $p = \frac{\eta_0+v}{2}$*.*

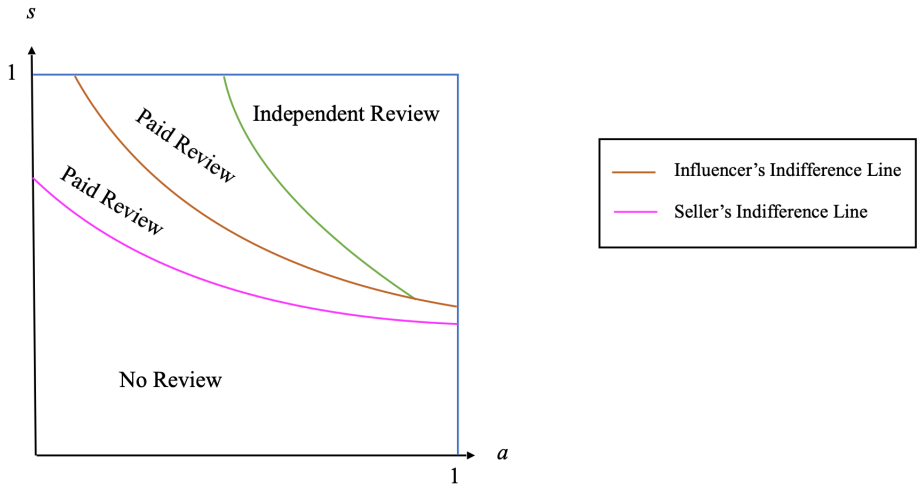

Figure 7: Market Outcome with No Regulation

3.2 Equilibrium with Disclosure Policy

When a disclosure policy is imposed, the influencer is required to disclose if the review was paid for by the seller. That is, a paid review is represented by $\theta = 1$ and an independent review is represented by $\theta = 0$.

The consumers are able to observe the message along with the type of review. They update their beliefs differently for a paid review and for an independent review. In case of a negative message, the consumers trust the review and update their beliefs. The effect on the demand curve and the subsequent price is same as the no-regulation cases. If a positive message is posted under an independent review, the consumers trust it and are certain that the influencer is reporting their genuine experience with the product. Therefore, the upward shift in the demand curve is more than the no-regulation case. Under the no-regulation case, the shift in the demand curve is based on the beliefs about a and is an average demand curve. After revealing the type of review, the consumers are certain about the quality of the review and fully incorporate the review in their decision-making process. Therefore, $\mathbb{E}\left(EV_{IR}^{\theta}\right) > \mathbb{E}\left(EV_{IR}\right)$, where $\mathbb{E}\left(EV_{IR}^{\theta}\right)$ is the expected economic value generated by the influencer's independent review under the disclosure regulation. At the new demand curve, the price maximizing the seller's profit is higher than that in the no-regulation case and given by:

$$p = \frac{\eta_1(m = 1, \theta = 0) + v}{2}$$

Under a paid review, a positive message may be a result of a positive experience with the product or a biased review of a negative experience. Therefore, when the consumer observes a positive message, he

takes into account both the possibilities and updates his beliefs about the product quality accordingly. The demand curve rotates upward but the amount of the shift is smaller than under an independent review because of the possibility of a bias. This shift is lower than the no-regulation case as the trustworthiness of the message is low. Therefore, $\mathbb{E}\left(EV_{PR}^{\theta}\right) < \mathbb{E}\left(EV_{PR}\right)$, where $\mathbb{E}\left(EV_{PR}^{\theta}\right)$ is the expected economic value generated by the influencer's paid review under the disclosure regulation. At the new demand curve, the price maximizing the seller's profit is lower than in the no-regulation case and is given by:

$$p = \frac{\eta_1(m = 1, \theta = 1) + v}{2}$$

As after regulation, the prices and associated demands differ for a paid review and an independent review, the difference in the expected EV generated will be higher than before. Thus, the influencer type who is willing to post an independent review in the absence of an advertisement offer by the seller is given by:

$$a \cdot \mathbb{E}\left(EV_{IR}^{\theta}\right) \geq c \tag{6}$$

As the EV generated from an independent review under the disclosure policy is much higher, the indifference curve between the independent review and no review shifts down. Thus, there is a higher possibility to generate an independent review after the implementation of a disclosure regulation. If the influencer is made an advertisement offer, the offer is accepted if the payoff from the paid review outcome is higher. For the influencer type on the left of the indifference line:

$$\tau(m) + a \cdot \mathbb{E}\left(EV_{PR}^{\theta}\right) - c \geq 0$$

$$\Rightarrow \quad \tau(m) + a \cdot \mathbb{E}\left(EV_{PR}^{\theta}\right) \geq c$$

For the influencer on the right of the indifference line:

$$\tau(m) + a \cdot \mathbb{E}\left(EV_{PR}^{\theta}\right) - c \geq a \cdot \mathbb{E}\left(EV_{IR}^{\theta}\right) - c$$

$$\Rightarrow \quad a \cdot \left[\mathbb{E}\left(EV_{IR}^{\theta}\right) - \mathbb{E}\left(EV_{PR}^{\theta}\right)\right] \geq \tau\left(m\right) \tag{7}$$

The optimal payment contract defined in equation (5) continues to be valid under disclosure regulation. The seller wants to maximize his profit by selecting the least-possible payment which is unaffected by the disclosure requirement. Therefore, with $\tau(m) = c$, all the types on the left of the indifference curve will accept the offer and the types on the right will accept only if equation (7) holds. Given the credibility of an independent review, the difference in expected EV generated is much higher than in the no-regulation case. Thus, there is now a lower possibility of the seller's offer to be accepted.

