Media Platforms and Technology Disruption: Pricing in the Digital Age

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Abstract

This research analyzes competition between streaming media platforms (Content Providers, CPs) employing different revenue models: ad-supported versus personalized, ad-free subscriptions. We uniquely model consumer heterogeneity across two dimensions: content preference and ad tolerance, departing from prior literature's uniform ad disutility. Our game-theoretical analysis determines optimal pricing strategies under varying market conditions, showing how CPs capture distinct market segments. Key findings reveal that high ad revenue per user (ARPU) drives CPs to prioritize ad-supported services, potentially marginalizing premium offerings. Conversely, strong consumer loyalty to content preferences enables CPs to raise prices for ad-free services. The study offers theoretical insights and actionable advice for navigating the evolving SVOD landscape.

Keywords: Media platforms, content personalization, ad-supported service, revenue model.

1. Introduction

The global media and entertainment landscape has been profoundly and irrevocably altered by the ascendancy of Streaming Video on Demand (SVOD) services. This paradigm shift has not only changed how audiences consume content but has also ignited a fierce competitive arena where platforms such as Netflix, Disney+, Hulu, Amazon Prime Video, and others continuously innovate to capture and retain subscriber loyalty by providing personalized content. The initial prevailing model, characterized by ad-free, subscription-based access to extensive content libraries, has undergone a significant metamorphosis. We are now witnessing a clear market evolution towards tiered offerings, where lower-priced, ad-supported options are becoming increasingly prominent. This strategic recalibration by major SVOD providers reflects a more sophisticated understanding of diverse consumer preferences, which are shaped by a confluence of factors including personalized content, price sensitivity, and tolerance for advertising interruptions. By early 2025, data indicates a continued migration of viewers towards these ad-supported tiers, even in mature markets, signaling a fundamental shift in consumer expectations and platform strategies (Porter, 2025).

This paper delves into the intricate competitive dynamics between two archetypal SVOD content providers (CPs). The first archetype, exemplified by services like Disney+ and Hulu, has embraced a multi-tiered strategy. This approach typically involves a premium, ad-free subscription coexisting with a more economically accessible, ad-assisted version. The financial viability of the latter is bolstered by advertising revenue, allowing the CP to cater to a wider spectrum of the consumer market by acknowledging varying price elasticities and advertising tolerance levels. Indeed, some reports in late 2024 suggest that for services like Disney+, around 30% of global subscribers (excluding some specific regions like Hotstar in India) are on ad-supported plans, and in the U.S., this figure can be even higher for new sign-ups [Konstantinovic, 2024].

In stark contrast, the second CP archetype, reminiscent of Netflix during its initial high-growth, ad-averse phase, concentrates on a singular, premium subscription model. This provider seeks differentiation through a vast, often critically acclaimed, and deeply personalized content inventory, striving to deliver an "ideal" and frictionless viewing experience tailored to individual subscriber tastes. The core assumption underpinning this model is that by minimizing content discovery friction and consistently satisfying niche viewer preferences, the platform can justify a premium price point and cultivate strong subscriber loyalty without diluting the brand with an ad-supported tier. This strategy holds particular appeal for consumers exhibiting strong allegiance to specific content genres, franchises, or cinematic universes, who derive substantial value from a curated, uninterrupted, and high-quality viewing journey.

Consumer decision-making in this crowded and evolving SVOD marketplace is consequently a complex interplay of factors. Loyalty to particular types of content – be it blockbuster movies, specific television series, or niche genres – serves as a powerful anchor,

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tethering viewers to platforms that specialize in their preferred programming. A clear example is the distinct content ecosystem of Disney+, which naturally attracts viewers seeking family-oriented entertainment, animated classics, and expansive cinematic universes. Simultaneously, individual advertising tolerance emerges as a critical variable in the subscription calculus. This research employs an analytical modeling approach to dissect and illuminate the competitive interplay between these two distinct SVOD provider strategies. Our primary objective is to explore how their divergent approaches to content personalization, pricing architecture, and advertising integration influence crucial market outcomes, including subscriber distribution, platform profitability, and overall market equilibrium. A key contribution of our model is the explicit incorporation of consumer heterogeneity not only with respect to content preferences but also through a novel framework for ad tolerance, which posits an individual-specific threshold before the disutility from advertising manifests. This allows for a more granular analysis of how varying sensitivities to ad loads impact consumer choice and platform strategy, aiming to furnish insights into the specific market conditions and consumer segment characteristics under which different SVOD strategies are likely to thrive or falter.

2. Literature Review

Our research investigates the competition between two content providers who pursue revenue models that compete on customer heterogeneity in two dimensions. The extant literature on media platforms primarily focuses on the revenue model where platforms depend on advertisement as their main source of revenue while providing the content or service for free (Prasad et al. 2003, Gabszewicz et al. 2004, Bhargava 2022). The other type of revenue model that has received attention is when a platform charges both consumers and advertisers (Rochet and Tirole 2003, Anderson and Coate 2005, Armstrong 2006, Amaldoss et al. 2021). In our research, we look at the competition between one platform which relies on customization to create unique viewing experience and initially offers only a premium service (i.e., a service without ads) and the other platform which, apart from providing a premium service, also offers an ad-supported service at a lower price while securing additional revenue from advertisers on the platform.

