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Pricing of Digital Video Supply Chain: Free versus Paid Service on the Direct Distribution Channel

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Abstract: Media publishers that have commonly relied on profits from advertisements and content sales to fund their operations are not only content providers (manufacturers) to media aggregator platforms (retailers) but are also competing service providers (rival retailers) in the digital video supply chain. Different from a traditional media supply chain, they can easily operate their own direct distribution channels in the Internet era. In the digital video supply chain, it is not clear whether commercialization of the direct distribution channel would be beneficial for the media publisher because it would decrease profits from advertisements. The choice about commercialization should be investigated thoroughly because it is closely related to the media publishers' sustainability as a public medium in a digital environment. In this study, we analyze the impacts of commercializing the direct distribution channel based on a game-theoretic approach. Specifically, we compare the profits of a media publisher with and without the commercialization of the channel from analyses of sequentially defined games. Our results show that media publishers prefer to use a free service on their direct channel if the content they provide is not highly valued. They can also choose not to provide their content to the media aggregator with a paid service.

Keywords: digital video supply chain; media publisher; media aggregator; distribution channel; paid service; free service

1. Introduction

The advent of the Internet has changed many aspects of media consumption. A recent study on TV usage showed that about 60% of young adults primarily use online streaming to watch television (<http://www.pewresearch.org/fact-tank/2017/09/13/about-6-in-10-young-adults-in-u-s-primarily-use-online-streaming-to-watch-tv/>). In addition, online newspapers are commonly consumed through mobile devices nowadays. Instead of traditional media consumption environments, media firms today have to cope with consumers in new environments. The broadcasters have now moved to media publishers in online video distribution platforms for video over-the-top (OTT) services such as Hulu or Netflix. Traditionally, the broadcasters earn profits from advertising and retransmission. They sell their TV programs to pay-TV in return for the retransmission fee, and the pay-TV heighten their service quality by retransmitting these programs to their subscribers. The broadcasters also earn profits from advertisements, which are usually proportional to the number of viewers exposed to their TV programs. To increase viewership, the broadcasters present TV programs on the free-to-air service so that viewers can watch them freely. The broadcaster is therefore not only a competing service platform (retailer) but also a content provider (manufacturer) to the pay-TV platform (competing retailer) with the content fee (wholesale price). Thus, the broadcaster is a service provider with dual distribution channels in a TV service supply chain because it provides its service freely on a direct channel and sells its content to retail service providers.

Online TV broadcasting has several advantages over terrestrial broadcasting for media publishers. The online version can easily operate direct distribution channels to consumers. The popularization of information technologies such as cloud services, online streaming technologies, and advanced mobile devices enables online TV broadcasting services to construct a direct channel at a cheaper price. Besides, it is possible for the publishers to commercialize the direct distribution channel by charging each online viewer, which is not possible with free-to-air broadcasting. Therefore, the media publisher can consider additional revenue channels other than advertising and content sales. When it comes to media distribution platforms, the media publisher has dual distribution channels in the digital video supply chain: the direct distribution platform and the media aggregator platform. Similar to terrestrial broadcasting, the media publisher can sell its content to the media aggregator in return for the content fee. The main concern between the TV service and digital video supply chains is whether it is possible for the media publisher to commercialize the direct distribution channel. However, it is not clear whether using a free service in a direct distribution channel is more profitable than using a paid service. As the free service is advantageous in terms of attracting more consumers, the paid service on the direct channel would reduce the profits from advertisements. Alternatively, the free service could lower the profits from the content resale because it could intensify competition between platforms. Thus, the choice regarding commercialization is important because it is closely related to the media publisher's sustainability as a public medium in a digital environment. To make media publishers sustainable, the impact of paid or free services in the direct distribution channel needs to be thoroughly investigated.

Additionally, it should be verified whether non-exclusivity in the TV service supply chain still remains in the digital video supply chain. It is observed that terrestrial broadcasters do not exclusively provide their TV programs on the free-to-air service. When retransmission discontinues, it is known as "TV blackout", and this attracts a lot of attention because it is not a common situation. The idea that non-exclusivity also provides more profits for the media publisher in the digital video supply chain is questionable. The OTT market in South Korea proves that the media publishers can operate a direct paid service platform "POOQ" without providing their content to rival media aggregator platforms such as "Tving" or "Oksusu." The exclusive service has not only the advantage that the media publisher can secure more subscribers but also a disadvantage that the profits from advertisements decrease as the number of consumers exposed to the content of the advertisements decreases. Therefore, we also study how exclusivity affects the supply chain.

We study the impact of commercializing the direct channel on a media service market based on the game-theoretic approach by comparing the equilibrium outcomes of the free service with those of the paid service. Our results show that the content fee increases with the paid service if the value of the service from the direct platform or from the aggregator's platform is high. The profit of the aggregator's platform always increases with the paid service on the publisher's platform, whereas the profit of the content publisher does not. This shows different results based on the value of service from the platforms and the advertising revenue per viewer.