On the basis of the strategies of the consumers and the influencer, the seller decides whether to make an advertisement offer to the influencer. The expected profit is different from the no-regulation case due to the change in EV. As the independent review generates higher EV and a higher price,

the expected profit from no offer has increased. As the paid review generates lower EV and a lower price, the expected profit from making an offer has decreased. Therefore, the difference in profit due to advertising is lower than under the no-regulation case. The seller will make an offer to the influencer if the increase in profits is higher than the payment:

$$\mathbb{E}\left(\pi_O^\theta(a,s)\right) - \mathbb{E}\left(\pi_{NO}^\theta(a,s)\right) \geq c \tag{8}$$

where $\mathbb{E}\left(\pi_O^\theta(a,s)\right)$ is the expected profit when the advertisement offer is made and the paid relationship is revealed to the consumers; and $\mathbb{E}\left(\pi_{NO}^\theta(a,s)\right)$ is the expected profit when the offer is not made. If the seller believes that the influencer is of the type (a,s) which satisfies equation (9), then the seller makes an offer to the influencer. Depending on equation (8), this offer may be accepted leading to a paid review or rejected leading to an independent review. If the seller believes that the influencer is of the type (a,s) which does not satisfy equation (9), then no offer is made and the outcome is no review. The market outcome is depicted in Figure 8. The seller's indifference curve shifts up due to the regulation. The following proposition summarizes the results. A formal proof is given in Appendix B.

Proposition 2 *A unique perfect Bayesian equilibrium satisfying the Intuitive criterion exists. It is characterized as follows:*

(a) When $a \cdot \left[\mathbb{E}\left(EV_{IR}^\theta\right) - \mathbb{E}\left(EV_{PR}^\theta\right)\right] \geq c$*, an independent review is posted. The influencer rejects the seller's offer of* $\tau(m=1) = c$*. A fraction* $\left(\frac{\eta_1(m,\theta)+v}{2\eta_1(m,\theta)}\right)$ *of buyers purchase the product at a price* $p = \frac{\eta_1(m,\theta)+v}{2}$*.*

(b) When $a \cdot \left[\mathbb{E}\left(EV_{IR}^\theta\right) - \mathbb{E}\left(EV_{PR}^\theta\right)\right] \leq c \leq \mathbb{E}\left(\pi_O^\theta(a,s)\right) - \mathbb{E}\left(\pi_{NO}^\theta(a,s)\right)$*, a paid review is posted. The influencer accepts the seller's offer of* $\tau(m=1) = c$*. A fraction* $\left(\frac{\eta_1(m=1,\theta=1)+v}{2\eta_1(m=1,\theta=1)}\right)$ *of buyers purchase the product at a price* $p = \frac{\eta_1(m=1,\theta=1)+v}{2}$*.*

(c) When $c \geq \mathbb{E}\left(\pi_O^\theta(a,s)\right) - \mathbb{E}\left(\pi_{NO}^\theta(a,s)\right)$*, no review is posted. The seller does not make an offer. A fraction* $\left(\frac{\eta_0+v}{2\eta_0}\right)$ *of buyers purchase the product at a price* $p = \frac{\eta_0+v}{2}$*.*

