

Shishikura, Manabu; Kasuga, Norihiro; Nakamura, Akihiro

Conference Paper

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22nd Biennial Conference of the International Telecommunications Society (ITS): "Beyond the Boundaries: Challenges for Business, Policy and Society", Seoul, Korea, 24th-27th June, 2018

Provided in Cooperation with:

International Telecommunications Society (ITS)

Suggested Citation: Shishikura, Manabu; Kasuga, Norihiro; Nakamura, Akihiro (2018) : On Commercial Preferences of TV Audiences: Payment for Avoidance, Type of Commercial, and Content Volume, 22nd Biennial Conference of the International Telecommunications Society (ITS): "Beyond the Boundaries: Challenges for Business, Policy and Society", Seoul, Korea, 24th-27th June, 2018, International Telecommunications Society (ITS), Calgary

This Version is available at:

<https://hdl.handle.net/10419/190354>

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On Commercial Preferences of TV Audiences
—Payment for Avoidance, Type of Commercial, and Content Volume—

Manabu Shishikura
Nagasaki University

Norihiro Kasuga
Konan University

Akihiro Nakamura
Yokohama City University

Summary

In this paper, we measure users' disutility from advertisements accompanying movies supplied by media based on the results gathered through our own survey questionnaire.

First, we confirmed the importance of measuring the disutility of advertisements based on the theoretical economic model developed from previous research. Through this work, we explicitly show the following:

- The advertisement volume supplied by media does not necessarily coincide with the socially optimal ad volume because media do not fully consider disutility from advertising.
- The equilibrium in ad volume is different depending on the supply method.
- Whether the volume of ads becomes too small or excessive will change depending on the magnitude of their disutility.

Subsequently, we measure the extent to which users intend to pay for ad avoidance based on our original data. As a result, we evaluate disutility on a monetary basis, showing that disutility differs depending on the type of ad.

1. Introduction

Users who enjoy media services will pay for content usage, whether they pay for services that are devoid of ads or view ads.

Formally, ads are information goods, similar to general content. However, unlike content, advertising information is not necessarily something requested by the user.¹ Consumption of ads tailored to various preferences brings disutility for users. Consequently, disutility associated with ads is part of the cost (i.e., subjective cost) that the user incurs to consume information goods.

From the supply side, the media in the two-sided market faces two demands: demand from users and demand from advertisers.² Normally, user demand is affected by disutility from ads. On the other hand, user demand affects advertising effectiveness. Since there is an interaction between users' demands and advertisers' demands, media manage the supply and establish prices, the number of ads, and content by incorporating the relationship between the two parties. Thus, media consider users' disutility from ads and evaluate their primary sources of revenue and the amount of advertising in relation to total information goods.

However, media do not necessarily consider such disutility accurately. Therefore, the amount of advertising determined as a result of media profit maximization behavior does not necessarily match the ad amount that maximizes social welfare.

¹ For viewers seeking information on products, such information brings positive value (positive utility), but for viewers who are not seeking such information, it has no positive value. However, even in the latter case, it does not necessarily create negative value (negative utility).

² Demand for advertising is derived demand, which is a demand arising from the expectation that sales of their products will increase through the use of ads.

2. Previous Research Studies

Examples of prior studies that analyze the influence of advertising disutility on the welfare of the media market include Anderson and Coate (2006), Kind et al. (2007), and Tåg (2009).

Anderson and Coate (2006) presented a theory on the market supply conditions of the media, suggesting that the ad amount related to market equilibrium depends on the disutility that the viewer feels from ads (patience cost), the substitutability of the program under the competitive environment of the market, and the benefit that the advertiser expects by obtaining access to the audience (expected return). Based on their model, the ad amount supplied by media can be too small or excessive compared to the optimal level, depending on the above parameters.

Kind et al. (2007) showed that the equilibrium in ad volume (which affects consumer surplus), media profit (producer surplus), and the advertiser's profit (producer surplus) are decreasing functions of ad disutility. The researchers also showed that the magnitude of disutility is a factor that determines whether advertising in relation to market equilibrium is too small or excessive compared to the optimal level. (In other words, they showed that the smaller the disutility from advertising, the higher the possibility that the number of ads will be too small.)