The rest of this paper comprises the following sections: we review the related literature in Section 2 and explain the research methodology in Section 3. A model for representing the digital video supply chain is introduced in Section 4. Based on the model, the free and paid services in the direct distribution channel are studied in Sections 5 and 6, respectively. We analyze the results in Section 7 and discuss them in Section 8. Finally, the study is summarized and concluded in Section 9.

2. Related Literature

Our research topic is related to the dual distribution channels of a manufacturer since the media publisher would be considered as a manufacturer in a digital video supply chain. There are several related works on supply chains with dual distribution channels including a manufacturer's direct channel and a retailer's channel. The coordination of the traditional retailer's channel and the Internet-based new distribution channel has been studied [1] along with consumer heterogeneity

with respect to the usability of the channels. There are studies that focused on the demand outcomes for the dual channels, which were distinguished based on the consumers' loyalty [2] or their willingness to pay for the quality [3]. The impact of the direct channel of a manufacturer was investigated based on a game-theoretic approach [4], which is a similar approach to that used in this paper. In contrast to the expectation that the retailer would be worse off with the new direct distribution channel of the manufacturer, it was shown that this would actually be profitable for the retailers owing to the lowered wholesale price [5]. Dual distribution channels of the retailer have also been studied [6]. It is assumed that the retailer can sell through large online marketplaces such as Amazon or e-Bay besides its retail channel. Several studies that addressed issues of online media consumption with multiple distribution channels have also been published. The competition between the media aggregator and the media firm was analyzed in [7], and the distribution strategy of digital content with differentiated service qualities was studied in [8]. The pricing policy of the manufacturer with a dual distribution channel was studied in [9] with respect to the greening cost for sustainable markets.

Making a sustainable profit structure in a digital transformation is essential for the media publisher since it changes the foundation of how people consume the media. Newspaper industries have suffered from the digital transformation due to the absence of exhaustive studies on improving their profitability [10]. It was expected that having a free newspaper service on websites would give them profits from the advertisements, as had occurred in the traditional newspaper, but the results were quite different from the expectations. In the face of the digital transformation, firms might change to ensure their sustainability in new environments that endanger existing revenue streams. A previous study investigated how media companies in the U.K. reshape their corporate frameworks to be sustainable in the digital era [11]. Technological shifts in media consumption change the way people use newspapers, and consequently, the way newspaper companies make profits. Also, media firms' reactions to a current revenue structure have been studied [12]. They analyzed a phenomenon, "news abuse", in which the firms choose to stay in the digital news ecosystem where the profit from the advertisements is solely dependent on consumers' attention. Besides the sustainability of media firms, the impact of the digital transformation on sustainability has been studied in various areas. There was a review on the adoption of disruptive technologies for smart real estate in [13]. By suggesting how to integrate nine new technologies, for example, virtual reality and artificial intelligence, into real estate, they studied the sustainability of smart real estate. Improvements to the sustainability of the poor strata enabled by digital transformation were also studied [14]. They suggested ways to improve the sanitation of the poor based on technology developed in the digital transformation.

Since the economic sustainability of the media firms against digital transformation is studied in this paper, research on the profitability of the media firms is closely related to our work. Economic analyses of the digital transformation of media firms have been conducted with regard to many aspects, such as revenue structure, transfer of digital goods, and promotional value. The cost structures and competition within the information and the industrial goods market have been compared [15]. The pricing of digital goods was studied in [16], and the revenue structures among wholesale pricing and revenue sharing that generate more profits for a media firm were investigated. Recent revenue models related to the digital goods market, crowdfunding services, or blogs have been studied based on the investigation of several revenue streams such as selling digital content, brokering consumer information, or selling advertisement slots [17]. Media content delivery methods were studied in [18]. In this study, the profit from selling online content was compared with the profit from renting for a few periods. One study that focused on the impact of the promotional value of a free service was also conducted [19]. Another study revealed that a free music streaming service stimulated overall consumption, thereby increasing profits from advertisements [20]. Third-party innovators' perceived risks to entry into a platform was also studied to investigate the sustainable evolution of platforms [21].

The impact of commercialization of the media, especially focusing on the compensation for loss in profits from advertisements, has been the focus of several papers. A combination of paid and free services has been suggested and shown to generate more profits for media firms [22–24]. It has

been suggested that adopting a free service during a period of high demand for media content is beneficial for firms because it prevents them from losing profits from advertisements [22]. Paid services with few (or no) advertisements and free services with advertisements were compared in [23,24] based on the assumption that there is a monopolistic media platform. Various pricing schemes regarding advertisement profits were compared. The impact of free content was captured in detail by distinguishing the services into three categories: paid services, paid services with free samples, and free services [25]. Free samples have been found to be helpful for consumers to adjust their quality expectations on content and for publishers to generate revenue from advertising.

There have been studies on the competition structure of the TV service market on which this paper is based. The competition between pay-TV operators was studied in [26,27], which mainly focused on the pay-TV platform's resale of premium content to rival pay-TV platforms. A comparison between two methods of payment, lump-sum fees, and per-subscriber fees, revealed that the resale of content is not contracted with a lump-sum fee payment. Competition was represented by Hotelling's model, and the asymmetries in service qualities between pay-TVs were considered. Similarly, a vertically integrated pay-TV operator's incentive to exclusively distribute premium programs to its rival was studied in [28]. The vertically integrated operator produces TV programs with advertisements and sells the programs to the rival with a per-subscriber fee, and it competes with the rival as a distributor. The comparison of profits of a pay-TV operator and a free-to-air broadcaster vying for viewership was studied in [29], but they did not consider the situation of retransmission. An investigation on the impact of competition between media firms revealed that content prices become higher in a duopoly as compared with in a monopoly [30].