Kind et al. (2009) and Godes et al. (2009) investigate the issues around the decision of opting for advertisements versus charging for content. Godes et al. (2009) conclude that competing CPs lead to lower advertising revenue (since they are competing for the same advertisers) and therefore end up charging higher subscription prices. Kind et al. (2009) analyzes the same question by framing it in terms of how differentiated the content is, and depending on the degree of differentiation, the CPs decide whether to charge for the content or instead rely on ads for revenue. However, their work does not throw light at why one CP might not have an ad-assisted service while the other platform considers two different services, with and without ads. Our study attempts to fill in this gap to understand the tradeoffs between these two strategies.

Advertisements have generally been considered a nuisance to consumers (Anderson and Coate, 2005). However, such an approach is not complete as in reality consumers are willing to tolerate ads up to a certain degree, and they are differentiated in terms of the amount of ads they are willing to tolerate as part of their viewing experience before they (the ads) become a significant source of disutility. The existing literature does not capture this heterogeneity in terms of ads tolerance. To take a few examples, Gal-Or and Dukes (2003), Kind et al. (2009), Godes et al. (2009), and Bhargava (2022) include advertisement revenue for the CP in their model but considers disutility from ads being the same for all consumers. In our model, we introduce a novel approach to capture this heterogeneity in reference to ads to shed light on what we see in practice, i.e., a CP that offers two services – one with and the other without ads.

Our model setup and analysis also rely on research related to product differentiation and customization. The product differentiation literature goes back to the horizontal differentiation model in Hotelling (1929). The idea is extended to vertical differentiation (Mussa and Rosen 1978, Shaked and Sutton 1982, Tirole 1988) and also a combination of two types of product differentiation (Neven and Thisse 1987, Economides 1993, Ferreira and Thisse 1996). In our model, we consider consumers' heterogeneity along two orthogonal and equally important dimensions – consumer tastes or preference for content and the extent to which they can tolerate ads within their content without discomfort. As we explain in the modeling section, while the differentiation in terms of taste is standard in the literature, the heterogeneity of consumers in terms of the disutility from ads is different from the usual Hotelling formulation. In the extant literature, from the perspective of competition among CPs along multiple dimensions (content variety and amount of advertisements), the focus so far has been either on the competition between CPs on a single dimension (Jiang et al. 2019, Jain and Qian 2021) or on CPs that have symmetric strategies along both dimensions (Godes et al. 2009, Amaldoss et al. 2021). Our paper differs from the existing literature in this aspect as we model asymmetric competition between two firms: one of which focuses on customizing its content on the "taste" dimension while the other offers different types of service offerings to pursue two distinct ways of gathering revenue.

Some of the early work on product customization include Dewan et al. (2003) who consider two symmetric firms offering a standard and a range of customized products on a "Salop" circle (Salop 1979). They show that in a sequential entry game, the first mover can deter subsequent entry by choosing its customization scope strategically. Syam et al. (2005) also consider two symmetric firms that can customize two attributes. Wattal et al (2009) examines how information personalization by firms interacts with product differentiation in two dimensions. While a two-dimensional model captures the competitive effects more accurately, the equilibrium analysis is based on a quality-fit ratio that essentially translates the problem to one where one dimension is more important than the other. As will be evident in the next section, in our model, heterogeneity in both dimensions – affinity for content and the ability to withstand ads without incurring disutility – are important factors in differentiating consumers and are therefore considered simultaneously in determining the equilibrium outcome. Our research focus and analysis are different from product customization in the sense that the media platforms rely on information personalization, enabling them to create a unique experience on their platform.

In the next section, we first introduce the base model where CP A has one offering without ads and CP B has one offering without ads and another with ads. This allows us to establish the two dimensions of differentiating consumers based on their preference for content and their varying thresholds to tolerate ads without disutility. We extend this base model to analyze a setup where CP A introduces customizations.

3. Model

CPs A and B are competing for consumers who are differentiated in two dimensions – their preference for their ideal content (the taste dimension) and their ability to withstand ads embedded within the streamed content without incurring any disutility. These two consumer characteristics are orthogonal to each other – how much a consumer likes a CP is independent of their distaste for ads. This orthogonality necessitates us to represent the market or consumer space by a square of unit length, in which we assume that the consumers are uniformly distributed over the unit square, $0 \leq x, \theta \leq 1$, where x is the dimension where the consumers are differentiated in terms of their preference for content and θ is the dimension where consumers are differentiated in terms of the disutility they incur from ads. As we explain below, the θ dimension captures the usual Hotelling horizontal differentiation framework. However, the θ dimension, where consumers are differentiated in terms of the amount of ads they can endure without experiencing a loss of gross utility for a service, is different from what we encounter in the literature.

