

Platform Specialization and Diversification in Content-Creation Markets: Impacts on Network Effects and Competitive Strategies

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Abstract

This paper studies two-sided market competition in the context of content creating platforms, specifically TikTok and YouTube. We assume players interact with each other under a static game and that platforms' strategies adapt to the intensity of competition among producers. Online short-video based content creation platforms such as TikTok and YouTube are fairly new and have newer implications for indirect (cross-side) network effects. We examine competition when users have preferences over two types of content and platforms can choose to specialize in one type of content or diversify into both. The study finds that platform strategies are significantly influenced by the level of competition among content producers. We consider two primary scenarios: one with an equal number of both types of producers, and another where one type of producers outnumber the other. For each scenario, we analyze how platforms respond to varying levels of competition intensity between producers. In environments with higher competitive intensity, one platform tends to diversify while the other specializes in the content type with more producers to avoid direct rivalry. Conversely, in low-intensity environments, platforms are more likely to adopt strategies akin to Hotelling's model, positioning themselves at opposite extremes.

Keywords: Two-sided market competition, Platforms competition

JEL Codes: L10, L16

1 Introduction

In the current era, people interact with each other through various means beyond traditional in-person interactions. Consider a scenario where an individual starts their day by ordering breakfast from an online delivery service (such as DoorDash or Uber Eats.) While waiting for their meal, they enjoy video content on a video content-creation platform (such as YouTube or TikTok). All of the aforementioned platforms act as crucial intermediaries, linking consumers with service providers. Specifically, food delivery platforms connect consumers with local restaurants and delivery service providers, whereas content-creation platforms bridge the gap between user generated content and its respective audience. The platform economy centering around platforms that connect two distinct agents: sellers (or provider) offering products or services, and consumers (or users) seeking these offerings is transforming how businesses operate.

Understanding the economics of platforms necessitates a grasp of network effects. These effects arise from the multitude of agents involved. They are particularly significant due to cross-side effects, where the value to users on one side increases as the user base on the opposite side grows (Belleflamme and Peitz (2018)). Consequently, platforms must take into consideration the mechanisms of how attracting agents from one side of the market impacts the participation of agents on the other side (Anderson and Jullien (2015)). In our model, platforms' decisions to specialize or diversify alter the strength of the same-side effect for producers. Consequently, this leads to variations in content portfolios and content quality, ultimately affecting users' platform choices.

There are a multitude of platforms working on the single goal of attracting agents to interact on their platform to maximize profits. In their bid to do so, they have the option to diversify their product/content offering or specialize in niches that drive their consumer traffic. This paper aims to understand how these platforms compete when given the option to diversify or specialize in various types of content and which strategy maximizes profit for them? Understanding the above mentioned problem while considering the presence of network effects is the primary focus of this

paper.

Content-creation platforms function as community-oriented ecosystems where individuals can engage interactively with a diverse array of content formats, including videos, images, and articles. Competition among these platforms typically occurs between those offering similar content formats. For example, both YouTube and TikTok focus on video content. YouTube, which was launched in 2005, initially concentrated on longer-form video content, hosting a range of videos from educational materials and tutorials to entertainment and vlogs. Conversely, TikTok, which rose to global prominence around 2018, specializes in short-form video content, with videos typically lasting just a few seconds to three minutes. In 2020, YouTube introduced 'YouTube Shorts' as a direct response to TikTok's success. This strategic move by YouTube illustrates a case of platform diversification in terms of content length, while TikTok continues to specialize in short videos.

In traditional marketplace platforms, buyers generally know what they need and perform targeted searches. Conversely, content creation platforms, which cater to leisure, entertainment, and education, attract users who often browse without a specific choice in mind. These users have preferences but not a predetermined selection, necessitating platforms to curate a diverse content portfolio. We examine content-creation platforms, such as YouTube (shorts) and TikTok, where one side of the market (content provider) produces and shares contents to the platforms, and the other side of the market enjoys them. These markets involve both inside competition (e.g., sellers competing within a platform) and outside competition (between platforms) (Rysman (2009)). In the context of online content creating platforms, this is seen in content producers competing for attention within platforms and the platforms themselves vying for both producers and users. This is in-turn influenced by user preferences and the costs of joining. The success of these platforms relies on attracting both types of agents as well as managing these network effects efficiently.

Our model examines the initial decision-making process of users choosing a platform based solely on its overall content portfolio. Users exhibit preferences for the composition of two types of con-

tents, which is captured by a location model. It identifies nine scenarios where platforms can either diversify or specialize in one of two content types. In our model, a platform’s decision to specialize in a particular content type does not preclude the availability of other content types. Instead, it implies that the platform will create a more conducive environment for the chosen content type. This is achieved through certain initial settings in the platform’s user interface, which are tailored to favor the selected content type. Such an environment helps to mitigate same-side negative effects for content producers within that content type. The study finds that platform strategies are significantly influenced by the level of competition among content producers. We consider two primary scenarios: one with an equal number of both types of producers, and another where one type of producers outnumber the other. For each scenario, we analyze how platforms respond to varying levels of competition intensity between producers. In environments with higher competitive intensity, one platform tends to diversify while the other specializes in the content type with more producers to avoid direct rivalry. Conversely, in low-intensity environments, platforms are more likely to adopt strategies akin to Hotelling’s model, positioning themselves at opposite extremes.

The rest of the paper is organized in the following manner. Section 2 discusses literature related to content-creation platforms. Section 3 introduces the model including the producers problem, users’ problem and platforms. Section 4 presents the analysis of the second stage game. Section 5 discusses the results and we conclude the paper in section 6.

2 Content-Creation Platforms

There are several aspects of content-creation platforms studied in the literature. One aspect studied extensively is the contract offerings by platforms. This large body of literature focuses on investigating the different contract structures specifically for one side of the market (usually content providers). Ambrus and Reisinger (2006) examines the effects of competition between horizontally differentiated platforms that offer both exclusive and non-exclusive contracts to content providers. These affect both content providers and users. They argue that incorporating non-exclusive con-

tracts alongside exclusive ones reduces competition for content providers among platforms, providing additional tools for platforms to capture surplus from content providers. Users, on the other hand, pay the same price as they would under an exclusive-only scenario but gain access to additional content from multi-homing providers, thereby increasing their surplus. The study aimed to model the competition between video streaming platforms, such as Netflix, Hulu, and Amazon Prime Video.