In addition, Tåg (2009) assumed a situation in which a user can choose from two options independently: (1) avoid paying for content by viewing ads, or (2) pay for content only with no ads (e.g., net media). Tag also analyzed the impact of introducing options to avoid ads, pointing out that the quality of ad-supported services can decline by increasing ad volume and introducing such options.

3. The Model

3.1 Setup

The relationship between optimal ad quantity and the ad quantity determined by a media firm varies depending on the supply system utilized by media. Below, we compare ad quantity under three different supply systems and examine how they relate to the optimum ad quantity.

The main concern of this paper is similar to that of Anderson and Coate (2006) and Tåg (2009). However, the analysis model has been changed in several ways. Though Tåg (2009) referred to a price-setting model, we will use the quantity-setting model, similar to the model used by Anderson and Coate (2006), in this paper. However, our model differs from that of Anderson and Coate (2006) because it does not directly consider the possibility of choosing to avoid ads by paying for services. Tåg (2009) compared the case of a media firm that is entirely ad-based and the case of media introducing the option to pay to remove ads, but we have added a third case in which the two types of media firms—one entirely ad-based and the other entirely fee-based—coexist in the market. Accordingly, we compare the three cases according to the different supply systems in the market.

The basic settings common to each model are as follows:

- In each case, the content amount supplied by the media firm is the same.
- The information goods supplied by media firms are differentiated by the quantity of ads.
- All users consume information goods provided by either media company.
- Since the surplus obtained by supplying and consuming content is fixed, only the ad amount affects the social welfare.

3.2 Case I: A situation whereby the ad-based media firm supplies services

The profit of a media firm is as follows:

$$\pi_A = p_A a \quad (1)$$

p_A is the advertiser's willingness to pay for ads and it is assumed to be:

$$p_A = 1 - \alpha a \quad (2)$$

where a is the ratio of ads to information goods supplied by media companies. α is the parameter, indicating the influence of additional ads on the marginal willingness of the advertiser to pay for them.

First-order condition of profit maximization in the advertising-based media firm is shown as follows:

$$\frac{\Delta \pi_A}{\Delta a} = p_A + a \frac{\Delta p_A}{\Delta a} = (1 - \alpha a) + a(-\alpha) = 0$$

Thus, the following solution is derived:

$$a^* = \frac{1}{2\alpha} \quad (3)$$

$$p_A^* = \frac{1}{2} \quad (4)$$

The most desirable ad quantity for social welfare in the case of the entirely advertising-based media firm is as follows:

$$a^o = \frac{1 - \gamma}{\alpha} \quad (5)$$

According to equation (5), a^o gets smaller as γ becomes higher. Further, a^o becomes smaller as α become higher. Additionally, whereas a^* is independent from γ ³, a^o is a decreasing function of γ .

There is no guarantee that the ad quantity when the market is in equilibrium will match the optimum ad quantity. It may be excessive

³ As shown in Anderson and Coate (2006), if there is a possibility that users will abandon use of the service because of the ad quantity, even in the case of an advertising-based media firm, the media consider the user's disutility from ads. However, if the user does not abandon the use of the service, media will not consider disutility.

or too small because of the value of γ . Specifically, ad quantity when the market is in equilibrium is too small for the optimum ad quantity if $\gamma < \frac{1}{2}$, and ad quantity becomes excessive if $\gamma > \frac{1}{2}$. Only when $\gamma = \frac{1}{2}$ are the values of both equal.

3.3 Case II: A situation in which the advertising-based media firm and the fee-based media firm are supplying services in the market

Next, we consider the situation whereby the advertising-based media firm and the fee-based media firm both exist in the market, and the user selects one of the services.

The profit function of the advertising-based media firm is the same as before:

$$\pi_A = p_A a$$

However, the advertiser's willingness to pay changes according to the following equation:

$$p_A = 1 - \alpha a - \delta m \quad (6)$$

δ is a parameter indicating the degree of reduction regarding the intention of the advertiser to pay, caused by an increase in the number of users who use the service for a fee.