To our knowledge, our research topic has not been studied before. Most literature from the dual distribution channel has looked at supply chain deals with a product, not a media service. Media services are different from products because it is possible to earn profits not from selling the service to consumers, but from selling advertisement slots to advertisers. Similarly, most research on the economics of the media firms has not dealt with the dual distribution channels of the media publishers, which can be easily observed in the real world. Therefore, our research is unique in that there is no such previous work in related literature.

3. Research Methodology

We used a game-theoretic approach to find whether the commercialization of a media publisher's direct distribution channel would be profitable or not. There were three players in the game: a media publisher, a media aggregator, and consumers. To represent their interactions, we defined a sequential game with the players based on the relationships given in Figure 1. In the first stage, the media publisher chooses the content fee and decides whether to sell its content to the media aggregator. If the content sales are not profitable, it would exclusively provide its contents to consumers. In the next stage, the media aggregator chooses whether to buy the content or not. If buying the contents is not profitable for the media aggregator, it gives up on doing so. In the third stage, the media publisher and the media aggregator simultaneously decide the subscription price of their services if the media publisher chooses to commercialize its direct distribution channel. Otherwise, only the media aggregator decides the subscription price. Then, the consumers, who have different preferences towards the direct service and the aggregator's service, select the distribution channel they prefer.

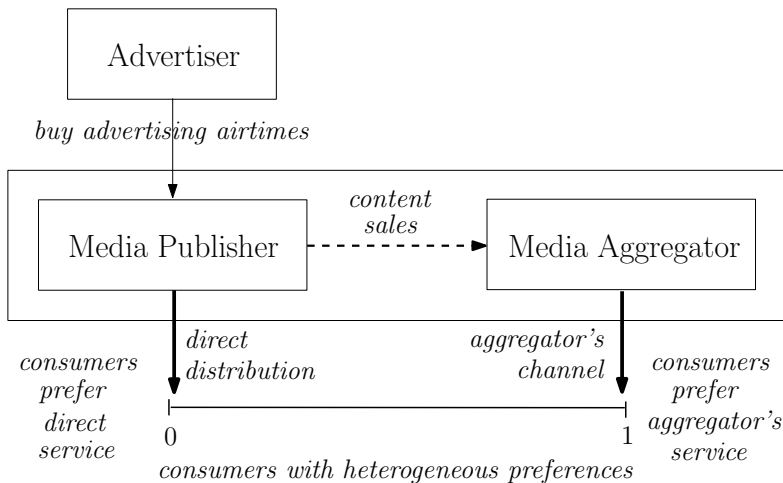


Figure 1. Model overview.

4. Model

We define a model of a media service market as that comprising a media publisher, a media aggregator, and consumers. The media aggregator earns profit from subscription charges, whereas the media publisher makes profit from selling advertisements to advertisers and charging content fees to the aggregator.

We consider two competing platforms, the media aggregator's platform and the media publisher's direct service platform. The media publisher is not only a competing service platform (retailer) but also a content provider (manufacturer) to the media aggregator's platform (competing retailer). By providing content from the media publisher, the aggregator has a competitive advantage within the market. The market structure is depicted in Figure 2.



Figure 2. Market structure.

The value of the media aggregator's platform and the value of the media publisher's content are v_m and v_b , respectively. Considering content sales, the utility v_m is given as follows:

$$v_m = m + s \cdot v_b. \quad (1)$$

Here, m is the base value of the media aggregator, and s indicates whether it buys the content from the publisher ($s = 1$) or not ($s = 0$).

The consumers get different utilities according to the services they choose. They get the utility v_m and pay p_m if they subscribe to the media aggregator's platform, whereas they get the utility v_b if they choose to use the media publisher's direct platform. The consumers are not charged any fee if the publisher directly provides content freely, whereas they are charged a subscription fee p_b if it directly delivers content that requires payment.

The media aggregator's platform pays the content fee w to the media publisher for each of its subscribers. Its profit is represented as follows:

$$\Pi_m = N_m \cdot (p_m - w). \quad (2)$$

Here, N_m is the number of subscribers to the media aggregator's service. We assume that the platform's marginal cost for serving an additional subscriber is zero.

The media publisher receives content charges from the media aggregator as a program rights holder and earns profit from selling advertisements included in its content. In addition, if it provides its service directly based on subscriptions, it obtains subscription charges from its subscribers.