Further exploration of types of contracts is done in more recent work by Carroni, Madio, and Shekhar (2024). This paper studies how exclusivity reshapes platform competition. They find that intense platform competition leads to more consumers affiliating with platforms that secure exclusive agreements with superstar providers—a self-reinforcing mechanism that attracts additional exclusive providers and significantly shapes market outcomes through cross-group externalities.

Platform competition and pricing strategies are also popular themes studied when it comes to understanding content creation platform markets. Rietveld and Schilling (2021) and Jullien, Pavan, and Rysman (2021) provide comprehensive reviews of platform competition and pricing within the two-sided market literature, respectively. Where Rietveld and Schilling (2021) analyzes 333 articles published between 1985 and 2019. It identifies four main themes: the impact of network effects and "winner-takes-all" dynamics, corporate strategies like vertical integration in platform markets, heterogeneity in platforms and users affecting platform dynamics, and how platform hubs orchestrate value creation and capture. Jullien, Pavan, and Rysman (2021) discusses both theoretical models and empirical studies concerning pricing in two-sided markets. They begin by discussing pricing strategies of monopoly platforms and contrasts these with welfare-maximizing pricing. It then explores competition among multiple platforms, including analyses of Bertrand oligopoly and Cournot competition. Their work provides a detailed exploration of how pricing strategies differ under various market structures and competitive conditions in two-sided markets.

Furthermore, network effects in relation with market competition and pricing are also studied

in previous literature. Caillaud and Jullien (2003), Rochet and Tirole (2003) and Armstrong and Wright (2007) focusing on cross-side network effects and established a comprehensive theoretical framework for pricing structures within two-sided markets. These seminal works have significantly influenced subsequent research, providing deep insights into the formulation and implementation of pricing strategies in markets that serve two distinct yet interdependent groups of participants.

Additionally, Belleflamme and Peitz (2019) explores how platforms manage competition among sellers, examining its implications for pricing strategies and overall market outcomes. Their research highlights that the intensity of competition among sellers can significantly influence the overall value created from the interactions between sellers and buyers. They further investigate the scenarios where two competing platforms experience negative same-side effects on one side of the market. Caillaud and Jullien (2003), Rochet and Tirole (2003) and Armstrong and Wright (2007) focusing on cross-side network effects and established a comprehensive theoretical framework for pricing structures within two-sided markets. These seminal works have significantly influenced subsequent research, providing deep insights into the formulation and implementation of pricing strategies in markets that serve two distinct yet interdependent groups of participants.

Lastly, consumer expectations and their relations with content providers and platform is another major them of past literature. Anderson and Jullien (2015) discuss the concept of two-sided markets, focusing on how platforms deliver content to consumers and sell consumer attention to advertisers. The study examines various issues such as equilibrium concepts, inefficiencies in advertising markets, and the effects of consumers patronizing multiple platforms on advertising strategies and market power. Furthermore, Anderson and Gabszewicz (2006) examine the complex interplay between media platforms, advertisers, and consumers, highlighting how media industries are financed by advertising and the implications this has for the content and quality of media, as well as market dynamics and consumer choice. Lin, Hou, and Zhou (2020) closely examine the competition between pay-TV and free-to-air media platforms, revealing that program content differentiation and advertising strategies vary based on viewers' tolerance for advertising, with pay-TV platforms potentially

offering more differentiated content and either higher or lower advertising volumes than free-to-air platforms, depending on viewers' advertising preferences. Also, Hagiu and Spulber (2013) investigates the strategic use of first-party content by two-sided platforms. They see how it is influenced primarily by two factors: the expectations of users and producers (favorable versus unfavorable) and the nature of the relationship between first-party and third-party content (whether they are complements or substitutes). Platforms facing unfavorable expectations have an additional challenge: they need to set their prices and invest in first-party content in a way that eliminates low or zero participation equilibria. This often leads them to invest more in first-party content when it substitutes third-party content and less when they are complements. Additionally, in competitive scenarios where an incumbent platform faces favorable expectations and an entrant faces unfavorable ones, the incumbent typically invests more in first-party content, especially in the presence of multi-homing on one market side.

There are also studies that have shown that consumers value both quality and quantity of products or services on platforms (Baek, Ahn, and Choi (2012), Zheng and Kaiser (2013), Kim, Prince, and Qiu (2014)). With this knowledge, media platforms focus on providing high-quality as well as exclusive content in the bid to attract skilled producers. This is not unprecedented behavior given user attraction is key to generating advert revenue (D'Annunzio (2017)). Platforms like YouTube share a significant portion of advert revenue with producers, and initiatives like TikTok's 2021 Creator Fund support quality content creation^{1 2}. This approach, where platforms subsidize high-quality content and balance user charges with producer compensation, is essential in their strategic operations in dynamic digital markets. Recent studies have further delved into these platforms' subsidization strategies for quality content (Huang, Lyu, and Xu (2022), Fu and Lyu (2022)).

A lot of the aforementioned studies consider quality as an exogenous factor, such as the type of producers. However, in our model, we allow producers to strategically choose quality to opti-

¹<https://newsroom.tiktok.com/en-gb/tiktok-creator-fund-your-questions-answered>

²<https://www.socialmediatoday.com/news/youtube-generated-288-billion-in-ad-revenue-in-2021-fueling-the-creator/618208/>

mize their expected earnings. This paper also focuses on a different networking aspect in content creation markets, concentrating on the cross-side effects between content producers and users. Our approach considers advertising as an external cost imposed on users by the platforms.

3 Model

Our model involves three key actors: platforms, producers, and users. Platforms act as intermediaries, supplying visual content and facilitating engagement between producers and users. Producers create content and select platforms for sharing it. Users, in turn, choose platforms on which to consume content. Both producers and users decide between two platforms ($j = 1, 2$) in order to maximize their utility. Let n^j and m^j denote the number of users and producers in platform j in equilibrium respectively. We assume that both content provider and user are single home and it is mandatory for all providers to participate on one of the two platforms.

3.1 Producers

Considering two types of producers $P_c \in \{P_A, P_B\}$ specializing in content type A and B, respectively. The total number of type c producer is represented by m_c . Producers who create content aligned with their specialty, $m_{c,c}$, produce high-quality content, while, the other group of producers, $m_{c,-c}$, chose to mimic the content choice of others, resulting in low-quality content production.