In this setting, CP A, which offers content without ads, strategizes to offer customized (i.e., personalized) offerings (A_{PR}) along with the preference for content dimension to capture the segment of the market that dislikes ads; while CP B pursues the strategy of offering two products – one that competes directly against A's offerings (B_{PR}), without ads; and another that offers the same content but with ads (B_{AD}). The latter offering

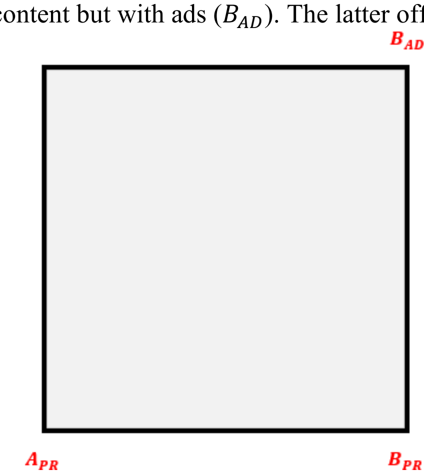

Figure 1. Location of services in consumer space.

from CP B can capture the segment of the market that is not inconvenient by the ads, especially if the service is discounted enough. We assume that A_{PR} and B_{PR} are located at the two extremities in the taste dimension, at $(0,0)$ and $(1,0)$, respectively, while B_{AD} is located at $(1,1)$ as shown in Figure 1. Any consumer in this unit square is represented by her coordinates (x, θ): her ideal content provider – in terms of the *content* itself – would be one that is located along the horizontal dimension at x $(0 \leq x \leq 1)$. This horizontal differentiation of content among media platforms is quite common in literature (see Amaldoss et al, 2021, Jiang et al. 2019). Her gross utility from the content from either A_{PR} or B_{PR}– both offered without any ads – is V. Along this dimension, the consumer's loss of utility for a CP located at x' due to the "distance" of its content from the consumer's own location at x is characterized by a linear cost $t.|x - x'|$ as per the Hotelling framework (Hotelling 1929), where t is a measure of misfit cost per unit distance.

Consumers are also differentiated in terms of their aversion to ads. Modeling the heterogeneity of consumers in terms of their tolerance for ads finds support from the observations of Peter Naylor, Senior

Vice-President of Sales at Hulu, who mentioned that while there are always some “ad-avoiders” (represented in our model on $\theta = 0$), the “majority of consumers have some level of ad acceptance” (Spangler 2019) – that is to say, while all consumers like the absence of ads, different consumers are amenable to differing amounts of ads within their viewing experience before those ads start to detract from their viewing experience – especially if service with ads is priced attractively. We model this heterogeneity among consumers to withstand ads without disutility as follows: the “higher” her location along the θ-axis, the greater is the amount of ads (measured, say, in seconds) a consumer can endure without being negatively impacted by them (i.e., without incurring any disutility from them). A consumer at $\theta = 0$ will incur disutility with the introduction of the slightest amount of ads in service (this explains why A_{PR} and B_{PR} are located on $\theta = 0$). The horizontal line $\theta = 1$ is defined as the location of the consumers who would prefer to watch B_{AD} – at $(1,1)$ – without incurring any disutility at all from the ads within B_{AD} service. Theoretically, there might exist some services with an even higher amount of ads than B_{AD}, but such a service would be considered an inferior product by *all* consumers and we assume that no CP is interested in including such an inherently irksome service as part of their service portfolio. Capping the ads to some maximum level finds support in real life – to quote the SVP of Sales at Hulu once again, to avoid “irritating viewers,” Hulu caps the length of the ad breaks at 90 seconds or less (Spangler 2019).

The gross utility of any SVOD service is capped at V: however, depending on their location, some consumers might derive a lower gross utility from an ad-supported service. At one extreme, consumers on $\theta = 0$, with their complete aversion to ads, will get zero utility from B_{AD} and will never choose such a service. However, consumers at $\theta = 1$, who have no aversion to the ads from B_{AD}, will get the full utility of V from B_{AD}.

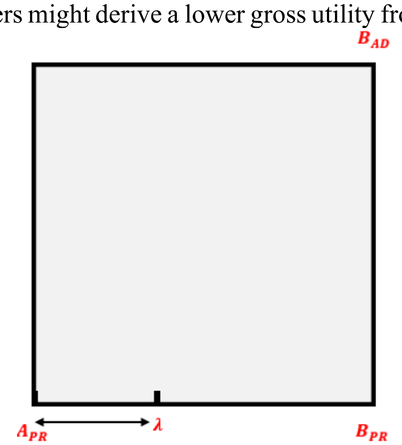

Figure 2. Location of different services when CP A customizes its offering.

For any intermediate y, for analytical tractability, we assume that the gross utility for an SVOD service decreases linearly with the amount of ads. Thus, while consumers at intermediate values of y will always derive the full gross utility V from B_{PR}, their utility from B_{AD} will be reduced linearly depending on their vertical

are located along the taste axis from $(0, \lambda)$. In Figure 2, these customized versions of A lies from $(0,0)$ to $(0, \lambda)$. The gross utility V is assumed to be high enough that each consumer gets a non-negative utility from subscribing to at least one of the service offerings.The nature of the demands for the different service offerings – and the subsequent analysis – changes dramatically depending on the number of offerings from CP A that are directly in competition to CP B’s service offerings. Therefore, in order to understand the general nature of the demands and the pricing strategies of CP A and CP B, we start our analysis with a model where CP A is offering no customization and subsequently provide a customized service.