On the other hand, the profit function of the fee-based media firm is as follows:

$$\pi_F = p_F m \quad (7)$$

p_F is the price of the paid service. p_F is assumed to be calculated as follows:

$$p_F = 1 - \beta m + \gamma a \quad (8)$$

β is a parameter indicating how the numbers of the user for the paid service will affect the marginal willing to pay to avoid ads. γ is a parameter indicating how much the size of the increase in ad quantity

will affect the willingness to pay. This parameter reflects the magnitude of the user's disutility from ads. Incidentally, in the equation (6), the coefficients of ad quantity a and the rate of paid users m are negative, meaning that both a and m are in an alternative relationship in the ad demand function.

On the contrary, in the equation (8), the coefficient of m is negative, whereas the coefficient of a is positive. This means that a and m are in a complementary relationship in the demand function for the paid service.

From each first-order condition,

$$\frac{\partial \pi_A}{\partial a} = p_A + a \frac{\partial p_A}{\partial a} = 0$$

$$\frac{\partial \pi_F}{\partial m} = p_F + m \frac{\partial p_F}{\partial m} = 0$$

Each response function is as follows:

$$a = \frac{1 - \delta m}{2\alpha} \quad (9)$$

$$m = \frac{1 + \gamma a}{2\beta} \quad (10)$$

From these, the Nash equilibrium solution is obtained as follows:

$$a^{**} = \frac{2\beta - \delta}{4\alpha\beta + \delta\gamma} \quad (11)$$

$$m^{**} = \frac{2\alpha + \gamma}{4\alpha\beta + \delta\gamma} \quad (12)$$

From equations (11) and (12), a^{**} is a decreasing function of γ , and m^{**} is an increasing function of γ . The price in an equilibrium situation is as follows:

$$p_A^{**} = \frac{2\alpha\beta + 3\alpha\delta + 2\delta\gamma}{4\alpha\beta + \delta\gamma} \quad (13)$$

$$p_F^{**} = \frac{2\alpha\beta + \beta\gamma}{4\alpha\beta + \delta\gamma} \quad (14)$$

In this case, the next step is to find the optimum number of ads . Since some users pay fees for services, advertisers' willingness to pay will be reduced accordingly. Therefore, the optimal ad quantity must satisfy the following equation:

$$\gamma = 1 - \alpha a - \delta m^{**} \quad (15)$$

Therefore, the following equation holds.

$$a^o = \frac{(1 - \delta m^{**}) - \gamma}{\alpha} \quad (16)$$

By substituting equation (11) into equation (16), the optimal ad quantity in this case is as shown in the following expression:

$$a^o = 2 \frac{(2\beta - \delta)}{(4\alpha\beta + \delta\gamma)} - \frac{\gamma}{\alpha} \quad (17)$$

Unlike Case I, not only for the ad quantity a^o that maximizes social welfare but also for the ad quantity when the market is in equilibrium, a^{**} is a function of a parameter γ related to the user's disutility from advertising. Hence, in Case II, even if all users use the service, the media firms will consider the user's disutility from ads.

However, there is no guarantee that a^o and a^{**} will have the same value. When a^o and a^{**} are compared, the following equation is derived:

$$a^o - a^{**} = \frac{(2\beta - \delta)}{(4\alpha\beta + \delta\gamma)} - \frac{\gamma}{\alpha} \quad (18)$$

If the relationship of $a^o - a^{**} > 0$ is established, the ad quantity in the market equilibrium situation is excessively small, but if the relationship of $a^o - a^{**} < 0$ is established, it becomes excessive. Therefore, the following relationship holds:

$$a^{**} \text{ is too small if } \frac{\gamma}{\alpha} < \frac{(2\beta - \delta)}{(4\alpha\beta + \delta\gamma)} \quad (19)$$

$$a^{**} \text{ is excessive if } \frac{\gamma}{\alpha} > \frac{(2\beta - \delta)}{(4\alpha\beta + \delta\gamma)} \quad (20)$$

The inequality (19) is transformed as follows:

$$2\alpha\beta(2\gamma - 1) + \delta(\gamma^2 + \alpha) < 0$$

Since the second term on the left side of the equation is positive, when the following two inequalities hold simultaneously, the quantity of ads becomes too small.

$$\gamma < \frac{1}{2}$$

and

$$|\delta(\gamma^2 + \alpha)| < |2\alpha\beta(2\gamma - 1)|$$

Even if $\gamma < 1/2$ is established, if the following inequality holds, the number of ads becomes excessive ($a^o < a^{**}$).

$$|\delta(\gamma^2 + \alpha)| > |2\alpha\beta(2\gamma - 1)|$$

On the other hand, in the case of $\gamma < 1/2$, since $a^o < a^{**}$ always holds, the number of ads becomes excessive.