The utility of producer, i , chooses platform, j , and content, c , aligned with specialty is given by:

$$V_{c,c}^j = p + \alpha n^j - \beta^j m_{c,c}^j \tag{1}$$

The utility of producer, i , chooses platform, j , and content, $-c$, different from specialty is given by:

$$V_{c,-c}^j = \gamma p + \alpha n^j - \beta^j m_{c,-c}^j \quad (2)$$

The first term of equation (1) and (2), p and γp is the wage producer received choosing content type aligned (and not aligned) with their respective specialty. We assume that p is a sufficiently large number to ensure that producers would choose joining the platform instead of pursuing outside options. $\gamma \in (0, 1)$ is a penalty for producers who choose to create content that mismatches their specialty. The second term, αn^j , captures the benefits to a producer from interacting with n^j users on the other side of the platform, where α is the cross-side effect parameter. β is the same-side effect parameter strategically choosing by platform j . $\beta m_{c,c}^j$ and $\beta m_{c,-c}^j$ indicates the level of competition among producers of the same specialty who choose identical content types. $m_{c,c}^j$ is the number of producers on platform j who choose to produce content aligned with their specialty. $m_{c,-c}^j$ is the number of producers on platform j who choose to produce content different from their specialty. The underlying assumption here is that competition occurs only when the content is of the same type and "quality"³.

3.2 Platform

Platforms, indexed as j ($j = 1, 2$), both offering comparable services and engaging in competition with each other. Once a platform decides on its content type specialization or diversification, the same-side effect parameter, $\beta_c^j = \{1, \beta\}$, $\beta > 1$, adjusts accordingly. A platform deciding to diversify indicates the platform values both content types equally. Furthermore, we define the same-side effect without any intervention by platform in this scenario as β for both content types. If a platform decides to specialize in "content A", it will create a more favorable environment for "A-type" content, resulting in lower same-side effects (decreasing $\beta_A^j = 1$).

³We will further explore the definition of "quality" for content in the User section.

		Platform 2		
		Diversify	Specialize in A	Specialize in B
Platform 1	Diversify	$(\beta_A^1 = \beta_B^1 = \beta; \beta_A^2 = \beta_B^2 = \beta)$	$(\beta_A^1 = \beta_B^1 = \beta; \beta_A^2 = 1, \beta_B^2 = \beta)$	$(\beta_A^1 = \beta_B^1 = \beta; \beta_A^2 = \beta, \beta_B^2 = 1)$
	Specialize in A	$(\beta_A^1 = 1, \beta_B^1 = \beta; \beta_A^2 = \beta_B^2 = \beta)$	$(\beta_A^1 = 1, \beta_B^1 = \beta; \beta_A^2 = 1, \beta_B^2 = \beta)$	$(\beta_A^1 = 1, \beta_B^1 = \beta; \beta_A^2 = \beta, \beta_B^2 = 1)$
	Specialize in B	$(\beta_A^1 = \beta, \beta_B^1 = 1; \beta_A^2 = \beta_B^2 = \beta)$	$(\beta_A^1 = \beta, \beta_B^1 = 1; \beta_A^2 = 1, \beta_B^2 = \beta)$	$(\beta_A^1 = \beta, \beta_B^1 = 1; \beta_A^2 = \beta, \beta_B^2 = 1)$

Table 1 displays the content strategies of platforms: Diversify, Specialize in Content A, or Specialize in Content B, along with the platform's corresponding choice of β_c^j . Given the symmetric nature of the two platforms, our problem now narrows down to 4 cases: $\{DD, DS, SS_1, SS_2\}$ representing the combinations of strategies adopted by platforms 1 and 2, respectively. Where (SS_1) denotes scenarios where both platforms specialize in the same content, whereas (SS_1) indicates each platform specializes in different type of content.

Platforms derive their primary revenue by imposing a fixed subscription fee, F^j on users, while paying producers a wage, p , for high-quality content and γp for low-quality content.

Given the content type choices of two platforms, platform j maximize its profit w.r.t F_j

$$\Pi^j = F^j n^j - p m_{c,c}^j - \gamma p m_{c,-c}^j \quad (3)$$

In equation (3), the first term, $F^j n^j$ ⁴, represents the revenue platform j generates from its users. The second and third terms indicate the wages that platform j pays to high-quality and low-quality producers, respectively.

⁴ F^j also defined in section 3.3 Users Problem

3.3 Users Problem

Users are uniformly distributed along a unit interval $[0, 1]$. Within this interval, there are two types of content, denoted as A and B, positioned at the extreme points 0 and 1, respectively. User's location on the unit interval, denoted as x signifies their preference for a particular combination of content A and B. This implies that users would prefer a platform with a portfolio most similar to their preference, represented as a linear combination of content A and B. For instance, if a user is located at 0.3 on the unit interval, it suggests that the user's ideal case is to join a platform with 30% of content A and 70% of content B.

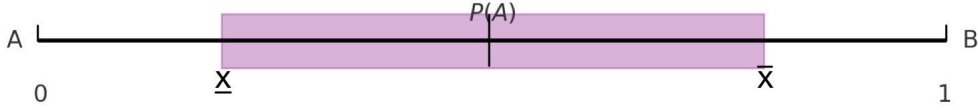


Figure 1: Potential user for platform with $P(A)$ portfolio

The utility for a user located at x on the unit interval joining platform j can expressed as follows:

$$U^j(x) = Q^j - |(1 - P(A | Pl_j)) - x| - F^j \quad (4)$$

Where $Q^j = \frac{m_{A,A} + m_{B,B}}{m^j}$ is the quality measure of platform j . We assume that only content aligned with the producer's specialty is considered qualitative. Therefore, Q^j is a weighted measure of content quality, assigning a weight of 1 to matched contents and 0 to unmatched contents. $P(A | Pl_j) = \frac{m_{A,A} + m_{B,A}}{m^j}$ is the proportion of content A on platform j . The second term, $|(1 - P(A | Pl_j)) - x|$, measures the absolute distance between the user's preferred portfolio to the actual portfolio of platform j . It serves as a penalty for the mismatch between the users preference and the platforms' portfolio, and conceptually it is similar to the transportation cost in Hotelling's

model. However, in our model, unlike the Hotelling's model where the platform selects its position along the line, the exact location is determined endogenously at equilibrium. The last term, F^j , represents the subscription fee required to access content on platform j .