3.1. CP A offers only premium service

In this this case, CP A has introduced a single product located at the coordinates $(0, 0)$. CP B has two service offerings, the premium product B_{PR} located at $(0, 1)$ and the ad-supported version B_{AD} at $(1, 1)$. The setting is represented in Figure 1. We assume that $p_{PR} > p_{AD}$, in other words, consumers will be willing to pay less for the ad-assisted service than the premium service. For example, Hulu currently charges around \$13 per month for its premium service and around \$6 per month for its ad-supported service.The utilities of any consumer located at (x, θ) from subscribing to A_{PR}, B_{PR}, and B_{AD} are denoted by U_A^{PR}, U_B^{PR} and U_B^{AD} respectively and are given by the following expressions:

$$U_A^{PR} = V - t.x - p_A^{PR} \quad (1a)$$
$$U_B^{PR} = V - t.(1 - x) - p_B^{PR} \quad (1b)$$
$$U_B^{AD} = \theta.V - t.(1 - x) - p_B^{AD} \quad (1c)$$

As is common in these types of models (e.g., Rhee and Thomadsen, 2017), we assume that the gross valuation V is sufficiently high such that all consumers get strictly positive utility from at least one of the providers. A consumer will subscribe to that service that gives her the highest utility. Consider a case where consumers find the utility from one of the three services to be lower than that from the other two. We get the indifferent consumers between A_{PR} and B_{PR}:

$$x = \frac{1}{2} - \frac{p_A^{PR} - p_B^{PR}}{2t} \quad (2a)$$

Similarly, the indifferent consumers between B_{PR} and B_{AD} are given by $U_B^{PR} = U_B^{AD}$, which simplifies to the horizontal line:

$$\theta = 1 - \frac{(p_B^{PR} - p_B^{AD})}{V} \qquad (2b)$$

Finally, the indifferent consumers between A_{PR} and B_{AD} are obtained by equating $U_A^{PR} = U_B^{AD}$:

$$\theta = -\frac{2t}{V}x + \frac{V + t + p_B^{AD} - p_A^{PR}}{V} \qquad (2c)$$

This line has a negative slope of $-\frac{2t}{V}$. We assume that t is high enough so that there are always some consumers located near $(0,1)$ who prefer to watch their ideal content (from N) even if they face no disutility due to ads. Mathematically, this implies that line doesn't intersect y-axis. The line intersects the $\theta = 1$ line at point $\left(\frac{1}{2} - \frac{p_A^{PR} - p_B^{AD}}{2t}, 1\right)$. This assumption of the dominance of the taste dimension is valid in our context. To understand why such an assumption makes sense, consider the case where t is quite low. Such consumers are extremely price-sensitive and a slight reduction in prices from one CP will allow it to capture the majority of the demand. In such a situation, B, with its two offerings, B_{PR} and B_{AD}, can very easily capture most of the market: consumers who do not like ads can be lured by a slight price reduction in price from B_{PR}, while a suitably-discounted B_{AD} can capture those consumers who are less inconvenienced by ads. In such an environment, where consumers do not have any well-defined preference for content and care only about the price of their SVOD service, A's customized offering will be of interest only to those consumers who completely abhor ads (and even then, some of those consumers can easily be lured away by B_{PR}), leaving the rest of the market to B_{AD}. Such an environment would render A's strategy of *not* pursuing an ad-assisted strategy completely unworkable in real life – which is not the case, as, to take an example, Netflix's past market share might attest. Thus, while we have analyzed and solved the problem in a setting where t is very low, we believe that such a model is only of academic interest and do not pursue it in the remainder of the analysis.

Based on the locations of the indifferent consumers, we can derive the demand for each of the three services. The demand functions are given by:

$$D_A^{PR} = \frac{2V(p_B^{PR} - p_A^{PR} + t) - (p_B^{PR} - p_B^{AD})^2}{4tV} \qquad (3a)$$

$$D_B^{PR} = \frac{(V - p_B^{PR} + p_B^{AD})(t + p_A^{PR} - p_B^{PR})}{2tV} \qquad (3b)$$

$$D_B^{AD} = \frac{(p_B^{PR} - p_B^{AD})(2(p_A^{PR} + t) - p_B^{PR} - p_B^{AD})}{4tV} \qquad (3c)$$

Service B_{AD} generates revenue from two sources – p_B^{AD} and the ad revenue from advertisers. For example, Hulu – whose ad-assisted model is seen as the main rival to Netflix's revenue model (Lee 2019) – offers its ad-supported plan at \$6 per month and generates an additional \$12 to \$15 in ad revenue per month per subscriber (Statista 2021). We denote the latter revenue per unit demand by r. Therefore, the per-period profit functions of CP A and B are as follows:

$$\pi_A = p_A^{PR}.D_A^{PR} \qquad (4a)$$

$$\pi_B = p_B^{PR}.D_B^{PR} + (p_B^{AD} + r).D_B^{AD} \qquad (4b)$$

Next, we solve the equilibrium prices. Without loss of generality, we normalize $V = 1$, as is common in the literature (e,g, Chen and Zhang, 2009). Since V is the gross value of the content from the online content providers, we can estimate its magnitude from the prices that erstwhile cable companies have charged for in-home entertainment. The average cable bill in the United States is around \$100 (Economist 2021). Considering the prices (anywhere between \$5-\$20) that are currently charged by online CPs as well as the ARPU of Hulu in recent times, we can therefore limit all prices as well as r to be less than 1. Also, for a given value of the parameters r and t, the (nearly) optimal solution for B is to set the two prices, p_B^{PR} and p_B^{AD}, such that the difference between them is simply a function of r and t. Based on this insight into the nature of the two prices set by H, we can therefore make the following simplifying approximation:

$$p_B^{AD} = p_B^{PR} - \alpha(r, t) \qquad (5)$$

For brevity hereafter, we will refer to $\alpha(r, t)$ as αThe resulting equilibrium solutions for prices (p_A^{PR*}, p_B^{PR*}, α^*) are summarized in Lemma 1.