3.4 Case III: A situation in which media introduce the option to pay to remove ads

In this case, media profit is the sum of the income from ads and income from users who have chosen the paid option. It is expressed by the following equation:

$$\pi_{A+F} = p_A a + p_F m \quad (21)$$

Incidentally, p_A is assumed to be derived from equation (6), and p_F is derived from equation (8), as in Case II.

First-order conditions of profit maximization in Case III are⁴

⁴ It differs from Case II in that there is a third term.

$$\frac{\partial \pi_{A+F}}{\partial a} = p_A + a \frac{\partial p_A}{\partial a} + m \frac{\partial p_F}{\partial a} = 0$$

$$\frac{\partial \pi_{A+F}}{\partial m} = p_F + m \frac{\partial p_F}{\partial m} + a \frac{\partial p_A}{\partial m} = 0$$

Solving the above first-order conditions simultaneously, the following equations are derived:

$$a^{***} = \frac{2\beta - (\delta - \gamma)}{4\alpha\beta - (\delta - \gamma)^2} \quad (22)$$

$$m^{***} = \frac{2\alpha - (\delta - \gamma)}{4\alpha\beta - (\delta - \gamma)^2} \quad (23)$$

Compared to equations (11) and (12), this case differs from Case II in that a^{***} and m^{***} are increasing functions of γ . On the other hand, the equilibrium price becomes as follows:

$$p_A^{***} = \frac{2\alpha(\beta + \delta) + (\delta - \gamma)(\alpha + \gamma - 2\delta)}{4\alpha\beta - (\delta - \gamma)^2} \quad (24)$$

$$p_F^{***} = \frac{2\beta(a + \gamma) + (\delta - \gamma)(\beta - \delta)}{4\alpha\beta - (\delta - \gamma)^2} \quad (25)$$

The next step is to find the optimum number of ads for Case III. As in Case II, since there are consumers who use fee-based services, the optimal quantity of ads must satisfy the following conditional equation:

$$a^o = \frac{(1 - \delta m^{***}) - \gamma}{\alpha} \quad (26)$$

Substituting equation (23) for this equation (26), the optimal ad quantity is calculated with the following equation:

$$a^o = \frac{2(2\beta - \delta + \gamma)}{4\alpha\beta - (\delta - \gamma)^2} - \frac{2\gamma(1 + 2\beta)}{4\alpha\beta - (\delta - \gamma)^2} + \frac{\gamma(\delta - \gamma)(\delta - \gamma + 1)}{4\alpha\beta - (\delta - \gamma)^2} \quad (27)$$

Compare the market equilibrium solution of equation (22) with the optimal solution (27). If the relationship of $a^o - a^{***} > 0$ is established, the quantity of ads when the market in in equilibrium is excessively

small; if the relationship of $a^o - a^{***} < 0$ is established, it becomes excessive. Therefore, the following relationship holds.

$$a^{***} \text{ is too small if } (2\beta - \delta + \gamma) - 2\gamma(1 + 2\beta) + \frac{\gamma}{\alpha}(\delta - \gamma)(\delta - \gamma + 1) > 0 \quad (28)$$

$$a^{***} \text{ is excessive if } (2\beta - \delta + \gamma) - 2\gamma(1 + 2\beta) + \frac{\gamma}{\alpha}(\delta - \gamma)(\delta - \gamma + 1) < 0 \quad (29)$$

The first term on the left side of inequalities (28) and (29) is basically a positive value. The second term is basically negative when the user dislikes ads. The third term depends on the relative relationship between δ and γ . It is positive if $\delta > \gamma$ and negative if $\delta < \gamma$.