3.4 Timing

We frame the problem as a three-stage competition game. In the first stage, each platform choosing between "Diversify," "Specialize in Content A," or "Specialize in Content B." and subscription fee, F_j . Moving to the second stage, given the platforms' decisions, producers choose C (the type of content), and the platform ($j = 1, 2$) to maximize their utility. In the final stage, users choose platform ($j = 1, 2$) based on the content portfolio and quality of the platforms.

4 Analysis of the Second Stage Game

In this section, we analyze the equilibrium of the game under different platform strategy outcomes from the first stage. As we discussed earlier, the strategies lead to 4 scenarios: $\{DD, DS, SS_1, SS_2\}$.

We now analyze each of the cases. For each of the cases, the following is expected to hold true:

Conditon # 1: Producer will not have a profitable deviation from switching content type on the both platform j and $-j$:

$$\begin{aligned} V_{c,c}^j &= V_{c,-c}^j \\ V_{c,c}^{-j} &= V_{c,-c}^{-j} \end{aligned} \tag{5}$$

Conditon # 2: Producer will not have a profitable deviation from switching to platform $-j$:

$$V_{c,c}^j = V_{c,c}^{-j} \tag{6}$$

Conditon # 3: Producer will not have a profitable deviation from switching to platform $-j$ and content type $-c$:

$$V_{c,c}^j = V_{c,-c}^{-j} \tag{7}$$

Conditon # 4: The total number of type c producers on both platforms chooses sum up to m_c :

$$\sum_j m_{c,c} + m_{c,-c} = m_c \tag{8}$$

4.1 Case DD: Both Platforms Decide to Diversify

We start with the case DD such that both platforms decided to diversify content type in the first stage ($\beta_A^1 = \beta_B^1 = \beta$; $\beta_A^2 = \beta_B^2 = \beta$). At the margin, producer i will be indifferent between platforms ($j = 1, 2$) and content type (A, B) .

Applying condition one through four (equations (5) to (8)), we can derive the number of producers who choose to create content aligned with their specialty and those who do not, respectively:

$$m_{c,c}^j = \frac{m_c + \frac{2p(1-\gamma)}{\beta}}{4} \quad (9)$$

$$m_{c,-c}^j = \frac{m_c - \frac{2p(1-\gamma)}{\beta}}{4} \quad (10)$$

Thus, we can derive the content portfolio and quality of platform j in this case:

$$P(A \mid P^j) = \frac{1}{2} \quad (11)$$

$$Q^j = \frac{m + 2k}{2m} \quad (12)$$

Where $k = \frac{2p(1-\gamma)}{\beta}$.

With users' utility, equation (4), we can derive numbers of users on platform j :

$$n^j = \frac{1}{2} + \frac{k}{m} - F^j \quad (13)$$

Then we substitute everything back into the platform's profit equation (3), together with the first order condition w.r.t F_j and derive the subscription fee for platform j , which in this case is:

$$F^j = \frac{1}{4} + \frac{k}{2m} \quad (14)$$

Finally, we can derive platforms' profit for Case DD, $\Pi_{D,D}^j$:

$$\Pi_{D,D}^j = \left(\frac{1}{4} + \frac{k}{2m}\right)^2 - \frac{p}{4}((1+\gamma)m - (1-\gamma)k) \quad (15)$$

4.2 Case DS: One Platform Decides to Diversify While the Other Decides to Specialize

In this subsection, we consider the case where only one platform decides to specialize. Without loss of generality, we consider the case platform 1 chooses to diversify, while platform 2 specializes in content type A ($\beta_A^1 = \beta_B^1 = \beta$; $\beta_A^2 = 1, \beta_B^2 = \beta$). Applying conditions one through four (equations (5) to (8)), we can derive the number of type c producers that chose to create content type c and $-c$ on platform 1 and 2, respectively: $m_{A,B}^1, m_{A,A}^1, m_{B,B}^1, m_{B,A}^1, m_{A,B}^2, m_{A,A}^2, m_{B,B}^2, m_{B,A}^2$.

Then, we can derive the content portfolio and quality of platform 1 that chooses to diversify in this case:

$$P(A \mid Pl^1) = \frac{1}{2} \quad (16)$$

$$Q^1 = \frac{1}{2} + \frac{\beta + 3}{4} \frac{k}{m} \quad (17)$$

As well as the content portfolio and quality of platform 2 that adopts a specializing strategy in content A:

$$P(A \mid Pl^2) = \frac{\beta}{1 + \beta} \quad (18)$$

$$Q^2 = \frac{\beta m_A + m_B}{(\beta + 1)m} + \frac{3\beta + 1}{2(\beta + 1)} \frac{k}{m} \quad (19)$$

Following the same procedure as subsection 4.1, we can obtain the number of users on each of the platforms, $n^j = 2Q^j - 2F^j$, as well as the subscription fee, $F^j = 1/2Q^j$. It is straightforward to observe that Q^2 is greater than Q^1 since $\beta > 1$. Nonetheless, the amount of quality B type content remains identical between the two platforms (i.e. $m_{B,B}^1 = m_{B,B}^2$). By adopting a specialization strategy, platform 2 draws more A type producers with high-quality content. Consequently, this allows platform 2 to levy a higher subscription fee on its users.

Thus, the platforms' profits can be written as:

$$\Pi_{DS}^1 = \frac{1}{2} \left(\frac{1}{2} + \frac{\beta+3}{4} \frac{k}{m} \right)^2 - (p + \gamma p) * \left(\frac{m}{\beta+3} + \frac{k}{2} \right) \quad (20)$$

$$\begin{aligned} \Pi_{DS}^2 = & \frac{1}{2} \left(\frac{\beta m_A + m_B}{(\beta+1)m} + \frac{3\beta+1}{2(\beta+1)} \frac{k}{m} \right)^2 \\ & - p * \left(\frac{\beta m_A + m_B}{\beta+3} + \left(\frac{3\beta+1}{\beta+3} \right) \frac{k}{2} \right) - \gamma p * \left(\frac{m_A + \beta m_B}{\beta+3} + \left(\frac{3\beta+1}{\beta+3} \right) \frac{k}{2} \right) \end{aligned} \quad (21)$$

4.3 Case SS_1 : Both Platforms Specialize in Same Content Type

Now we examine the case where both platforms decide to specialize in the same content type. Without loss of generality, we consider the case where both platforms choose to specialize in content A ($\beta_A^1 = 1, \beta_B^1 = \beta; \beta_A^2 = 1, \beta_B^2 = \beta$). This specific case is symmetric across both platforms. By applying Equation (5) through (8), we can derive the number of type c producers chooses to create content type c as $-c$ on both platforms: $m_{A,B}^j, m_{A,A}^j, m_{B,B}^j, m_{B,A}^j$.