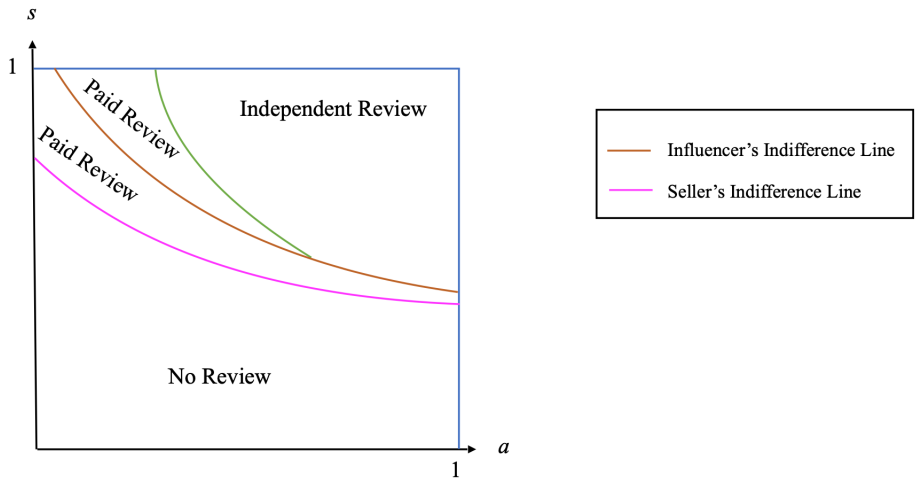

Figure 8: Market Outcome with Disclosure Regulation

4 Impact of Disclosure Policy

Depending on the prior beliefs about the influencer type, the impact of disclosure policy can either be positive or negative or none whatsoever. In this section, I elaborate on three main equilibrium outcomes and the effect of the disclosure policy on these outcomes. First, the independent review is posted irrespective of the disclosure policy. The role of disclosure is reflected in the increased incidence of independent review outcomes. A higher economic value has led more influencer types to post a disclosed independent review. This is true for influencer types who possess moderate to high skill levels. This results in an increased consumer surplus as consumers are able to incorporate valuable information about product quality into their decision-making. Interestingly, the seller's expected profit also increases. As the shift in demand under independent review is higher than under paid review, the increase in price is higher for a positive independent review. The negative review has the same effect irrespective of regulation. Therefore, the higher profit in the event of a positive review increases the expected profits of the seller. Therefore, the seller prefers disclosure regulation. There are two takeaways: contrary to what one would expect, (i) the seller would lobby for disclosure regulation to be implemented; (ii) the independent review is posted even without any regulatory policy. That is, there was no need for regulation and if monitoring cost is to be accounted, such regulation has led to a deadweight loss; and (iii) sellers do not advertise their product through these influencer types who are highly skilled and highly trusted by the consumers, i.e., influencer types whose reviews have high credibility. Advertising through these influencers would have a positive impact on the seller's profit. However, sellers cannot afford the high compensation needed to engage them.

Second, the paid review is posted irrespective of the disclosure policy. The role of disclosure is reflected in the decreased incidence of paid review outcomes. A lower economic value has led fewer

influencer types to post a disclosed paid review. The range of influencer types who posted a paid review under no-regulation are now divided into three subsets. (i) The higher-end types have switched to independent review outcome, as discussed above. (ii) The intermediate range continue to post a paid review. As the seller does not gain much from a paid review, he makes an advertisement offer to fewer influencer types. These types possess enough skill to increase the expected profits. The paid review is sustained after regulation because there is a possibility that the influencer's positive review is based on a positive experience with the product, so consumers trust the review to some extent and update their beliefs positively about the product quality. The persistence of a paid review has been empirically proven by Ershov & Mitchell (2023). The final impact on the consumer surplus depends on the prior beliefs about product quality. The seller's expected profits fall as the price is lower. (iii) The lower-end influencer types are not made an advertisement offer and therefore, no review is posted. This lack of additional information about product quality leads to a loss in consumer surplus and seller's profit in comparison to the no-regulation case.

Third, no review is posted irrespective of the disclosure policy. These influencer types possess low to intermediate skill level and hence, do not produce much valuable information about product quality. In this case as well, disclosure policy has no effect and leads to deadweight loss.

4.1 Role of Trust in Influencer

The disclosure policy is helping consumers to know which review to trust on the basis of the reliability of the message sent. The consumer's evaluation of the review is also based on the prior beliefs about the influencer type. Particularly, without regulation, the review is likely to be trusted depending on the prior beliefs about the level of a, the importance assigned towards the welfare of the followers. a determines the trustworthiness of the influencer, i.e., if they are willing to inflate their review to generate revenue through paid advertisements. By revealing the type of review, the disclosure regulation provides information on the level of a. The review itself reveals information about the skill level of the influencer.

a plays an important role in the trade-off faced by the influencer: how to simultaneously balance the relationships with the seller and the followers. The followers form an audience base which the influencer has to maintain in the long-run. The paid advertisements through the seller generates revenue for the influencer. Therefore, the influencer's trade-off is whether to maximize monetary benefit or moral benefit. Note that the moral benefit is of importance to the influencer as the economic value created is the main reason behind the long-run relationship with the followers. By creating a high economic value for the followers today, they will continue to follow tomorrow. If the influencer loses out on the followers, the seller will not approach with advertisement offers. Alternatively, a captures the discount factor which represents the reputation effect of a dynamic version of the model in a reduced form.

Depending on the value of a, the influencer types can be broadly divided into three categories. First, a low level of trust is associated with a corrupt influencer who gives a high importance to the relationship with the seller. Such an influencer type has a low level of concern towards the welfare of his followers and is willing to create biased information in exchange for monetary benefits. In the absence of an advertisement offer from the seller, these types will never generate an independent review.

Consequently, they are always willing to accept the seller's offer. Even after the implementation of the disclosure policy, they will continue to create a paid review outcome or no review outcome. Figure 9 shows the impact of market outcome on the expected consumer surplus for varying skill levels when the influencer is corrupt. The no-review outcome for low skill level generates a constant consumer surplus. For high skill level, the paid review outcome generates a lower surplus under disclosure as the shift in demand curve is lower. Moreover, the surplus increases with expertise as the degree of informativeness is higher. The impact of disclosure is on the intermediate skill level where the possibility of bias has been eliminated by changing the outcome from paid review to no review. The effect of the policy is negative in terms of the expected consumer surplus. The paid review is possibly based on a positive experience with the product that can provide valuable information to the consumers to make a more suitable purchase decision. The disclosure regulation has eliminated bias at the cost of creating economic value for the consumers.