Lemma 1. The equilibrium prices, demands, and profits of the two content providers, A and B are given by:

(a) Prices:

$$p_A^{PR*} = t + \frac{1}{6}\alpha(\alpha - 2r) \qquad (6a)$$

$$p_B^{PR*} = t + \frac{1}{6}\alpha(5\alpha - 4r) \qquad (6b)$$

$$p_B^{AD*} = t + \frac{1}{6}\alpha(5\alpha - 4r - 6) \qquad (6c)$$

(b) Demands:

$$D_A^{PR*} = \frac{1}{2} + \frac{\alpha(\alpha - 2r)}{12t} \qquad (7a)$$

$$D_B^{PR*} = (1 - \alpha)\left(\frac{1}{2} - \frac{\alpha(2\alpha - r)}{6t}\right) \qquad (7b)$$

$$D_B^{AD*} = \alpha\left(\frac{1}{2} - \frac{\alpha(4\alpha - 2r - 3)}{12t}\right) \qquad (7c)$$

(c) Profits:

$$\pi_A^* = \frac{(\alpha(\alpha - 2r) + 6t)^2}{72t} \qquad (8a)$$

$$\pi_B^* = \frac{(\alpha(\alpha - 2r) + 6t)^2}{72t} + \frac{\alpha\big(4t(2r - \alpha) + 3\alpha(r - \alpha)(1 - \alpha)\big)}{12t} \qquad (8b)$$

Where the discount provided for ad-supported service, α^*, is the real solution of the following cubic equation:

$$13\alpha^3 - 3(3 + 4r)\alpha^2 + (2r(3 + r) - 6t)\alpha + 6rt = 0 \qquad (9)$$

We verify that the discriminant (Δ) of the equation 9 is always greater than or equal to zero, which means that the equation has three real roots although we need complex numbers to represent them (this is a case of Casus Irreducibilis: see Cox 2011 for more details). Note that (p_A^{PR*}, p_B^{PR*}, α^*) depends on just r and t and hence we can compare the profits of A and B for any given value of r and t. It enables us to understand the nature of the two-dimensional competition. In Section 3b, we proceed to examine the role of the ad-supported service provided by CP A.

3.2. CP A offers premium and ad-supported service

In this case, CP A has introduced two services- the premium service A_{PR} and the ad-supported service A_{AD}. A_{PR} is located at the coordinates $(0,0)$ while A_{AD} is located at the coordinates $(1,0)$. CP B also has two service offerings, the premium product B_{PR} located at $(0,1)$ and the ad-supported version B_{AD} at $(1,1)$. The setting is represented in Figure 3. The utilities of any consumer located at (x,θ) from subscribing to A_{PR}, A_{AD}, B_{PR}, and B_{AD} are denoted by U_A^{PR}, U_A^{AD}, U_B^{PR} and U_B^{AD} respectively and are given by the following expressions:

$$U_A^{PR} = 1 - t.x - p_A^{PR} \qquad (10a)$$

$$U_A^{AD} = \theta - t.x - p_A^{AD} \qquad (10b)$$

$$U_B^{PR} = 1 - t.(1 - x) - p_B^{PR} \qquad (10c)$$

$$U_B^{AD} = \theta - t.(1 - x) - p_B^{AD} \qquad (10d)$$

In this setting, CP A and CP B are symmetric along the taste dimension as well as the ad-disutility dimension. As shown in Figure 4, this symmetry is visible through the line that represents indifferent customers between the two premium services (and ad-supported services) as well as indifferent customers between the premium service and ad-supported service offered by CP A (and CP B). Based on the indifferent customers, we can calculate the demand for services represented by ($D_A^{PR}, D_A^{AD}, D_B^{PR}, D_B^{AD}$). Next, both CPs maximize their profits. In the resulting equilibrium, we see that $\alpha_A^* = \alpha_B^*$ ($= \alpha^*$) and $p_A^{PR*} = p_B^{PR*}$. The solutions for prices (p_A^{PR*}, p_B^{PR*}, α^*) are provided in the following lemma.

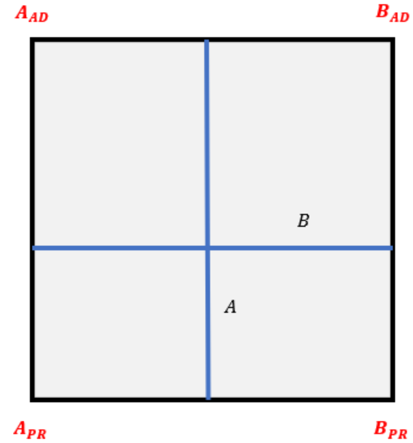

Figure 3. Two services offered by CP A.