Thus, we can derive the content portfolio and quality of platform j in this case:

$$P(A | Pl^j) = \frac{\beta}{\beta+1} \quad (22)$$

$$Q^j = \frac{\beta m_A + m_B}{(\beta+1)m} + 2 \frac{k}{m} \frac{\beta}{\beta+1} \quad (23)$$

Following the same procedure as in previous subsections, we can obtain the number of users on each of the platforms, $n^j = Q^j - F^j$, as well as the subscription fee, $F^j = 1/2Q^j$.

Thus, the platforms' profits can be written as:

$$\begin{aligned} \Pi_{SS_1}^1 = & \frac{1}{4} \left(\frac{\beta m_A + m_B}{(\beta+1)m} + 2 \frac{k}{m} \frac{\beta}{\beta+1} \right)^2 \\ & - p \left(\frac{\beta m_A + m_B}{2(\beta+1)} + \frac{\beta}{\beta+1} k \right) - \gamma p \left(\frac{m_A + \beta m_B}{2(\beta+1)} - \frac{\beta}{\beta+1} k \right) \end{aligned} \quad (24)$$

4.4 Case SS_2 Both Platforms Specialize Different Content Type

We now consider the case where each platform choose to specialize in different types of content. Platform 1 specializes in content A, while platform 2 specializes in content B ($\beta_A^1 = 1, \beta_B^1 = \beta; \beta_A^2 = \beta, \beta_B^2 = 1$). Applying equations (5) to (8), we can derive the number of type c producers that choose to create content type c and $-c$ on platform 1 and 2, respectively: $m_{A,B}^1, m_{A,A}^1, m_{B,B}^1, m_{B,A}^1, m_{A,B}^2, m_{A,A}^2, m_{B,B}^2, m_{B,A}^2$.

Then, we can derive the content portfolio and quality of platform 1 that chose diversifying in this case:

$$P(A \mid Pl^1) = \frac{\beta}{1 + \beta} \quad (25)$$

$$Q^1 = \frac{\beta m_A + m_B}{(\beta + 1)m} + \frac{\beta + 1}{2} \frac{k}{m} \quad (26)$$

As well as the content portfolio and quality of platform 2 that adopts a specializing strategy in content A:

$$P(A \mid Pl^2) = \frac{1}{1 + \beta} \quad (27)$$

$$Q^2 = \frac{m_A + \beta m_B}{(\beta + 1)m} + \frac{\beta + 1}{2} \frac{k}{m} \quad (28)$$

Following the same procedure as in subsection 4.1, we can obtain the number of users on each of the platforms, $n^j = 2Q^j - 2F^j$, as well as the subscription fee, $F^j = 1/2Q^j$.

Thus, the platforms' profits can be written as:

$$\begin{aligned} \Pi_{SS_2}^1 = & \frac{1}{2} \left(\frac{\beta m_A + m_B}{(\beta + 1)m} + \frac{\beta + 1}{2} \frac{k}{m} \right)^2 \\ & - p \left(\frac{\beta m_A + m_B}{2(\beta + 1)} + \frac{k(\beta + 1)}{4} \right) - \gamma p \left(\frac{m_A + \beta m_B}{2(\beta + 1)} - \frac{k(\beta + 1)}{4} \right) \end{aligned} \quad (29)$$

$$\begin{aligned}\Pi_{SS_2}^2 = & \frac{1}{2} \left(\frac{m_A + \beta m_B}{(\beta + 1)m} + \frac{\beta + 1}{2} \frac{k}{m} \right)^2 \\ & - p \left(\frac{m_A + \beta m_B}{2(\beta + 1)} + \frac{k(\beta + 1)}{4} \right) - \gamma p \left(\frac{\beta m_A + m_B}{2(\beta + 1)} - \frac{k(\beta + 1)}{4} \right)\end{aligned}\quad (30)$$

5 Results and Discussion

In the first stage, each of the two platforms decides whether to specialize in “Content A” or “Content B,” or to diversify by offering both “Content A and B,” considering the potential equilibrium profits in the subsequent stage. Table 1 presents the equilibrium profits for the two platforms under nine different strategic scenarios. The subscripts in the table represent the specific specialization strategies adopted by Platform 1 and Platform 2.

		Platform 2's Strategy		
		Diversify	Specialize in A	Specialize in B
Platform 1's Strategy	Diversify	(Π_{DD}^1, Π_{DD}^2)	$(\Pi_{DSA}^1, \Pi_{DSA}^2)$	$(\Pi_{DSB}^1, \Pi_{DSB}^2)$
	Specialize in A	$(\Pi_{SAD}^1, \Pi_{SAD}^2)$	$(\Pi_{SASA}^1, \Pi_{SASA}^2)$	$(\Pi_{SASB}^1, \Pi_{SASB}^2)$
	Specialize in B	$(\Pi_{SBD}^1, \Pi_{SBD}^2)$	$(\Pi_{BSA}^1, \Pi_{BSA}^2)$	$(\Pi_{BSB}^1, \Pi_{BSB}^2)$

Firstly, we examine a scenario where there is an equal distribution of producer types, with $m_A = m_B = 0.5$.⁵ This setup results in symmetric outcomes for both platforms for Case SS_2 , where platforms chooses to specialize in different content type ($\Pi_{SS_2}^1 = \Pi_{SS_2}^2$).