The profits for the media publisher are represented as follows:

$$\Pi_b = \begin{cases} r \cdot (N_b^T + N_m^T) + w \cdot N_m^T, & \text{free service on direct channel} \\ r \cdot (N_b^O + N_m^O) + w \cdot N_m^O + p_b \cdot N_b^O, & \text{paid service on direct channel.} \end{cases} \quad (3)$$

Here, r is the advertising revenue per viewer, and N_b and N_m are the number of consumers using the media publisher's direct platform and the number of subscribers to the media aggregator's service, respectively. Note that the profit from advertisements is affected by the overall number of consumers ($N_b + N_m$) who are exposed to the content. We use the superscripts T and O to distinguish cases where the media publisher operates the free-of-charge service and the subscription-based paid service, respectively. We assume that the content publisher's maintenance costs are zero.

The media publisher first sets the content fee w , following which the media aggregator decides whether to buy the content or not. After making a decision, the media aggregator selects the subscription price for its platform. If the media publisher operates the paid service on its direct channel, it also selects the subscription price simultaneously.

5. Direct Free-of-Charge Service Channel

We assume that the media publisher delivers its content freely through its direct channel. We consider Hotelling's model with a transportation parameter t and consumers' preference $x \in [0, 1]$ on the media service platforms. The utility of a viewer is given as follows:

$$U(x) = \begin{cases} v_b - t \cdot x, & \text{use direct service platform of media publisher} \\ v_m - p_m - t \cdot (1 - x), & \text{subscribe to media aggregator's platform.} \end{cases} \quad (4)$$

Here, t is the unit transportation cost and x indicates the type of consumer between 0 and 1. If the consumers are closer to 0 (or 1), they prefer the media publisher's direct service platform (or the paid-service platform) more. This indicates the number of consumers who choose the direct service platform $N_b = \frac{1}{2} - \frac{m-p_m}{2t}$ and the number who choose the media aggregator's platform $N_m = \frac{1}{2} + \frac{m-p_m}{2t}$ (it is assumed that the market is fully covered by the two platforms). Then, the subscription price p_m^* of the media aggregator's platform is $p_m^* = \frac{m+w+t}{2}$, which indicates the profit $\Pi_m = \frac{(m+t-w)^2}{8t}$.

It is always beneficial for the media publisher if the media aggregator buys the content because its profit with content sales $\Pi_b = (N_b + N_m) \cdot r + N_m \cdot w$ is larger than that without content sales $\hat{\Pi}_b = \hat{N}_b \cdot r$ owing to $\hat{N}_b \leq N_b + N_m = 1$. However, the media aggregator will not buy the content if it generates a lower profit. Thus, we need to determine the media aggregator's profit without content sales. In this case, the value of the media aggregator's platform $v_m = m + v_b$ is decreased to $\hat{v}_m = m$, and the profit that the media aggregator generates is $\hat{\Pi}_m = \hat{N}_m \cdot \hat{p}_m$.

If the viewership of the media publisher's direct service platform is $\hat{N}_b = \frac{1}{2} - \frac{m-v_b-\hat{p}_m}{2t}$ and the number of media aggregator's service subscribers is $\hat{N}_m = \frac{1}{2} + \frac{m-v_b-\hat{p}_m}{2t}$, then the subscription price \hat{p}_m^* of the media aggregator's platform is $\hat{p}_m^* = \frac{m-v_b+t}{2}$, which generates a profit of $\hat{\Pi}_m = \frac{(m-v_b+t)^2}{8t}$. This indicates that the content fee w should be lower than or equal to v_b .

Proposition 1. In a state of equilibrium, the media publisher with the free-of-charge service on the direct channel chooses the content fee w_T^* as follows:

$$w_T^* = \begin{cases} \frac{m+t}{2}, & \text{if } \frac{m+t}{2} < v_b \\ v_b, & \text{otherwise} \end{cases} \quad (5)$$

Proof. The media publisher's profit is $\Pi_b = r + w \cdot \left(\frac{1}{4} + \frac{m-w}{4t}\right)$. Since the profit is concave in w , the first-order condition gives the maximum profit for the publisher. \square

With the content fee w^* , the profits of the media publisher Π_b and the media aggregator Π_m are

$$\Pi_b^T = \begin{cases} r + \frac{(m+t)^2}{16t}, & \text{if } \frac{m+t}{2} < v_b \\ r + v_b \cdot \left(\frac{m-v_b+t}{4t}\right), & \text{otherwise} \end{cases}, \quad \Pi_m^T = \begin{cases} \frac{(m+t)^2}{32t}, & \text{if } \frac{m+t}{2} < v_b \\ \frac{(m-v_b+t)^2}{8t}, & \text{otherwise} \end{cases} \quad (6)$$

6. Direct Paid Service Channel

Instead of the free service on the direct channel, the media publisher delivers its content through the subscription-based paid service. As is in the free service case, we consider Hotelling's model as being representative of the competition between the media publisher's direct service platform and the media aggregator's platform. The utility of a viewer is given as follows:

$$U(x) = \begin{cases} v_b - p_b - t \cdot x, & \text{subscribe to media publisher's direct service} \\ v_m - p_m - t \cdot (1-x), & \text{subscribe to media aggregator's service} \end{cases} \quad (7)$$

Here, p_b is the subscription price of the media publisher's direct service platform. If the viewers are closer to 0 (or 1), they prefer the media publisher's platform (or the media aggregator's platform) more. The value of the media aggregator's platform is $v_m = m + v_b$, and this indicates the number of subscribers who choose the direct service platform $N_b^O = \frac{1}{2} - \frac{m-p_m+p_b}{2t}$ and the media aggregator's platform $N_m^O = \frac{1}{2} + \frac{m-p_m-p_b}{2t}$. Then, the subscription prices are $p_m^{O*} = t + w + \frac{m}{3}$ and $p_b^{O*} = t + w - \frac{m}{3}$, which indicates the profit $\Pi_m^O = \frac{(m+3t)^2}{18t}$.