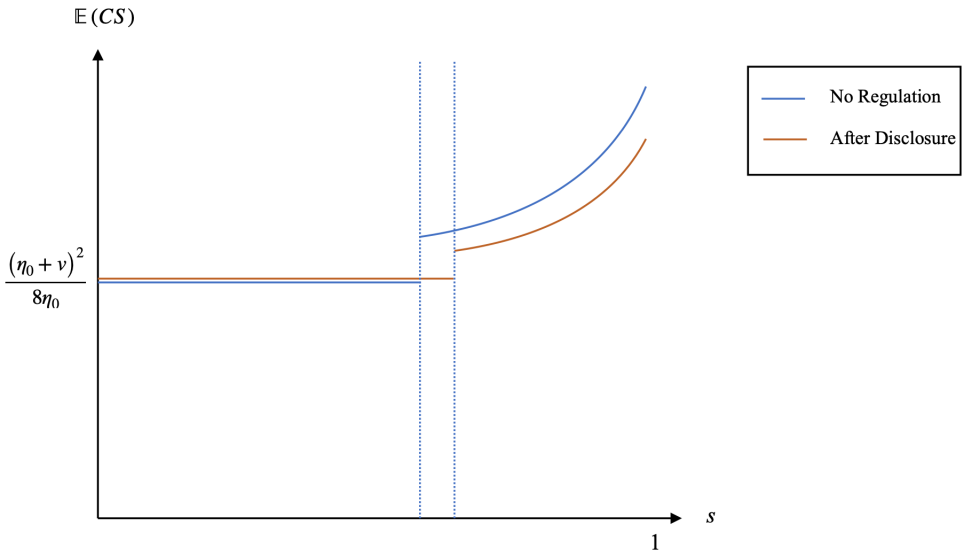

Figure 9: Expected Consumer Surplus for low levels of a

Second, an intermediate level of trust is associated with a strategic influencer who gives equal importance to the relationships with the seller as well as the followers. Such an influencer type chooses the best strategy that maximizes his payoff. The policy has a positive effect on the higher end of the influencer spectrum by removing the possibility of bias. Instead, the independent review is generating valuable and credible information. Their optimal strategy is dependent on the skill level. If there is no advertisement offer from the seller, these influencer types generate an independent review for intermediate to high skill level and no review for low skill level. When the seller makes an offer, the independent review outcome changes to paid review outcome as it generates a higher payoff for these influencer types. The disclosure policy forces the influencer to revert back to the independent review

outcome. The disclosed independent review involves a higher payoff for the influencer by generating a higher economic value for the consumers. The increase in the expected consumer surplus for high skill level is shown in Figure 10. This denotes a strong and positive impact of the disclosure policy.

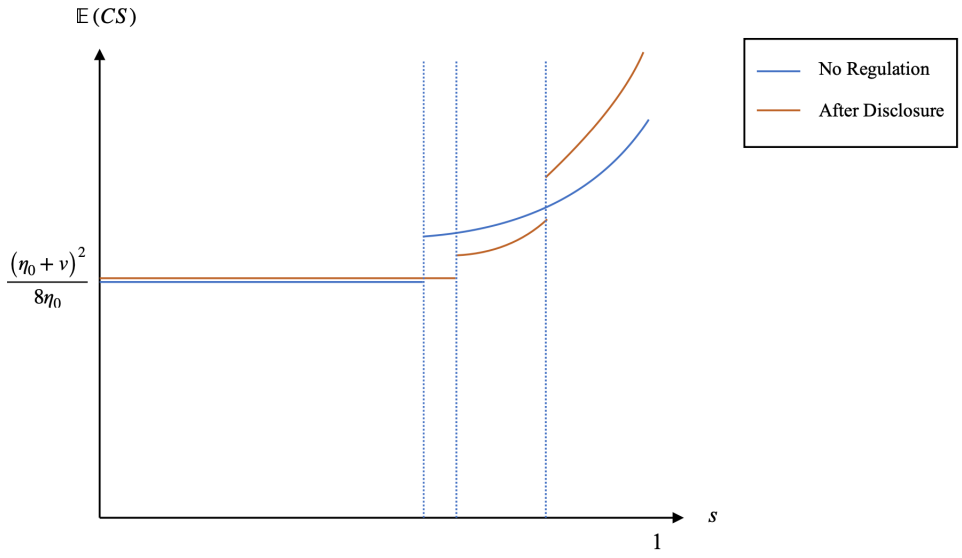

Figure 10: Expected Consumer Surplus for intermediate levels of a

Third, a high level of trust is associated with an altruistic influencer who gives a high importance to the relationship with the followers. For an intermediate to high skill level, these influencer types are willing to generate an independent review. For a low skill level, no review is posted. When a seller makes an advertisement offer, only the influencer type with an intermediate skill level accepts the offer. The highly skilled influencer rejects the seller's offer as the compensation is lower than the economic value lost from a paid review. The seller cannot afford to engage a highly skilled altruistic influencer. The disclosure policy eliminates the possibility of bias from the intermediate skill range in two ways. First is a negative effect on the lower bound of the range. Disclosure changes the paid review outcome to a no review outcome. The cost of eliminating bias is much higher than the benefit. Second is a positive effect on the upper bound of the range. Disclosure changes the paid review outcome to an independent review outcome. The impact of disclosure on the expected consumer surplus is shown in Figure 11.