⁵ $\gamma = 0.1$ and $p = 1$

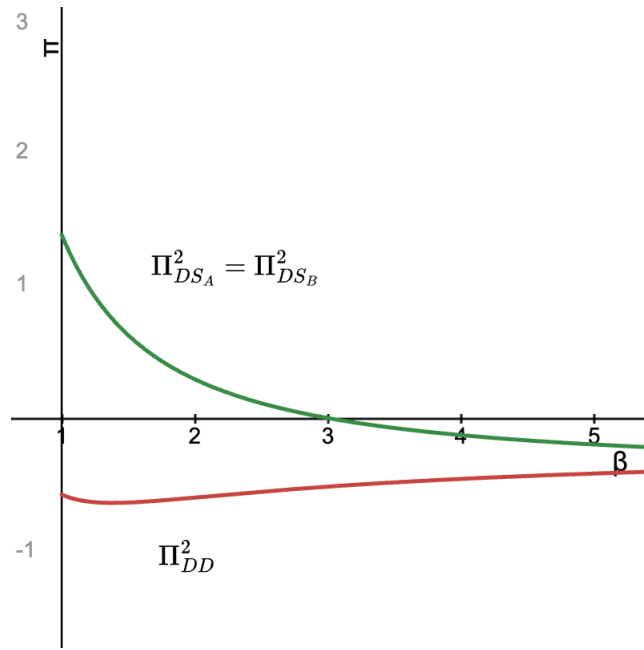


Figure 2.a Platform 1 chooses Diversity Strategy

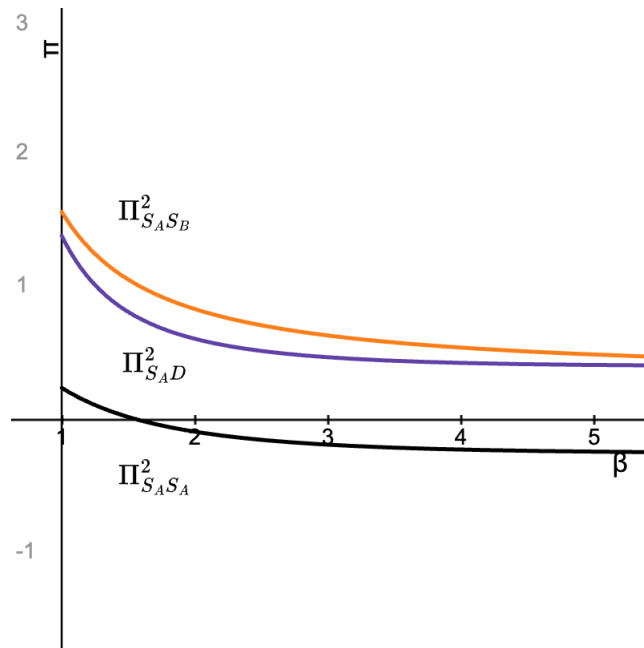


Figure 2.b Platform 1 chooses Specialize in A Strategy

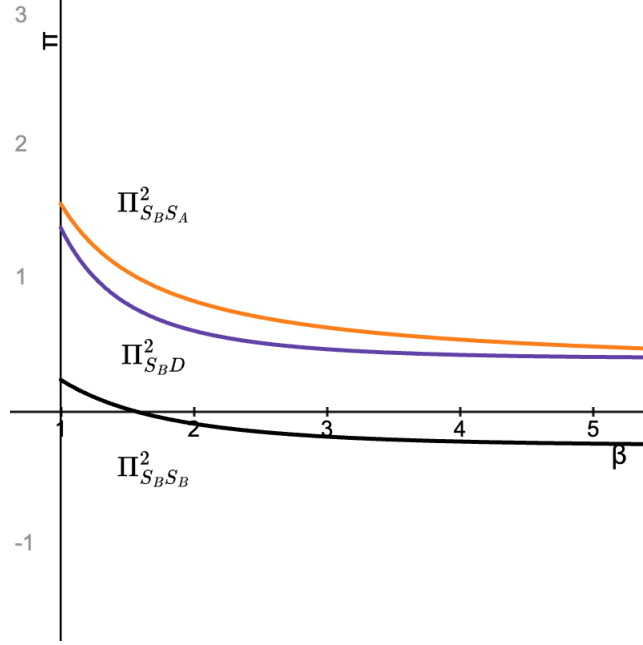


Figure 2.c Platform 1 chooses Specialize in B Strategy

Figure 2 illustrates the profits of platform 2 in response to the content type choices of platform 1. In Figure 2(a), it is shown that when platform 1 chooses to diversify, platform 2's most profitable strategy is to specialize in any content type, as indicated by the green line consistently being above the red line, which signifies higher profits for platform 2 under the Case DS . Figure 2(b) and 2(c) indicate that when platform 1 specializes in a specific content type, the optimal response for platform 2 is to specialize in the alternative content type. This is demonstrated by the orange line consistently being at the top, indicating that platform 2 earns more in the case SS_2 .

In such scenarios, $\{S_A, S_B\}$, $\{S_B, S_A\}$ emerge as Nash Equilibria. This finding implies that platforms are inclined to embrace different specializations with an equal distribution of producer types. This behavior aligns with predictions from Hotelling's model, where platforms position themselves at extremes to maximize user attraction. Additionally, the graph shows that as β increases, profits decrease in this scenario. This trend occurs because an increase in β , with a fixed penalty for mismatch γ , intensifies competition among producers for the non-targeted content type. This com-

petitive environment encourages mimicking behavior among producers of the non-targeted content type, leading to a decline in content quality for the platform's targeted content.

Now we consider the scenario where we have more of one type of content producer than the other, for example $m_A = 0.2$ ⁶. We present the case where we have more type B producers. Figure 3 presents the profits of platform 2 in response to the content type choices of platform 1.

