Online Appendix

B.1 Continuous quality levels

To enable tractable analysis, we consider a stylized scenario involving two symmetric creators, denoted as i and j, who can choose continuous quality levels $q \in [v, 1]$ for their items. Each creator can at most produce one item, and the production cost of an item with quality level q is given by $\lambda(q - v)$, where there is no cost for producing a quality level at v and λ is the cost parameter and is the same for both creators. As in our main model, the display positions of items matter to creators. Specifically, there are in total two positions in the viewer's content feed, and the item at the first (top) position obtains more expected views than that at the second (bottom) position. To model this, suppose viewers have heterogeneous opportunity costs of consumption, uniformly distributed between [0,s], where $s \geq 1$, they will consume an item only if the utility of consumption is higher than their opportunity cost (the size of viewers is normalized to be 1). A viewer starts with consuming the item at the first position. Therefore, the expected size of views for the item displayed at the first position is given by $\frac{q-\delta a}{s}$ (note that $q - \delta a$ is the utility of consumption for the viewer), whereas the expected size of views for the item at the second position is $\frac{q-\delta a-c}{s}$. Here, c measures the utility reduction due to satiation (referred to as satiation rate). Notably, the expected number of views at the first position is higher than that at the second position.

Similar to our main model, the likelihood of an item being displayed at the first position increases with its quality. For this, we assume that the probability of an item $k \in \{i, j\}$ being displayed at the first position is given by $\frac{q_k}{q_k+q_{-k}}$. Additionally, each user view of the item results in a payoff of γ for the creator. Therefore, the creator $k \in \{i, j\}$ chooses the quality level q_k to maximize the following payoff function:

$$\pi_k = \max_{q_k \in [v,1]} \frac{q_k}{q_k + q_{-k}} \underbrace{\max\{\frac{q_k - \delta a}{s}, 0\}\gamma}_{\text{expected payoff at the first position}} + \frac{q_{-k}}{q_k + q_{-k}} \underbrace{\max\{\frac{q_k - \delta a - c}{s}, 0\}\gamma}_{\text{expected payoff at the second position}} - \lambda(q_k - v)$$

At the first stage, the platform decides the advertising level a to maximize its profit $(\max\{\frac{q^*-\delta a}{s}, 0\} + \max\{\frac{q^*-\delta a-c}{s}, 0\})a$, where q^* is the equilibrium quality level at the second stage where creators choose their quality levels.

To show that our core insight (i.e., a high satiation rate can lead to a high equilibrium quality level and thus a high advertising level) still holds under continuous quality levels, we focus on the equilibrium scenario where some viewers would consume both items (this equilibrium exists if $\frac{\sqrt{2}}{\frac{\gamma}{2(\lambda-\gamma)}-1} < c < \frac{4(\lambda-\gamma)}{\gamma}$), and we assume $s = 1$ and $\gamma < \lambda < \frac{7}{6}\gamma$ for simplicity. In this scenario, it can be shown that the equilibrium quality level is $q^* = \frac{\gamma}{4(\lambda-\gamma)}c$, and the equilibrium advertising level is $a^* = \frac{\frac{\gamma}{2(\lambda-\gamma)}-1}{4\delta}c$.

Note that both q^* and a^* above increase with the satiation rate c. The intuition behind this is similar to the core insight in our main model: as the satiation rate c becomes higher, the item at the first position can obtain even more views than that at the second position, leading to increased competition among creators to produce higher-quality items. Consequently, the equilibrium quality level increases, allowing the platform to set a higher level of advertising.

Furthermore, when c is very small (i.e., $c \to 0$), there is little competition among creators, resulting in a low equilibrium quality level (i.e., $q^* = v$) and, consequently, a low advertising level. On the other hand, when c is very high (e.g., $c > 1$), viewers only consume the item at the first position (there is no consumption for the item at the second position). As a result, there is not a sufficiently large audience size to cover the production cost, leading creators to produce low-quality items and the platform to set a low level of advertising as well. This implies that there is a non-monotonic impact of the satiation rate on the equlibrium quality and advertising levels (i.e., the equilibrium quality and advertising levels can be higher under intermediate satiation rate than those under a very small or large satiation rate.)

In conclusion, when creators can choose continuous quality levels, a higher satiation rate can motivate creators to (continuously) increase the quality level, leading to a (continuous) increase in the equilibrium advertising level, which is consistent with our core insight in the main model. Additionally, as in the main model, the satiation rate, in general, can have a non-monotonic impact on the equilibrium quality and advertising levels. Overall, the analysis above shows that our core results obtained from the main model are driven by the competition incentives among creators rather than the assumption of discrete quality levels.