The regulatory concern is the highest for the case of the corrupt influencer type. Without any regulation, the possibility of bias is the highest and the economic value created is the lowest. The implementation of disclosure regulation does not improve the outcome. In fact, the effect is either negative or non-existent depending on the prior beliefs about the product quality.

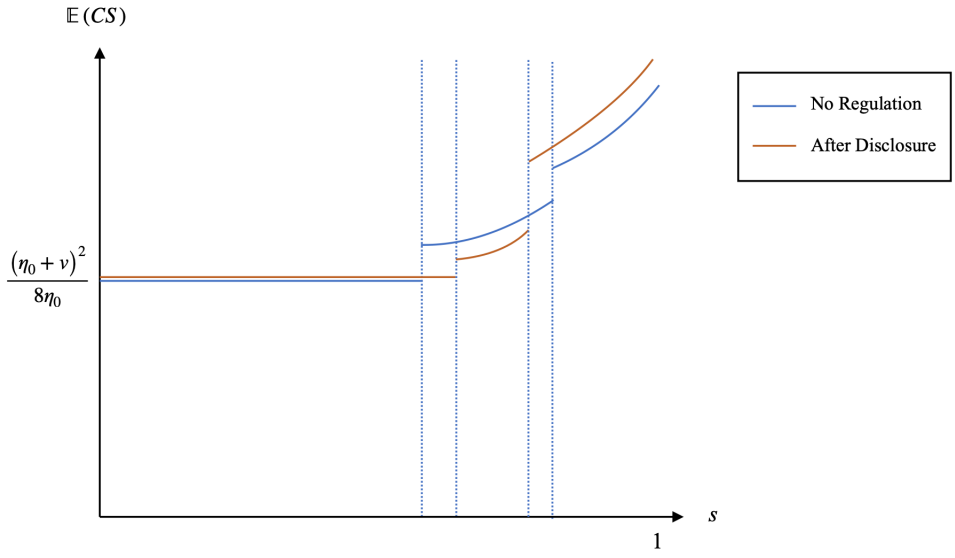

Figure 11: Expected Consumer Surplus for high levels of a

5 Conclusion

Advertising through influencers is an emerging phenomenon and rapidly growing. This industry was valued at $8 billion in 2019 and is expected to increase to $21 billion by the end of 2023. Such native advertising deceives consumers by not only keeping relations with the seller private but also, in some instances, sending out biased reviews about product quality. My paper evaluates the effect of the FTC's disclosure regulation on this particular advertising industry. The results highlight the economic environments where the effect of disclosure regulation is effective and where it is ineffective, depending on the market characteristics.

There are four main takeaways. First, an independent review can be sustained even without the regulation. Second, paid affiliations can continue to persist after the implementation of the policy. This supports the empirical evidence in Ershov and Mitchell (2023). In both cases, the regulation is ineffective. As the implementation of the policy is costly, it leads to a pure deadweight loss. In addition, in the latter case, the consumer surplus is negatively affected by native advertisements and disclosure does not improve it whatsoever. Third, the disclosure policy can have a significant effect on eliminating the possibility of posting a biased review. This leads to an increase in the expected consumer surplus and expected profits of the seller. Therefore, the seller has an incentive to lobby for such regulation. Lastly, the disclosure increases the incidence of no-review outcome. The consumers are at loss because they are not able to receive valuable information about the product.

To the best of my knowledge, this is the first paper to outline a clear comparison of the impact of the disclosure versus non-disclosure of any affiliation of the influencer with the seller, while focusing on both sides of the strategic interaction: (i) between the buyers and the influencer and (ii) between the sellers and the influencer.

Appendix A: Calculation of EVM

Economic value of the message (EV) sent by the influencer measures the value added to the buyers' ex-post utility. In other words, how did the influencer's message help the buyers in their decision making process. The EV is measured by the increase in consumer surplus due to the message sent by the influencer. Because an independent review is always truthful, the expected economic value of the message generated is defined as:

$$\mathbb{E}\left(EV_{IR}\right) = \eta_0 \cdot EV(m=1) + (1-\eta_0) \cdot EV(m=0) \tag{9}$$

The event $m = 1$ occurs when the influencer has a positive experience with the product. Therefore:

$$EV(m=1) = CS|_{m=1} - CS|_{m=\phi}$$

$$= \left(\frac{\eta_1(m=1)+v}{4}\right)\left(\frac{\eta_1(m=1)+v}{2\eta_1(m=1)}\right) - \left(\frac{\eta_0+v}{4}\right)\left(\frac{\eta_0+v}{2\eta_0}\right)$$

$$\Rightarrow \quad EV(m=1) = \frac{\left(\eta_1(m=1)+v\right)^2}{8\eta_1(m=1)} - \frac{\left(\eta_0+v\right)^2}{8\eta_0}$$