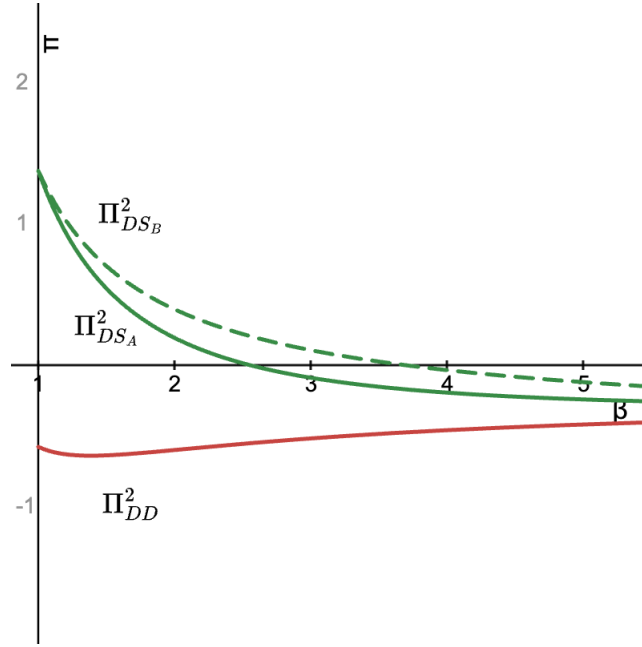


Figure 3.a Platform 1 chooses Diversity Strategy

⁶similar results as long as $m_A < m_B$

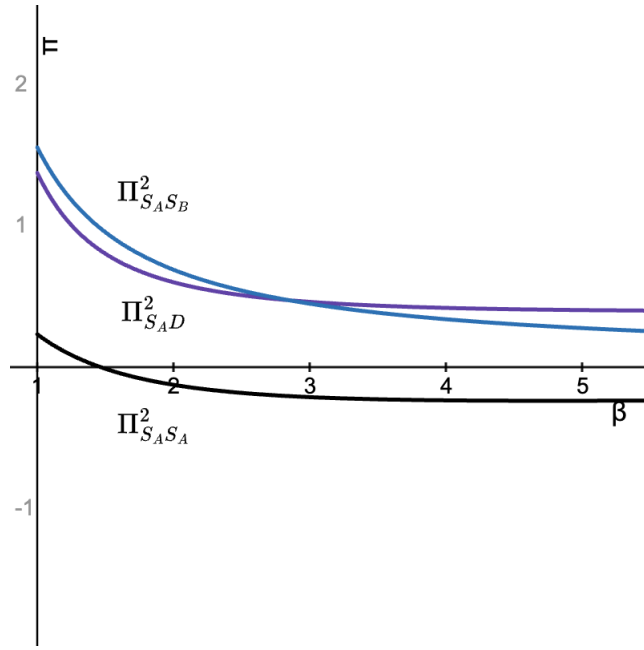


Figure 3.b Platform 1 Chooses Specialization in A Strategy

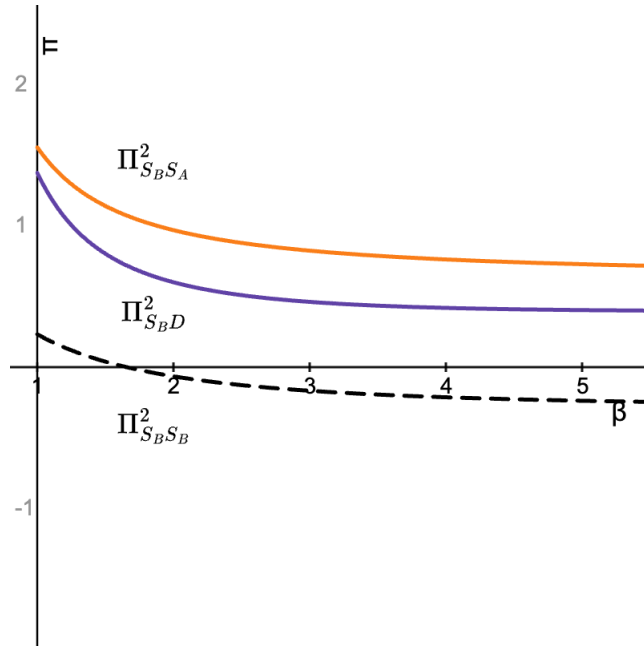


Figure 3.c Platform 1 Chooses Specialization in B Strategy

Figure 3.a illustrates the profits of platform 2 under various content choice strategies, responding to platform 1's decision to diversify its content. In this graph, the green dashed line indicates when platform 2 specializes in content type B, while the green solid line represents specialization in content type A, and the red line shows when platform 2 also opts to diversify. The graph suggests that the optimal strategy for platform 2, when faced with platform 1's diversification, is to specialize in the content type that has a larger number of producers. This is because a greater number of producers typically enhances the quality of content, which in turn can lead to higher profits.

Figure 3.b displays the profits of platform 2 for different content choice strategies $(\{S_A, S_B, D\})$ when platform 1 specializes in content type A. platform 2's profit outcomes of these strategies are represented by the blue, black, and purple lines, respectively. The graph indicates that specializing in content type A (black line) results in the lowest profit for both platforms when they both choose this strategy. Notably, the intersection of the blue and purple lines suggests that the optimal strategy for platform 2 varies depending on the value of β . Specifically, when β is relatively small⁷, Platform 2's best response is to specialize in a different content type from platform 1, as indicated by the blue line being on top. Conversely, when β exceeds this threshold, platform 2's optimal strategy shifts to diversification, as shown by the purple line rising to the top.

Figure 3.c illustrates the profits of platform 2 under its content choices $(\{S_A, S_B, D\})$ conditioned on platform 1 specializing in content type B. The profit outcomes for platform 2's strategies are shown by the orange, purple, and black dashed lines, respectively. The graph indicates that platform 2's best response to platform 1's specialization in content B is to specialize in the alternative content type, A.

In this scenario, we consider two cases for β : small β and large β . When the un-adjusted same-side effect β is small, $\{S_A, S_B\}$, $\{S_B, S_A\}$ are the Nash equilibria. Conversely, when the un-adjusted same-side effect β is large, the Nash equilibria become $\{D, S_B\}$, $\{S_B, D\}$. These results sug-

⁷ $\beta < 2.85$

gest that when the un-adjusted same-side effect for producers is relatively small, the proportion of producer types does not alter the Nash equilibria. However, with a high same-side effect and a shortage of type A producers in this setup, if a platform still chooses to specialize in content type A in response to the other platform specializing in content type B , type B producers might mimic type A content, reducing the overall quality of the platform. Since users in the model value both the content portfolio and platform quality, this decrease in platform quality would deter users, resulting in lower profits for the platforms. Which makes diversification a preferable strategy when β is large.