Note that it should be first verified whether content sales generate more profit for both. The media publisher's profit with content sales $\Pi_b^O = (N_b^O + N_m^O) \cdot r + N_m^O \cdot w + N_b^O \cdot p_b^O$ is larger than that without the sales $\hat{\Pi}_b^O = \hat{N}_b^O \cdot (r + \hat{p}_b^O)$ if the content fee is $w > \frac{\hat{N}_b^O \cdot \hat{p}_b^O - (1 - \hat{N}_b^O) \cdot r - N_b^O \cdot p_b^O}{N_m^O}$. To make the media aggregator buy the content, the publisher should suggest a content fee that generates more profit for the aggregator than that without content sales. In that case, the value of the aggregator's platform is $\hat{v}_m = 0$, and the profits of the media publisher and the media aggregator will be $\hat{\Pi}_m^O = \hat{N}_m^O \cdot \hat{p}_m^O$. The subscription price of the media aggregator's platform is $\hat{p}_m^{O*} = t + \frac{m-v_b-r}{3}$ and that of the media publisher is $\hat{p}_b^{O*} = t + \frac{v_b-m-2r}{3}$. Then, we have the media aggregator's profit without content sales $\hat{\Pi}_m^O = \frac{(r+v_b-3t-m)^2}{18t}$. This indicates that content sales are always beneficial to the media aggregator as $v_b > 0$ and $r > 0$.

Proposition 2. In a state of equilibrium, the media publisher with the paid service on the direct channel chooses the content fee w_O^* as follows:

$$w_O^* = v_b + \frac{m-3t}{2}, \quad (8)$$

if $6t + m - v_b - \sqrt{9t^2 + 21tm + m^2} < r < 6t + m - v_b + \sqrt{9t^2 + 21tm + m^2}$. Otherwise, it does not suggest content sales.

Proof. The media publisher can increase the content fee as long as the whole market is covered because its profit $\Pi_b^O = \frac{(m-3t)^2}{18t} + w + r$ increases as much as the content fee. Content sales are not suggested if w_O^* is smaller than $\underline{w} = \frac{\hat{N}_b \cdot \hat{p}_b - (1 - \hat{N}_b) \cdot r - N_b \cdot p_b}{N_m} = \frac{v_b - 2r}{3} + \frac{(r + v_b)(r + v_b - 2m)}{18t}$. \square

In contrast to the free service, the media publisher may choose between the non-exclusive paid service with the content fee w_O^* and the exclusive paid service without retransmission. In the case of the non-exclusive paid service, the profits of the media publisher and the media aggregator are

$$\Pi_b^O = r + v_b + \frac{(m-3t)(m+6t)}{18t}, \quad \Pi_m^O = \frac{(m+3t)^2}{18t}. \quad (9)$$

In the case of the exclusive paid service, the profits of the media publisher and the media aggregator are

$$\hat{\Pi}_b^O = \frac{(r+v_b+3t-m)^2}{18t}, \quad \hat{\Pi}_m^O = \frac{(r+v_b-3t-m)^2}{18t}. \quad (10)$$

7. Analysis

The results from the free service and the paid service are summarized in Table 1.

Table 1. Summary of Results.

	Free Service ($\frac{m+t}{2} < v_b$)	Free Service ($\frac{m+t}{2} \geq v_b$)	Exclusive Paid Service	Non-Exclusive Paid Service
Content Fee	$\frac{m+t}{2}$	v_b	-	$v_b + \frac{m-3t}{2}$
Subscription price (media publisher)	-	-	$\frac{3t-m-2r+v_b}{3}$	$v_b + \frac{m-3t}{6}$
Subscription price (media aggregator)	$\frac{m+v_b+t}{2}$	$\frac{m+t}{2}$	$\frac{3t+m-r-v_b}{3}$	$v_b + \frac{5m-3t}{6}$
Number of consumers (media publisher)	$\frac{3}{4} - \frac{m-v_b}{4t}$	$\frac{7}{8} - \frac{m}{8t}$	$\frac{1}{2} + \frac{r-m+v_b}{6t}$	$\frac{1}{2} - \frac{m}{6t}$
Number of consumers (media aggregator)	$\frac{1}{4} + \frac{m-v_b}{4t}$	$\frac{1}{8} + \frac{m}{8t}$	$\frac{1}{2} - \frac{r-m+v_b}{6t}$	$\frac{1}{2} + \frac{m}{6t}$
Profit (media publisher)	$r + \frac{(m+t)^2}{16t}$	$r + v_b \cdot \left(\frac{m-v_b+t}{4t} \right)$	$\frac{(r+v_b+3t-m)^2}{18t}$	$r + v_b + \frac{(m-3t)(m+6t)}{18t}$
Profit (media aggregator)	$\frac{(m+3t)^2}{32t}$	$\frac{(m-v_b+t)^2}{8t}$	$\frac{(r+v_b-3t-m)^2}{18t}$	$\frac{(m+3t)^2}{18t}$