The event $m = 0$ occurs when the influencer has a negative experience with the product. Therefore:

$$EV(m=0) = CS|_{m=0} - CS|_{m=\phi}$$

$$= \left(v - \frac{(\eta_1(m=0)+v)}{2}\right)\left(\frac{\eta_1(m=0)+v}{2\eta_1(m=0)}\right) - \left(v - \frac{(\eta_0+v)}{2}\right)\left(\frac{(v+\eta_0)}{2\eta_0}\right)$$

$$\Rightarrow \quad EV(m=0) = \left(\frac{v-\eta_1(m=0)}{2}\right)\left(\frac{\eta_1(m=0)+v}{2\eta_1(m=0)}\right) - \left(\frac{v-\eta_0}{2}\right)\left(\frac{\eta_0+v}{2\eta_0}\right)$$

$$\Rightarrow \quad EV(m=0) = \left(\frac{v^2-\eta_1^2(m=0)}{4\eta_1(m=0)}\right) - \left(\frac{v^2-\eta_0^2}{4\eta_0}\right)$$

Hence, the expression for the expected EV in (2) is given by:

$$\mathbb{E}\left(EV_{IR}\right) = (\eta_0)\left[\frac{\left(\eta_1(m=1)+v\right)^2}{8\eta_1(m=1)} - \frac{\left(\eta_0+v\right)^2}{8\eta_0}\right] + (1-\eta_0)\left[\left(\frac{v^2-\eta_1^2(m=0)}{4\eta_1(m=0)}\right) - \left(\frac{v^2-\eta_0^2}{4\eta_0}\right)\right] \tag{10}$$

In case of a paid review, the influencer only posts a positive message. If the influencer has a positive experience with the product, then he is being truthful and the economic value generated is the same as equation (3). However, if he has a negative experience and reports $m = 1$, then it is a biased review. Denote a biased review by $m_b = 1$. The economic value of a biased review is given by:

$$EV(m_b=1) = CS|_{m_b=1} - CS|_{m=\phi}$$

$$= \left(v - \frac{\eta_1(m=1)+v}{2}\right)\left(\frac{\eta_1(m=1)+v}{2\eta_1(m=1)}\right) - \left(v - \frac{(\eta_0+v)}{2}\right)\left(\frac{\eta_0+v}{2\eta_0}\right)$$

$$\Rightarrow \quad EV(m_b = 1) = \left(\frac{v - \eta_1(m=1)}{2}\right)\left(\frac{\eta_1(m=1) + v}{2\eta_1(m=1)}\right) - \left(\frac{v - \eta_0}{2}\right)\left(\frac{\eta_0 + v}{2\eta_0}\right)$$

$$\Rightarrow \quad EV(m_b = 1) = \left(\frac{v^2 - \eta_1^2(m=1)}{4\eta_1(m=1)}\right) - \left(\frac{v^2 - \eta_0^2}{4\eta_0}\right)$$

Therefore, the expected economic value generated under a paid review is expressed as:

$$\mathbb{E}\left(EV_{PR}\right) = \eta_0 \cdot EV(m=1) + (1-\eta_0) \cdot EV(m_b = 1) \tag{11}$$

$$\mathbb{E}\left(EV_{PR}\right) = (\eta_0)\left[\frac{(\eta_1(m=1)+v)^2}{8\eta_1(m=1)} - \frac{(\eta_0+v)^2}{8\eta_0}\right] + (1-\eta_0)\left[\left(\frac{v^2 - \eta_1^2(m=1)}{4\eta_1(m=1)}\right) - \left(\frac{v^2-\eta_0^2}{4\eta_0}\right)\right] \tag{12}$$

Appendix B: Proofs

Proof of Proposition 1: The proof is divided into the following steps:

Step 1 – Consumer's decision

The consumers decide whether to buy the product. This decision is based on their prior beliefs about the influencer type. The derivation of the demand curve and the perceptions of the consumers are covered in the main text.

Step 2 – Influencer's decision

The influencer has to make two decisions:

(1) If the influencer is not made any offer, should he post an independent review or not?

As mentioned in the main text, the influencer posts an independent review if $a \cdot \mathbb{E}\left(EV_{IR}\right) \geq c$. Substituting EV from equation (14):

$$a \cdot \left[(\eta_0)\left\{\frac{(\eta_1(m=1)+v)^2}{8\eta_1(m=1)} - \frac{(\eta_0+v)^2}{8\eta_0}\right\} + (1-\eta_0)\left\{\left(\frac{v^2-\eta_1^2(m=0)}{4\eta_1(m=0)}\right) - \left(\frac{v^2-\eta_0^2}{4\eta_0}\right)\right\}\right] \geq c$$

(2) If the influencer receives an advertisement offer from the seller, should he accept or reject the offer?
As mentioned in the main text, the influencer accepts the offer if $a \cdot \left[\mathbb{E}\left(EV_{IR}\right) - \mathbb{E}\left(EV_{PR}\right)\right] \geq c$. Substituting the expression of EV from equations (14) and (16):

$$a \cdot \left[(1-\eta_0) \cdot \left\{\left(\frac{v^2-\eta_1^2(m=0)}{4\eta_1(m=0)}\right) - \left(\frac{v^2-\eta_1^2(m=1)}{4\eta_1(m=1)}\right)\right\}\right] \geq c$$

Step 3 – Seller's pricing and advertising decision

The seller has to make two decisions:

(1) What price to charge that maximizes his profit?