Lemma 2. The equilibrium prices, demands, and profits of the two content providers, A and B are given by:

(a) Prices:

$$p_A^{PR*} = p_B^{PR*} = t - \frac{r^2}{4} \qquad (11a)$$

$$p_A^{AD*} = p_B^{AD*} = t - \frac{r}{2}\left(1 + \frac{r}{2}\right) \qquad (11b)$$

(b) Demands:

$$D_A^{PR*} = D_B^{PR*} = \frac{2 - r}{4} \qquad (12a)$$

$$D_A^{AD*} = D_B^{AD*} = \frac{r}{4} \qquad (12b)$$

(c) Profits:

$$\pi_A^* = \pi_B^* = \frac{t}{2} \qquad (13)$$

In Section 3c, we proceed to examine the role of the customized offerings of CP A by considering the case where the customized product by CP A lies from $(0,\lambda)$.

3.3. CP A offers only customized service

In this case, CP A offers horizontally differentiated services that are located from $(0,\lambda)$ as shown in Figure 2. We note that CP A's ultimate strategy is to introduce many customized versions for its consumers. The utilities of any consumer located at (x,θ) where $x > \lambda$ from subscribing to A_{PR}, B_{PR}, and B_{AD} are denoted by U_A^{PR}, U_B^{PR} and U_B^{AD} respectively and are given by the following expressions:

$$U_A^{PR} = 1 - t.(x - \lambda) - p_A^{PR} \qquad (16a)$$

$$U_B^{PR} = V - t.(1 - x) - p_B^{PR} \qquad (16b)$$

$$U_B^{AD} = \theta.V - t.(1 - x) - p_B^{AD} \qquad (16c)$$

We solve for equilibrium and provide our solutions for prices (p_A^{PR*}, p_B^{PR*}, α^*) are provided in Appendix A. As we can see in Figures 6 and 7, the demand structures change as r, t, and λ change. An interesting case is when we have a high value of r and a low value of t, we observe that customers are not loyal, and the ad-supported service benefits from such parameter values. We also see that as the customization of premium service offered by CP A increases, CP A can capture more demand along the taste dimension.

Lemma 3. The equilibrium prices, demands, and profits of the two content providers, A and B are given by:

(a) Prices:

$$p_A^{PR*} = \frac{1}{6}(2t(3+\lambda) + \alpha(\alpha - 2r) \qquad (14a)$$

$$p_B^{PR*} = \frac{1}{6}(2t(3-\lambda) + \alpha(5\alpha - 4r) \qquad (14b)$$

$$p_B^{AD*} = \frac{1}{6}(2t(3-\lambda) + \alpha(5\alpha - 4r - 6) \qquad (1c)$$

(b) Demands:

$$D_A^{PR*} = \frac{2(3+\lambda)t - \alpha(2r-\alpha)}{12t} \qquad (15a)$$

$$D_B^{PR*} = \frac{(1-\alpha)((3-\lambda)t - \alpha(2\alpha - r))}{6t} \qquad (15b)$$

$$D_B^{AD*} = \frac{\alpha(2(3-\lambda)t + (3+2r-4\alpha)\alpha)}{12t} \qquad (15c)$$

(c) Profits:

$$\pi_A^* = \frac{(\alpha(\alpha-2r) + 2(\lambda+3)t)^2}{72t} \qquad (16a)$$

$$\pi_B^* = \frac{\begin{pmatrix} 4(3-\lambda)^2t^2 + 4(3-\lambda)(2r-\alpha)\alpha t + \\ \alpha^2(2r(9+2r) - 2(9+11r)\alpha + 19\alpha^2) \end{pmatrix}}{72t} \qquad (16b)$$

The discount for ad-supported service, α^*, is the real solution of the following cubic equation:

$$13\alpha^3 - 3(3+4r)\alpha^2 + 2(r(3+r) - (3-\lambda)t)\alpha + 2(3-\lambda)rt = 0 \qquad (17)$$

Similar to solution in subsection 3b, we verify that the discriminant of the equation 17 is greater than or equal to zero, which means that the equation has three real roots although we need complex numbers to represent them (this is a case of Casus Irreducibilis: see Cox 2011 for more details). In Section 3d, we analyze the general case where CP A offers horizontally differentiated customizations of its service as well as ad-supported versions.

3.4. CP A offers customized and ad-supported services

In the final case, CP A not only offers customized versions of the premium service but also the ad-supported service. In other words, CP A has introduced the premium service A_{PR} and the ad-supported service A_{AD}. A_{PR} is located from the coordinates $(0,0)$ to $(\lambda, 0)$ while A_{AD} is located from coordinates $(0,1)$ to $(\lambda, 1)$. CP B also has two service offerings, the premium product B_{PR} located at $(0,1)$ and the ad-supported version B_{AD} at $(1,1)$. The setting is represented in Figure 4.

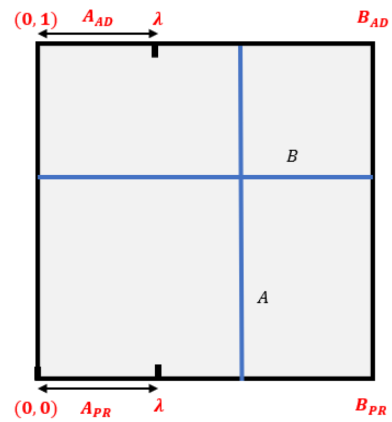

Figure 4. Customizations as well as ad-supported services offered by CP A.