7.1. Content Fee

The content fee with the non-exclusive paid service w_O^* is higher than that with the free service w_T^* if the media publisher's value is high ($v_b > 2t$) or if the media aggregator's base value is high ($m > 3t$). With the non-exclusive service, the media publisher extracts the surplus from content sales by suggesting the highest possible content fee as long as the whole market is covered. Thus, the higher the value the media aggregator's platform provides ($v_m = m + v_b$), the higher content fee the media publisher can suggest with the non-exclusive service ($w_O^* = v_b + \frac{m-3t}{2}$). On the other hand, the media publisher cannot suggest a content fee higher than its value v_b with the free service ($w_T^* < v_b$).

It is possible for the content fee w_O^* to be negative. This means that the media publisher subsidises the media aggregate for each subscriber it secures. This happens when the media publisher earns more profit from advertisements, which are proportional to the number of overall consumers exposed to the content.

7.2. Profit of the Media Aggregator

The media aggregator's profit is the highest with the media publisher's non-exclusive paid service. The profit Π_p^O is greater than the profit $\hat{\Pi}_p^O$ with the media publisher's exclusive service because it can

attract more subscribers with the higher value v_m . In addition, it is higher than the profit Π_p^T with the media publisher's free service since the competition is less stiff. In that case, because it needs to compete with the media publisher's service platform with the zero-subscription price $p_b = 0$, it is difficult to set a more profitable price.

7.3. Profit of the Media Publisher

The decision of the media publisher on whether or not to commercialize the direct distribution channel depends on the values m , v_b of the platforms, the advertising revenue per viewer r , and the transportation cost t . An example is depicted in Figure 3.

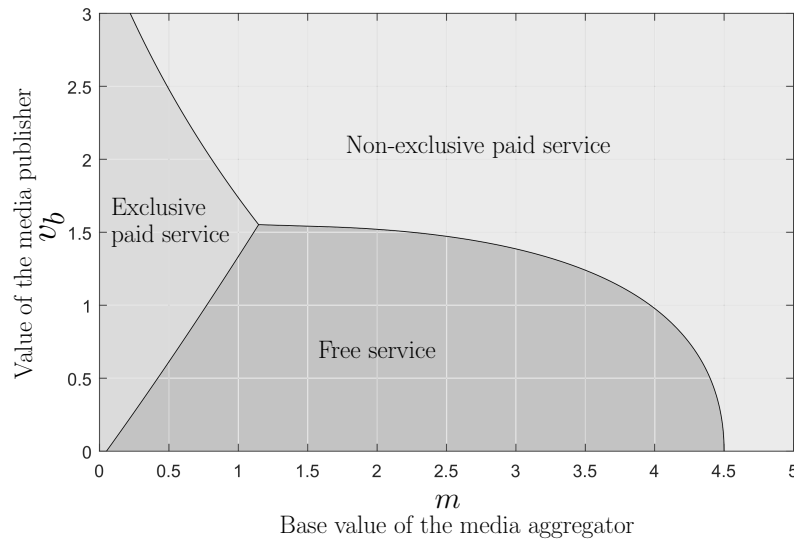


Figure 3. Decision of the media publisher ($r : 1, t : 1.5$).

Free Service The media publisher's profit with the free service Π_b^T is larger than the profit with the non-exclusive paid service Π_b^O when

$$\begin{cases} v_b \leq \frac{1}{144t}(m^2 - 6mt + 153t^2), & \text{if } v_b \geq \frac{m+t}{2} \\ v_b \leq \frac{m-3t}{2} + \frac{\sqrt{(m-3t)(v-75t)}}{6}, & \text{otherwise} \end{cases} \quad (11)$$

It is larger than the profit with the exclusive paid service $\hat{\Pi}_b^O$ when

$$\begin{cases} v_b \leq m - r - 3t + \frac{3\sqrt{2(m+t)^2 + 32rt}}{4}, & \text{if } v_b \geq \frac{m+t}{2} \\ v_b \leq \frac{(13m-3t-4r+3\sqrt{9m^2+50mt-87t^2+8mr+120tr-8r^2})}{22}, & \text{otherwise} \end{cases} \quad (12)$$

This indicates that the free service is beneficial for the media publisher when the value of the content v_b is low. A low value implies that it is not competitive enough to secure consumers ($\hat{N}_b^O < N_b^T$) if it chooses the exclusive paid service. Therefore, it is difficult to make up for the lowered revenue from advertising. Additionally, it is not possible to suggest a higher content fee if the non-exclusive paid service is chosen because the content fee is $w_O^* < w_T^*$ if the value v_b is low. However, if the base value of the media aggregator's platform m is high ($m > 3t$), the free service is not profitable compared to the non-exclusive service, regardless of the value v_b . This is because the media aggregator's platform gets the whole demand and the content fee w_O^* is higher than that with the free service w_T^* , which results in higher profit from content sales. As the transportation cost t becomes higher (Figure 4a), the free service is more likely to be chosen than before because it is difficult to get the whole demand for the media aggregator. The free service contributes to exposing all consumers to the advertisement.