In case of no review, the profit function is given by:

$$\pi_{NR} = p \cdot \left[1 + \frac{(v-p)}{\eta_0}\right]$$

Maximizing with respect to price generates the profit-maximizing price as:

$$p = \frac{\eta_0 + v}{2}$$

In case of a product review by the influencer, the profit function is given by:

$$\pi_R = p \cdot \left[1 + \frac{(v-p)}{\eta_1(m)}\right]$$

Maximizing with respect to price generates the profit-maximizing price as:

$$p = \frac{\eta_1(m) + v}{2}$$

(2) Whether or not to advertise through the influencer. If he advertises and the influencer accepts, what should be $\tau(m)$ that maximizes his profit?

The optimal payment contract has been derived in the main text. We concentrate on deriving the expected profit of the seller. We know that the influencer types on the left of the indifference curve will always accept the offer. Let $q_1$denote the probability that the influencer is of the type who is located above the indifference curve. Then the expected profit from not making an offer is given as:

$$\mathbb{E}(\pi_{NO}) = (1-q_1)\left(\frac{(\eta_0+v)^2}{4\eta_0}\right) + q_1\left[\eta_0\left(\frac{(\eta_1(m=1)+v)^2}{4\eta_1(m=1)}\right) + (1-\eta_0)\left(\frac{(\eta_1(m=0)+v)^2}{4\eta_1(m=0)}\right)\right]$$

Let $q_2$denote the probability of the influencer type who is located above the indifference curve and rejects the seller's offer. Then $1-q_2$ is the probability of the influencer type who accepts the offer. The expected profit of the seller when he makes an offer is given as:

$$\mathbb{E}(\pi_O) = q_2\left[\eta_0\left(\frac{(\eta_1(m=1)+v)^2}{4\eta_1(m=1)}\right) + (1-\eta_0)\left(\frac{(\eta_1(m=0)+v)^2}{4\eta_1(m=0)}\right)\right] + (1-q_2)\left(\frac{(\eta_1(m=1)+v)^2}{4\eta_1(m=1)} - c\right)$$

Comparing the expected profit expressions, the seller makes an advertisement offer if and only if:

$$\mathbb{E}\pi_O \geq \mathbb{E}\pi_{NO}$$

$$q_2\left[\eta_0\left(\frac{(\eta_1(m=1)+v)^2}{4\eta_1(m=1)}\right) + (1-\eta_0)\left(\frac{(\eta_1(m=0)+v)^2}{4\eta_1(m=0)}\right)\right] + (1-q_2)\left(\frac{(\eta_1(m=1)+v)^2}{4\eta_1(m=1)} - c\right)$$

$$\geq$$

$$(1-q_1)\left(\frac{(\eta_0+v)^2}{4\eta_0}\right) + q_1\left[\eta_0\left(\frac{(\eta_1(m=1)+v)^2}{4\eta_1(m=1)}\right) + (1-\eta_0)\left(\frac{(\eta_1(m=0)+v)^2}{4\eta_1(m=0)}\right)\right]$$

$$\Rightarrow \quad \frac{(1-q_1)}{(1-q_2)}\left[\frac{(\eta_1(m=1)+v)^2}{4\eta_1(m=1)}-\frac{(\eta_0+v)^2}{4\eta_0}\right]-\frac{(q_1-q_2)}{(1-q_2)}\left[\eta_0\left(\frac{(\eta_1(m=1)+v)^2}{4\eta_1(m=1)}\right)+(1-\eta_0)\left(\frac{(\eta_1(m=0)+v)^2}{4\eta_1(m=0)}\right)\right]\geq c$$

Proof of Proposition 2: The proof is divided into the following steps:

Step 1 – Consumer's decision

The consumers decide whether to buy the product. This decision is based on their prior beliefs about the influencer type, only in terms of skill level s. The derivation of the demand curve and the perceptions of the consumers are covered in the main text.

Step 2 – Influencer's decision

The influencer has to make two decisions:

(1) If the influencer is not made any offer, should he post an independent review or not?