The relationship between parameters and an inadequate or excessive number of ads can be summarized as follows.

$$\text{If } \gamma < \delta \text{ and } \gamma < \frac{1}{2} \left(\frac{\beta - \frac{1}{2}\delta}{\beta + \frac{1}{4}} \right), a^{***} \text{ is too small.}$$

$$\text{If } \delta < \gamma \text{ and } \gamma < \frac{1}{2} \left(\frac{\beta - \frac{1}{2}\delta}{\beta + \frac{1}{4}} \right), a^{***} \text{ is too small or excessive.}$$

$$\text{If } \gamma < \delta \text{ and } \gamma > \frac{1}{2} \left(\frac{\beta - \frac{1}{2}\delta}{\beta + \frac{1}{4}} \right), a^{***} \text{ is too small or excessive.}$$

$$\text{If } \delta < \gamma \text{ and } \gamma > \frac{1}{2} \left(\frac{\beta - \frac{1}{2}\delta}{\beta + \frac{1}{4}} \right), a^{***} \text{ is excessive.}$$

If γ exceeds a certain value, with a relatively large value compared to δ , the possibility of an excessive number of ads increases. Conversely, if γ falls below $1/2$, with a relatively large value compared to δ , the possibility of an inadequate number of ads increases. In other words, the smaller the disutility from ads, the smaller the inadequacy—and the

larger the disutility, the more advertising tends to be excessive. This trend is in common with cases I and II.

3.5 Comparison of ad quantity in each case

Below, we will compare the quantity of ads in the equilibrium situation for all three cases. Applying equation (11), the equilibrium ad amount for Case II is as follows:

$$a^{**} = \frac{1}{2\alpha} \frac{\left(1 - \frac{\delta}{2\beta}\right)}{\left(1 + \frac{\delta\gamma}{4\alpha\beta}\right)} \quad (30)$$

Since the following inequality holds, $a^* > a^{**}$ must be established for the ad amount.

$$\frac{\left(1 - \frac{\delta}{2\beta}\right)}{\left(1 + \frac{\delta\gamma}{4\alpha\beta}\right)} < 1$$

Additionally, for Case III, if we transform equation (22), the following equation holds.

$$a^{***} = \left(\frac{1}{2\alpha}\right) \left(\frac{2\beta - (\delta - \gamma)}{2\beta - \frac{(\delta - \gamma)^2}{2\alpha}}\right) \quad (31)$$

Therefore, the following relationship holds.

$$a^* < a^{***}, \text{ if } \frac{2\beta - (\delta - \gamma)}{2\beta - \frac{(\delta - \gamma)^2}{2\alpha}} > 1,$$

$$a^* > a^{***}, \text{ if } \frac{2\beta - (\delta - \gamma)}{2\beta - \frac{(\delta - \gamma)^2}{2\alpha}} < 1,$$

Or,

$$a^* < a^{***}, \text{ if } \gamma < \delta - 2\alpha$$
$$a^* > a^{***} \text{ if } \gamma > \delta - 2\alpha$$

The relationship pertaining to the quantity of ads in each case and the relevant supply is summarized as follows. The relationship of $a^{**} < a^*$ is fundamentally established. In other words, ad quantity of the advertising-based media firm is larger than when this firm and the fee-based media firm compete in the market. On the other hand, the relationship between a^* and a^{***} varies depending on the relationship of the parameters. However, if the user dislikes ads (that is, if it is $\gamma > 0$), the relationship of $a^{***} < a^*$ is basically established.

3.6 Summary of model analyses

Regarding the disutility from ads, the results from analyzing the models are summarized as follows. The influence of disutility from advertising on ad quantity varies depending on media supply.

In particular,

- In Case I, ad quantity when the market is in equilibrium is independent of γ .
- In Case II, ad quantity when the market is in equilibrium is a decreasing function of γ .
- In Case III, ad quantity in the equilibrium situation is an increasing function of γ .

In cases II and III, γ affects not only the optimum ad quantity but also the ad quantity in the market equilibrium situation. However, how to incorporate the disutility from ads varies depending on the supply method.

Comparing the ad quantity in all three cases, the quantity in cases

II and III is less than that in the first case when users dislike ads. This finding indicates that if it is possible to choose to pay for a service, the quantity of ads is likely to decrease.