The utilities of any consumer located at (x, θ) where $x > \lambda$ from subscribing to A_{PR}, A_{AD}, B_{PR}, and B_{AD} are denoted by U_A^{PR}, U_A^{AD}, U_B^{PR} and U_B^{AD} respectively and are given by the following expressions:

$$U_A^{PR} = 1 - t.(x-\lambda) - p_A^{PR} \qquad (18a)$$
$$U_A^{AD} = \theta - t.(x-\lambda) - p_A^{AD} \qquad (18b)$$
$$U_B^{PR} = 1 - t.(1-x) - p_B^{PR} \qquad (18c)$$
$$U_B^{AD} = \theta - t.(1-x) - p_B^{AD} \qquad (18d)$$

We derive the equations of the lines representing the indifferent consumers between the different services of CPs A and B to derive an equilibrium solution for prices ($p_A^{PR*}, p_B^{PR*}, \alpha^*$).

Lemma 4. The equilibrium prices, demands, and profits of the two content providers, A and B are given by:

(a) Prices:

$$p_A^{PR*} = t\left(1+\frac{\lambda}{3}\right) - \frac{r^2}{4} \qquad (22a)$$

$$p_A^{AD*} = t\left(1+\frac{\lambda}{3}\right) - \frac{r}{2}\left(1+\frac{r}{2}\right) \qquad (22b)$$

$$p_B^{PR*} = t\left(1 - \frac{\lambda}{3}\right) - \frac{r^2}{4} \quad (22c)$$

$$p_B^{AD^*} = t\left(1 - \frac{\lambda}{3}\right) - \frac{r}{2}\left(1 + \frac{r}{2}\right) \quad (22d)$$

(b) Demands:

$$D_A^{PR*} = \frac{(2-r)(3+\lambda)}{12} \quad (23a)$$

$$D_A^{AD^*} = \frac{r(3+\lambda)}{12} \quad (23b)$$

$$D_B^{PR*} = \frac{(2-r)(3-\lambda)}{12} \quad (23c)$$

$$D_B^{AD^*} = \frac{r(3-\lambda)}{12} \quad (23d)$$

(c) Profits:

$$\pi_A^* = \frac{t(3+\lambda)^2}{18} \quad (24a)$$

$$\pi_B^* = \frac{t(3-\lambda)^2}{18} \quad (24b)$$

4. Results

4.1. CP A Profit with and without ads

Here we compare the profits for CP A in two different scenarios. These two different scenarios refer to two different strategies that CP A can deploy to attract customers. On the one hand, in case 3b, CP A can offer ad-supported services along with premium services to capture customers who are price-sensitive. On the other hand, in case 3c, CP A can offer customized versions of its premium service to capture customers who want to consume the content that they like and can pay the price for the premium service. It is not clear in which case; CP A can make more profit. In case 3b it is capturing customers who are willing to watch advertisements to pay less for the content but in case 3c, CP A is capturing people who are willing to pay for the premium service that is closest to their preference on the taste dimension while losing on the customers that would have watched the ad-supported version. We plot the graphs to compare the profits in two cases as shown in Figures 5-a, 5-b. We can make three important observations. The first observation is that case 3b is better for CP A when r is sufficiently high. It means that case 3b would allow CP A to generate more revenue as compared to case 3c because the additional revenue from showing ads offsets the profit that CP A gets from gaining extra customers due to customizations. The second observation is that the advantage of case 3b will decrease as the amount of customization in case 3c increases. From Figure X, we observe that the region in (r, t) space where case 3 makes more profit increases as the customization (λ) increases. It means that CP A's strategy to win customers by customizing the content can be more effective than just offering an ad-supported service if the

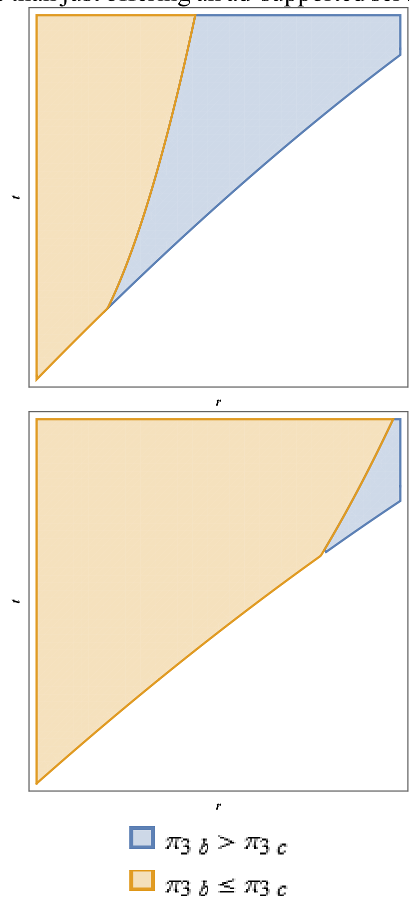

Figure 5-a, 5-b. Profit comparison for CP A for case 3b and case 3c.

market conditions are such that the ARPU is not high. Finally, near the boundary region where we see that profitability in case 3b becomes more than case 3c, we observe that for a fixed value of r, as t increases, CP A profit in case 3c is higher than in case 2b because of the increase in customers' loyalty. When t is low, then CP A profits from the ad-supported version is more than any additional customers it is able to attract in case 3c.