B.2 Centralized content creation

Here, we construct a scenario where viewer preferences for content influence advertising levels differently depending on whether content creation is centralized or decentralized. Under centralized creation, a lower viewer preference leads to less advertising, whereas under decentralized creation, it results in more advertising.

Specifically, with everything else being the same as in the main model, suppose the viewer's utility function is given by $u = \frac{q}{3+\tau}x - \frac{1}{2}x^2 - \delta ax$, where a high τ indicates a low viewer preference for the content (note that τ plays a similar role as the satiation rate c in the main text). Given this, the viewer may satiates at the high-quality content ($x_H^* = \frac{1}{3+\tau} - \delta a$) or satiates at the low-quality content $x_L^* = \frac{v}{3+\tau} - \delta a$.

In the context of centralized content creation, if the platform induces the satiation point $x^* = x_H^*$, it produces only high-quality items and its profit function is given by $\pi_p = x_H^*(af - \lambda_p) = (\frac{1}{3+\tau} - \delta a)(af - \lambda_p)$. Thus, given $f = 1$, the optimal advertising level is $a_H^* = \frac{\frac{1}{3+\tau}+\delta\lambda_p}{2\delta}$. If the platform opts to induce the satiation point $x^* = x_L^*$, it produces only low-quality items and its profit function becomes $\pi_p = x_L^* a = (\frac{v}{3+\tau} - \delta a)af$. Consequently, the optimal advertising level is $a_L^* = \frac{\frac{v}{3+\tau}}{2\delta}$. We can show that the platform would choose to produce high-quality items and set a high level of advertising if and only if $\tau < \frac{1-v}{\delta\lambda_p} - 3$. That is, under centralized content creation, a high τ (i.e., a low preference for the content) incentivizes the platform to produce low-quality items, leading to a low level of advertising.

However, regarding decentralized content creation, we can determine the equilibrium levels of quality and advertising through similar analysis as in the main model. Unlike the centralized content creation, we find that if $\tau < \frac{1-\sqrt{1-v^2}}{2n\gamma} - 3$, creators with high creative costs would produce low-quality items (while some creators with low creative costs produce high-quality items), leading the viewer to reach satiation at the low-quality items. In this scenario, the platform sets a relatively low level of advertising ($a_L^* = \frac{\frac{v}{3+\tau}}{2\delta}$). Conversely, if $\tau \geq \frac{1-\sqrt{1-v^2}}{2n\gamma} - 3$, all active creators produce high-quality items, allowing the platform to set a high level of advertising ($a_H^* = \frac{\frac{1}{3+\tau} - n\gamma}{\delta}$ if $\tau < \frac{1}{2n\gamma} - 3$, and $a_H^* = \frac{\frac{1}{3+\tau}}{2\delta}$ if $\tau \geq \frac{1}{2n\gamma} - 3$). That is, a high τ can increase the competition among creators, leading to a high equilibrium quality level and thus a high advertising level.

Overall, a high τ leads to a low level of advertising under centralized content creation but results in a high level of advertising under decentralized content creation.

B.3 Imperfect quality ordering

For simplicity, we assume that the creator's creative costs uniformly distribute between 0 and 1. We assume that high-quality items will always be placed in prominent or forefront positions on the view page or content feed. However, a fraction β of low-quality items will also be randomly mixed with these high-quality items. Given $0 < \beta < 1$, there are m^* high-quality items randomly mixed with $(n - m^*)\beta$ low-quality items, occupying the first $m^* + (n - m^*)\beta$ prominent positions on the view page. Items in subsequent positions will be low-quality.

First, consider the scenario where $x^* > m^* + (n - m^*)\beta$. As in our basic model, we have that $x^* = \frac{v-\delta a}{c}$. Furthermore, the marginal creator λ^* who is indifferent between producing high-quality item and low-quality item should satisfy that $\gamma - \lambda^* = (\beta + (1-\beta)\frac{x^*-(m^*+(n-m^*)\beta)}{n-(m^*+(n-m^*)\beta)})\gamma$. We can further obtain that $m^* = \frac{n}{2} - \sqrt{\frac{n^2}{4} - (n - \frac{v-\delta a}{c})n\gamma}$. This is the same as in our basic model. However, for this scenario to arise as an equilibrium, we need $x^* > m^* + (n - m^*)\beta$, which implies that $0 < a < \overline{a} \equiv \frac{v-c((1-\beta)\gamma n+\beta(n-(1-\beta)\gamma n))}{\delta}$.