As mentioned in the main text, the influencer posts an independent review if $a\cdot\mathbb{E}\left(EV_{IR}^{\theta}\right)\geq c$. Substituting EV from equation (14):

$$a\cdot\left[(\eta_0)\left\{\frac{(\eta_1(m=1,\theta=0)+v)^2}{8\eta_1(m=1,\theta=0)}-\frac{(\eta_0+v)^2}{8\eta_0}\right\}+(1-\eta_0)\left\{\left(\frac{v^2-\eta_1^2(m=0)}{4\eta_1(m=0)}\right)-\left(\frac{v^2-\eta_0^2}{4\eta_0}\right)\right\}\right]\geq c$$

(2) If the influencer receives an advertisement offer from the seller, should he accept or reject the offer? As mentioned in the main text, the influencer accepts the offer if $a\cdot\left[\mathbb{E}\left(EV_{IR}^{\theta}\right)-\mathbb{E}\left(EV_{PR}^{\theta}\right)\right]\geq c$. Substituting the expression of EV from equations (14) and (16):

$$a\cdot\left[(1-\eta_0)\cdot\left\{\left(\frac{v^2-\eta_1^2(m=0)}{4\eta_1(m=0)}\right)-\left(\frac{v^2-\eta_1^2(m=1,\theta=1)}{4\eta_1(m=1,\theta=1)}\right)\right\}\right]\geq c$$

Step 3 – Seller's pricing and advertising decision

The seller has to make two decisions:

(1) What price to charge that maximizes his profit?

In case of no review, the profit function is given by:

$$\pi_{NR}=p\cdot\left[1+\frac{(v-p)}{\eta_0}\right]$$

Maximizing with respect to price generates the profit-maximizing price as:

$$p=\frac{\eta_0+v}{2}$$

In case of a product review by the influencer, the profit function is given by:

$$\pi_{R}=p\cdot\left[1+\frac{(v-p)}{\eta_1(m,\theta)}\right]$$

Maximizing with respect to price generates the profit-maximizing price as:

$$p=\frac{\eta_1(m,\theta)+v}{2}$$

(2) Whether or not to advertise through the influencer. If he advertises and the influencer accepts, what should be $\tau(m)$ that maximizes his profit?

The optimal payment contract has been derived in the main text. We concentrate on deriving the expected profit of the seller. We know that the influencer types on the left of the indifference curve will always accept the offer. Let $q_1$denote the probability that the influencer is of the type who is located above the indifference curve. Then the expected profit from not making an offer is given as:

$$\mathbb{E}\left(\pi_{NO}\right) = (1-q_1)\left(\frac{\left(\eta_0+v\right)^2}{4\eta_0}\right) + q_1\left[\eta_0\left(\frac{\left(\eta_1(m=1,\theta=0)+v\right)^2}{4\eta_1(m=1,\theta=0)}\right) + (1-\eta_0)\left(\frac{\left(\eta_1(m=0)+v\right)^2}{4\eta_1(m=0)}\right)\right]$$

Let $q_2$denote the probability of the influencer type who is located above the indifference curve and rejects the seller's offer. Then $1-q_2$ is the probability of the influencer type who accepts the offer. The expected profit of the seller when he makes an offer is given as:

$$\mathbb{E}\left(\pi_{O}\right) = q_2\left[\eta_0\left(\frac{\left(\eta_1(m=1,\theta=0)+v\right)^2}{4\eta_1(m=1,\theta=0)}\right) + (1-\eta_0)\left(\frac{\left(\eta_1(m=0)+v\right)^2}{4\eta_1(m=0)}\right)\right] + (1-q_2)\left(\frac{\left(\eta_1(m=1,\theta=1)+v\right)^2}{4\eta_1(m=1,\theta=1)} - c\right)$$

Comparing the expected profit expressions, the seller makes an advertisement offer if and only if:

$$\mathbb{E}\pi_O \geq \mathbb{E}\pi_{NO}$$

$$q_2\left[\eta_0\left(\frac{\left(\eta_1(m=1,\theta=0)+v\right)^2}{4\eta_1(m=1,\theta=0)}\right) + (1-\eta_0)\left(\frac{\left(\eta_1(m=0)+v\right)^2}{4\eta_1(m=0)}\right)\right] + (1-q_2)\left(\frac{\left(\eta_1(m=1,\theta=1)+v\right)^2}{4\eta_1(m=1,\theta=1)} - c\right)$$

$$\geq$$

$$(1-q_1)\left(\frac{\left(\eta_0+v\right)^2}{4\eta_0}\right) + q_1\left[\eta_0\left(\frac{\left(\eta_1(m=1,\theta=0)+v\right)^2}{4\eta_1(m=1,\theta=0)}\right) + (1-\eta_0)\left(\frac{\left(\eta_1(m=0)+v\right)^2}{4\eta_1(m=0)}\right)\right]$$

$$\Rightarrow \quad \frac{(1-q_1)}{(1-q_2)}\left[\frac{\left(\eta_1(m=1,\theta=1)+v\right)^2}{4\eta_1(m=1,\theta=1)} - \frac{\left(\eta_0+v\right)^2}{4\eta_0}\right] - \frac{(q_1-q_2)}{(1-q_2)}\left[\eta_0\left(\frac{\left(\eta_1(m=1,\theta=0)+v\right)^2}{4\eta_1(m=1,\theta=0)}\right) + (1-\eta_0)\left(\frac{\left(\eta_1(m=0)+v\right)^2}{4\eta_1(m=0)}\right)\right]$$

$$\geq$$

$$c$$

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