4.2. CP A Profit with or without ads with content personalization

Next, we look into case 3c and case 3d and see how CP A decides between these two cases. Intuitively, case 3d profit is more as compared to case 3c. The reason is that CP A has two levers in case 5, customization as well as providing ad-supported service, to attract customers. This allows CP A to capture customers who are price sensitive (by ad-supported service) and also the versions of its premium service to capture customers in case 3.

An important question arises here: Should CP A always prefer case 3d even if it means it is diluting its customers who are taste sensitive (by customized service). On the one hand, CP A only offers customized brand value by

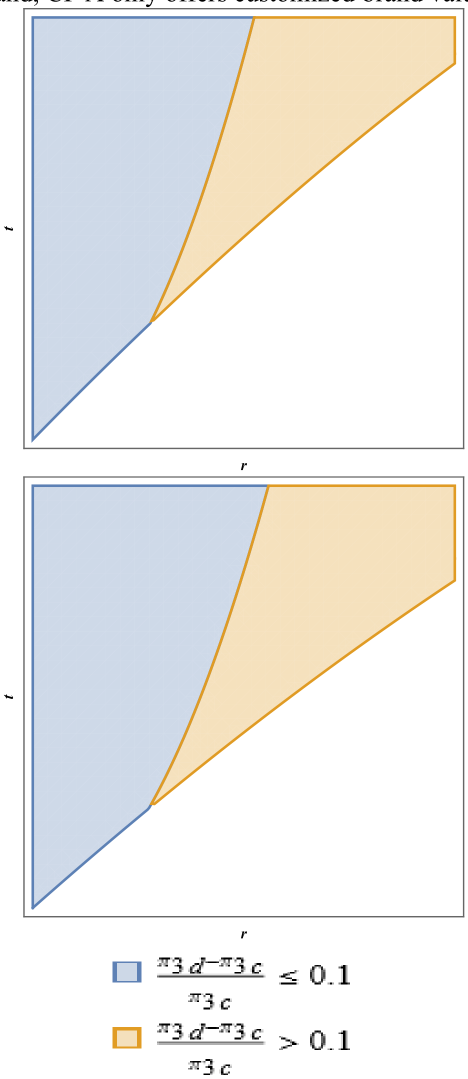

Figure 6-a, 6-b. Increase in Profit for CP A from case 3c to case 3d for $\lambda = 0.1$ and $\lambda = 0.5$.

providing a lower-cost ad-supported version? To answer this important research question, we compared the profits of CP A in case 3c and case 3d to see how much profit increases in case 3d as compared to case 3c. The intuition behind this research question is that to launch an ad-supported service, CP A has to bear significant additional technology costs. For example, when Netflix launched its ad-supported service, it partnered with Microsoft, a technology service provider, for needed support (Peters, 2022). To compare cases 3c and 3d, we looked at if the profit of CP A is at least 10% (The graphs are qualitatively similar for any other percentage values) more in case 5 as compared to case 3. The results are presented in our next proposition. Our result is presented in Figures 6-a, 6-b. From Figure panel 6, we see that it is not always beneficial for CP A to launch the ad-supported service along with the customized premium service. We can observe that when r is sufficiently high, then irrespective of t, only case 3d is beneficial as compared to case 3c. It means that a high enough ARPU value can cause the CP A to launch ad-supported service even if customers are very loyal (or t is high). On the other hand, when r is low then it is not beneficial for CP A to pursue the case 3d strategy. Although it is making more profit than case 3c, the extra profit is not enough to offset the expense to launch and support the ad-supported service. At the boundary region, where we see an increase in profitability in case 3d from case 3c compared to the cost of ad-supported service, we observe that for a fixed value of r, as t increases, CP A should remain with case 3c.

5. Conclusions

In this research, we consider the competition between two competing streaming media platforms (A and B) that pursue different consumer acquisition and revenue generation strategies. In the process, we contribute to literature in several ways. First, because we differentiate consumers on two dimensions – their taste for content and their tolerance for ads without discomfort – we are able to carry out an effective analysis of this asymmetric competition between two different revenue generation models, which is missing in the extant literature. Second, unlike the extant literature, where ads have been considered to be a uniform detractor for all consumers, our model allows us to capture the heterogenous disutility for ads in a manner that borrows ideas from the literature on horizontal and vertical differentiation but is ultimately distinct from either. Third, we explicitly considers the interplay of both dimensions – unlike prior literature on competition in two dimensions that, for tractability, mostly emphasize one at the expense of the other.

Our analysis highlights the importance of the two parameters – the strength of consumer taste preference (t) and the ARPU (r) – on the equilibrium conditions. For example, in a market where the ARPU is high, B lowers the price of its ad-supported service in order to drum up demand and thereby increase its revenue through the revenue from ads, allowing its premium service to be cannibalized. However, when consumers care more about their ideal content (i.e., t is high), both CPs can raise prices to extract more surplus from the consumers. With increasing customization, for CP A, providing ad-supported service is not always beneficial.

There are several possible extensions of our research. One promising direction might be to incorporate the multihoming behavior of some consumers by allowing a proportion of consumers to multihome and then study the impact of multihoming on the equilibrium conditions. Another possible direction might be to introduce the sunk costs of increasing the number of customizations in a multi-period game.

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