Next, consider the scenario where $x^* = m^* + (n - m^*)\beta$. In this case, we need $v - \delta a < cx^* < \frac{m^*}{m^*+(n-m^*)\beta} + \frac{(n-m^*)\beta}{m^*+(n-m^*)\beta}v - \delta a$ (note that $\frac{m^*}{m^*+(n-m^*)\beta} + \frac{(n-m^*)\beta}{m^*+(n-m^*)\beta}v$ is the expected quality of consuming the item at each of the $m^* + (n-m^*)\beta$ prominent positions). Furthermore, the marginal creator λ^* who is indifferent between producing high-quality item and low-quality item should satisfy that $\gamma - \lambda^* = \beta\gamma$, which leads to $m^* = (1-\beta)\gamma n$. For this scenario to arise as an equilibrium, we need that $\overline{a} \leq a \leq \overline{\overline{a}} \equiv \frac{\frac{(1-\beta)\gamma n}{(1-\beta)\gamma n+(n-(1-\beta)\gamma n)\beta} + \frac{(n-(1-\beta)\gamma n)\beta}{(1-\beta)\gamma n+(n-(1-\beta)\gamma n)\beta}v - c((1-\beta)\gamma n+(n-(1-\beta)\gamma n)\beta)}{\delta}$.

Finally, consider the scenario where $x^* < m^* + (n - m^*)\beta$. In this case, $cx^* = \frac{m^*}{m^*+(n-m^*)\beta} + \frac{(n-m^*)\beta}{m^*+(n-m^*)\beta}v - \delta a$. For the creators, the marginal creator λ^* should satisfy that

$$\frac{\frac{\frac{m^*}{m^*+(n-m^*)\beta} + \frac{(n-m^*)\beta}{m^*+(n-m^*)\beta}v - \delta a}{c}}{m^*+(n-m^*)\beta}\gamma - \lambda^* = \beta\frac{\frac{\frac{m^*}{m^*+(n-m^*)\beta} + \frac{(n-m^*)\beta}{m^*+(n-m^*)\beta}v - \delta a}{c}}{m^*+(n-m^*)\beta}\gamma.$$

Since $n\lambda^* = m^*$, we further have

$$n\gamma(1-\beta)\frac{\frac{m^*}{m^*+(n-m^*)\beta} + \frac{(n-m^*)\beta}{m^*+(n-m^*)\beta}v - \delta a}{c} = m^*(m^* + (n - m^*)\beta).$$

There is no close-form solution but one can show that there always exists one unique solution for m^*, and m^* decreases in a and β. This scenario can arise as equilibrium when $a > \overline{\overline{a}}$.

Similarly, one can further examine the optimal advertising level under noisy quality ordering.

Overall, numerical analysis shows that our main results in basic model still hold.

B.4 Heterogeneous quality preferences

Suppose the platform wants to induce both segments to consume. We denote x_H^* and x_L^* as the equilibrium number of items consumed by high preference segment and low preference segment respectively. For the ease of exposition, we focus on analyzing the case where k is small enough such that the low quality preference segment would only consume high-quality items in equilibrium (thus, $x_L^* = \frac{k-\delta a}{c}$). First, consider the case where $x_H^* > m^*$. In this case, $x_H^* = \frac{v-\delta a}{c}$, and the marginal creator λ^* who is indifferent between producing high-quality and low-quality item satisfies that $(\omega + (1-\omega)\frac{\frac{k-\delta a}{c}}{m^*})\gamma - \lambda^* = \omega\frac{\frac{v-\delta a}{c} - m^*}{n-m^*}\gamma$. We solve m^* numerically. Next, consider the case where $x_H^* = m^*$. In this case, the marginal creator λ^* satisfies that $(\omega + (1-\omega)\frac{\frac{k-\delta a}{c}}{m^*})\gamma - \lambda^* = 0$. In this case, we have $x_H^* = m^* = \frac{n\gamma\omega}{2} + \sqrt{(\frac{n\gamma\omega}{2})^2 + n\gamma(1-\omega)\frac{k-\delta a}{c}}$. Finally, consider the case where $x_H^* < m^*$. In this case, $x_H^* = \frac{1-\delta a}{c}$, and the marginal creator λ^* satisfies that $(\omega\frac{\frac{1-\delta a}{c}}{m^*} + (1-\omega)\frac{\frac{k-\delta a}{c}}{m^*})\gamma - \lambda^* = 0$. This leads to $m^* = \sqrt{n\gamma(\omega\frac{1-\delta a}{c} + (1-\omega)\frac{k-\delta a}{c})}$. Following the analysis for the basic model, we can characterize the equilibrium conditions and solve the platform's optimal advertising decision. Numerical analysis shows that our main insights do not change under heterogeneous quality preferences. Similarly, one can analyze the scenario where the platform only targets the high preference segment. Given this, we find that only when the size of the low-preference segment becomes large enough will the platform set a relatively low level of advertising to encourage consumption by both segments. Otherwise, the platform would opt for a relatively high level of advertising, which only targets the high-preference segment, as the low-preference segment would be discouraged from consuming content due to the increased advertising.