Similarly, when the profit from the advertisement is large (r is high, Figure 4b), the free service is also more likely to be chosen than before because the number of consumers exposed to its contents matters.

Exclusive Paid Service The media publisher's profit with the exclusive paid service $\hat{\Pi}_b^O$ is closely related to the advertising revenue per viewer r . As r is close to 0, the overall number of consumers exposed to the advertisements affects the profits of the media publisher less. In this case, the free service or the non-exclusive paid service, which maximize the profits from advertisements, would not be profitable at all. In addition, with the low value m of the media aggregator's platform, because the media publisher has the advantage of gaining more subscribers than does the media aggregator's platform, it will probably choose the exclusive service. However, note that it is more profitable to choose the non-exclusive service if the value of the media publisher v_b is considerably higher because the profit from content sales increases as much as the value increases ($\Pi_b^O \propto v_b$). When the transportation cost t is higher than before, the exclusive paid service is preferred because the profit from the direct service takes up larger portion (Figure 4a). With the high transportation cost, it is difficult to increase the profit from the advertisements because it is hard to expose the advertisements to all consumers. Contrary to this, if the profit from the advertisements is expected to be large (r is high), the exclusive paid service is not preferred (Figure 4b).

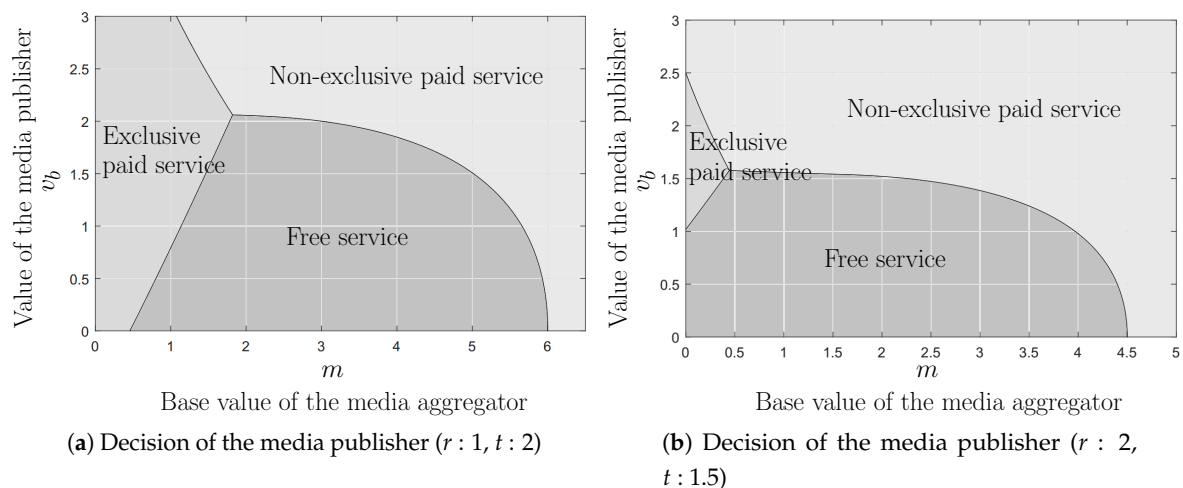


Figure 4. Decision of the media publisher as the advertisement revenue r and the transportation cost t change.

Non-Exclusive Paid Service The media publisher's profit with the non-exclusive paid service Π_b^O always generates better profit if the value m is higher ($m > 3t$). In this case, since the whole market is covered ($N_p^O = 1$), the media publisher earns content fees from all consumers in the market. Additionally, because the content fee w_O^* is larger than w_T^* , the overall profit with the non-exclusive service Π_b^O is always larger than that with the free service Π_b^T . This indicates that the non-exclusive service is a more profitable choice even though it does not attract any subscribers. By maintaining the additional commercialized distribution channel, it gets more profit than does the free service.

The profit Π_b^O is larger with a higher value v_b of the media publisher because it enables the media publisher not only to suggest a higher content fee but also to ensure there are more subscribers to the media aggregator's platform. Although it sounds strange that it is profitable for a rival platform to have more subscribers, this really is the case. If the media publisher with the high value remains a free service, this prevents the media aggregator's platform from securing more subscribers. However, if the media publisher chooses the paid service, the prevention would be weaker owing to the subscription price $p_b^O \geq 0$ of the publisher. Thus, the overall profit from content sales is increased with the non-exclusive paid service.

8. Discussion

In this section, we discuss the important features that affect the results: exclusivity, advertisements, and value of service.

Exclusivity The most interesting result was that the paid service is divided into two cases: non-exclusive paid service and exclusive paid service. This is considerably different from the case of free service, which engenders only a non-exclusive service. Exclusivity is preferred if the advertising profit is expected to be much lower than the profit from subscription charges. In that case, the publisher does not have an incentive to expand its viewership since it generates little benefit. The exclusive service enables the media publisher to attract more subscribers because the rival, the media aggregator, loses additional values from the media publisher's contents. Thus, the media publisher does not sell its content to the media aggregator if content sales are not profitable enough to sacrifice subscribers. Instead, it can obtain more profit by directly charging the subscribers.