6 Conclusion

This study introduces a new theoretical framework to examine competition between two-sided platforms featuring diverse content types. Our model explores nine distinct scenarios, where platforms can opt for either a diversified approach or specialize in one of two content types. The findings reveal that platform strategies are influenced by the level of competition among content producers. We examined two scenarios, first, with equal amount of both types of producers, and the other where type B producers exceed the type A producers. For each of these scenarios, we see how the platforms respond to changes in competition intensity between producers. With higher competitive intensity, one platform tends to diversify while the other specializes in the content types with more producers to avoid direct rivalry. Conversely, in a low-intensity environment, platforms are more inclined to adopt strategies similar to the Hotelling’s model where they would locate on two extremes. Our findings offer a benchmark and strategic direction for competition among two-sided platforms. By modifying their specialization approach, platforms can enhance their profitability and attract a larger consumer base to the market.

For future research aiming to more accurately model real-world competition in two-sided markets, it would be reasonable to consider the a few aspects. Firstly, introducing heterogeneity among producers by considering unique factors like individual abilities or varying availability for work.

Secondly, broadening the applicability of results by moving away from the assumption that all producers fully participate. Lastly, Acknowledging the potential overlap between users and producers, such as scenarios where users also generate content on the platform and producers engage in content consumption.

References

- Ambrus, Attila and Markus Reisinger (2006). “Exclusive vs Overlapping Viewers in Media Markets”. In: Publisher: Universitätsbibliothek der Ludwig-Maximilians-Universität München.
- Anderson, Simon P. and Jean J. Gabszewicz (2006). “Chapter 18 The Media and Advertising: A Tale of Two-Sided Markets”. In: *Handbook of the Economics of Art and Culture*. Vol. 1. Elsevier, pp. 567–614.
- Anderson, Simon P. and Bruno Jullien (2015). “The Advertising-Financed Business Model in Two-Sided Media Markets”. In: *Handbook of Media Economics*. Vol. 1. Elsevier, pp. 41–90.
- Armstrong, Mark and Julian Wright (Aug. 2007). “Two-sided Markets, Competitive Bottlenecks and Exclusive Contracts”. In: *Economic Theory* 32(2), pp. 353–380.
- Baek, Hyunmi, JoongHo Ahn, and Youngseok Choi (Dec. 2012). “Helpfulness of Online Consumer Reviews: Readers’ Objectives and Review Cues”. In: *International Journal of Electronic Commerce* 17(2), pp. 99–126.
- Belleflamme, Paul and Martin Peitz (Feb. 23, 2018). “Platforms and network effects”. In: *Handbook of Game Theory and Industrial Organization, Volume II*. Ed. by Luis C. Corchón and Marco A. Marini. Edward Elgar Publishing.
- Belleflamme, Paul and Martin Peitz (Jan. 2019). “Managing competition on a two-sided platform”. In: *Journal of Economics & Management Strategy* 28(1), pp. 5–22.
- Caillaud, Bernard and Bruno Jullien (2003). “Chicken & Egg: Competition among Intermediation Service Providers”. In: *The RAND Journal of Economics* 34(2), p. 309.
- Carroni, Elias, Leonardo Madio, and Shiva Shekhar (Feb. 2024). “Superstar Exclusivity in Two-Sided Markets”. In: *Management Science* 70(2), pp. 991–1011.
- D’Annunzio, Anna (July 2017). “Vertical integration in the TV market: Exclusive provision and program quality”. In: *International Journal of Industrial Organization* 53, pp. 114–144.
- Fu, Qi and Gaoyan Lyu (Oct. 2, 2022). “Competition Between Two-Sided Platforms With Quality-Based Subsidization”. In: *International Journal of Electronic Commerce* 26(4), pp. 526–551.

- Hagiu, Andrei and Daniel Spulber (Apr. 2013). “First-Party Content and Coordination in Two-Sided Markets”. In: *Management Science* 59(4), pp. 933–949.
- Huang, Peng, Gaoyan Lyu, and Yi Xu (June 2022). “Quality Regulation on Two-Sided Platforms: Exclusion, Subsidization, and First-Party Applications”. In: *Management Science* 68(6), pp. 4415–4434.
- Jullien, Bruno, Alessandro Pavan, and Marc Rysman (2021). “Chapter 7 - Two-sided markets, pricing, and network effects”. For comments and suggestions, we thank the editors, anonymous referees, as well as Mark Armstrong, Jay-Pil Choi, Avi Goldfarb, Hanna Halaburda, Igal Hendel, Chuqing Jin, Marshall Van Alstyne, Shuang Wang, Stefan Weiergraeber, Julian Wright, and Junjie Zhou. Special thanks to Martin Peitz for very detailed comments. Jishan Du, Tyler Haas, and Shuang Wang provided excellent research assistance. Bruno Jullien acknowledges funding from ANR under grant ANR-17-EURE-0010 (Investissements d’Avenir program) and ANITI (ANR grant 3IA), and from the European Research Council (ERC) under the European Union’s Horizon 2020 research and innovation programme (grant agreement No 670494).” In: *Handbook of Industrial Organization, Volume 4*. Ed. by Kate Ho, Ali Hortaçsu, and Alessandro Lizzeri. Vol. 4. Handbook of Industrial Organization 1. ISSN: 1573-448X. Elsevier, pp. 485–592.
- Kim, Jin-Hyuk, Jeffrey Prince, and Calvin Qiu (Nov. 2014). “Indirect network effects and the quality dimension: A look at the gaming industry”. In: *International Journal of Industrial Organization* 37, pp. 99–108.
- Lin, Xiaogang, Rui Hou, and Yongwu Zhou (Feb. 2020). “Platform Competition for Advertisers and Viewers in Media Markets with Endogenous Content and Advertising”. In: *Journal of Systems Science and Systems Engineering* 29(1), pp. 36–54.
- Rietveld, Joost and Melissa A. Schilling (July 2021). “Platform Competition: A Systematic and Interdisciplinary Review of the Literature”. In: *Journal of Management* 47(6), pp. 1528–1563.
- Rochet, Jean-Charles and Jean Tirole (June 1, 2003). “Platform Competition in Two-Sided Markets”. In: *Journal of the European Economic Association* 1(4), pp. 990–1029.
- Rysman, Marc (Aug. 1, 2009). “The Economics of Two-Sided Markets”. In: *Journal of Economic Perspectives* 23(3), pp. 125–143.

Zheng, Yuqing and Harry Kaiser (Aug. 1, 2013). “Optimal quality threshold of admission in a two-sided farmers’ market”. In: *Applied Economics* 45(23), pp. 3360–3369.