Advertisement Although the advertisement revenue per viewer is high, it does not affect the commercialization of the direct distribution channel for the non-exclusive paid service. The media publisher does not necessarily provide a free service in cases with high advertisement revenue. The advantage of a free service—that is, encouraging consumers to watch—is somewhat limited because the publisher can reach all consumers in the market through content sales. The impact of the advertisement revenue mainly occurs in the exclusive paid service. If the revenue is high, the exclusive paid service is disadvantageous because it gives up some of the profit from the advertisements. The purpose of the exclusive service is to increase subscribers by differentiating the media publisher's direct service from the media aggregator's service. If the profit from the subscription is relatively small compared with that from the advertisement, the exclusive paid service is not a practical choice.

Value of Service The most important factor in the digital video supply chain is the value of the service platforms. The publisher's choice with regard to commercializing the direct distribution channel and providing an exclusive/non-exclusive service mainly depends on the value of the platforms. The value is related to the number of subscribers that each platform can secure and the number of paid service subscribers who can afford the service. If the value of the publisher is not high enough to attract a considerable number of consumers, it is better off providing a free service, which at least generates the maximum possible profit from advertisements. This is because without the considerably high base value of the media aggregator, the low value of the publisher cannot help the media aggregator cover the whole market. Therefore, if it is anticipated that if the publisher cannot maximize its viewership from the dual distribution channel, it should provide a free service so as to not lose profits from advertisements.

The commercialization of digital video services in the real world is comparable with the results from our model. In South Korea, where the streaming video services have been provided for 10 years, there is a digital video service called 'POOQ' which is an online video platform for the media publishers. At first, it sold its content to other digital video services such as 'Oksusu' or 'Tving', which are media aggregator platforms, but it discontinued the sales in 2015 (<http://www.etnews.com/20150527000213>) and now exclusively provides videos to its subscribers due to economic reasons. Interestingly, the number of subscribers to the POOQ increased to 700,000 from 500,000 after the beginning of the exclusive service (<https://news.joins.com/article/21903712>). As the advertisement profit of the POOQ is much lower than that of YouTube or Facebook, it is anticipated that the POOQ should not consider a free service. Instead, it has chosen to heighten its service quality against rival platforms by exclusively providing original content to its subscribers.

Our results give more detailed information on the exclusivity of the service platform. In [28], it was found that the pay-TV operator with premium content always supplies its content to the rival from the economic comparison of two pay-TV operators. The main difference of that study from our model is that it did not consider the free service. Since the profit from advertisements would be the most important revenue stream for the media publisher, increasing the viewership by the free service

should be considered an important option for the media firm. Also, our model assumes different values for both platforms, which enables us to capture optimal strategies for various situations where the value between the media publisher and the media aggregator is different.

9. Conclusions

In this paper, we analyzed the impact of commercializing the direct distribution channel of a digital media publisher. In a digital video supply chain, the media publisher is a content provider to the media aggregator platform as well as to the independent media service platform. The publisher thus earns profit not only from advertisements but also from content sales to the aggregator. To be sustainable as a media publisher for the public, it has to find the most profitable way to operate its direct distribution channel. The free service on its direct media service platform allows the publisher to attract more viewers, thereby increasing the overall profit from advertisements, whereas the paid service provides an additional revenue stream for the publisher. By investigating equilibrium outcomes of the publisher and the aggregator, we derived their decisions on subscription prices and content fees for cases of free and paid services.

Our results reveal that the content fee of paid services is higher than that of free services if the values of the platforms are high. In this case, it is easy for the publisher to secure all consumers in the market for its viewership. We also found that the profit of the media aggregator is the largest if the publisher chooses the non-exclusive paid service. The aggregator derives benefits in that case because it can increase the number of subscribers by providing the publisher's content together, and it can be in a more advantageous position in terms of competition with the publisher. The publisher is better off providing a paid service if its value is not severely low. When the value is low, the free service ensures it will generate the largest possible profit, at least from advertisements. Otherwise, the paid service is better for the publisher since it generates more profit from the subscription charges. The exclusive service is possible only when the profits from advertisements are expected to be low.

This study on the impact of commercializing the direct distribution channel in the digital video supply chain offers several directions for future research. First, we could extend our analysis by incorporating two-sidedness, which is often considered in the analysis of advertising markets. This would enable us to more precisely interpret the impact of commercialization and the media publisher's sustainability as a public content producer. Second, it was assumed that there are two competing platforms, but it is possible that there are other firms in the supply chain, such as pure content providers or other competing publishers. It would give us more accurate results if we considered other firms as well. Finally, the way that the content fee is decided is not the same as what we assumed in this paper. Since contracts between firms involve complex interactions, ours might have ignored details of the decisions made regarding the content fee. Therefore, an investigation into the process of content fee negotiation would be an interesting topic of study for the future.

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