Further, there is no reason to think that ad quantity in any situation involving market equilibrium matches the optimum ad volume. In either supply system, depending on the value of the parameter indicating disutility from γ , the quantity of ads may become excessive or too small. However, in any of the supply systems, a lower value of the parameter γ means that ad quantity will be smaller when the market is in equilibrium. Additionally, as the value of parameter γ increases, the ad amount is likely to become excessive.

4. Empirical Analysis

According to our analysis in the previous section, the level of ad disutility is a factor for determining whether the number of ads in the equilibrium situation becomes excessive or too small in either scheme. In the following, we use the demand function of the fee-based service from the previous model:

$$p_F = 1 - \beta m + \gamma a$$

Taking the inverse function of the equation above,

$$m = \frac{1}{\beta} - \frac{1}{\beta} p_F + \frac{\gamma}{\beta} a$$

We estimated the parameters for the equation above.⁵

Based on the results of our survey questionnaire,⁶ we measured the

⁵ Percentage of people who use ad-supported services; n is defined as $1-m$.

⁶ For the empirical estimation, we used an original data set collected in August 2016. Respondents were selected and given the questionnaire by employees of Cross Marketing Inc.; 1,200 participants were selected equally across genders and age group. Each sample was divided into four segments and assigned its own set of questions.

magnitude of media users' disutility from ads in using media services. More concretely, we measured possible payments for eliminating ads if users were selecting this option (marginal willingness to pay or marginal WTP). Findings show a trade-off relationship for users between watching ads (no fee) and paying a fee to enjoy contents with no ads.

We prepared for the following three types of questions and investigated users' attitudes toward various types of ads:

- (1) The relationship between ad volume and users' WTP for ad avoidance.
- (2) The relationship between different types of ads and users' WTP for ad avoidance.
- (3) The relationship between content volume and ad volume.

4.1 Relationship between ad volume and users' WTP for ad avoidance

Regarding question (1), we show the ad percentage per hour and fee for eliminating ads. We asked the audience whether they accepted this option (binary-choice), assuming the instream-type ad was adopted for current terrestrial broadcasting. Using our survey data, we estimated using the bivariate logit model. Results are shown in Table 1.

Table 1. Estimation results from bivariate logit model

Variables	Estimated Value	Standard Error	
Logit Model			
Constant	-2.431	0.246	***
Advertisement	0.007	0.006	
Price	-0.001	0.000	***
Sex (male = 1)	0.274	0.118	**
No. of living together (single = 1)	0.060	0.124	
Job (no job = 1)	0.191	0.127	
Age	0.009	0.004	**
Personal income	0.072	0.025	***

No. of respondents	1,200	Number of samples	3,600
Maximum likelihood	-1382.731	McFadden's Pseudo R2	0.035
Restricted likelihood	-1,432.227	Prob Chi Sq > value	0.000

The star symbols ***, **, and * indicate statistical significance at 1, 5, and 10% respectively.

We can conclude the following:

The coefficient of ad volume (time) is not significant.

- The coefficient of fees for eliminating ads is negative and significant.
- Regarding individual attributes:

Significant; sex (male = 1), age (logit case only), personal income

Not significant: the number of people living together dummy (single = 1), Job dummy (= 1 if student, part-time employee, or unemployed individual)

Because males with higher income levels tend to use ad-eliminating services, we can see quite naturally that people with much money and tight schedules tend to use these services.

A significantly negative sign on the coefficient of price was observed, whereas that of ad volume was not, meaning that users sensitively responded to price but not to ad volume. In fact, we confirmed that many respondents did not choose the option requiring a fee to eliminate ads (even referring to raw data). In short, results showed that users' WTP for eliminating ads was small and users preferred to "pay" by watching ads instead of paying a fee, which means that their disutility from viewing ads was relatively lower.

Based on these results, we can say that: (a) media tend to adopt the ad-supported method because they expect large amounts of revenue compared to subscription fees, (b) there is room for increasing ad volume

because current ad levels are under-broadcasted, and (c) it is possible to show negative signs regarding price under optimal conditions.

4.2 Relationship between different types of ads and users' WTP for ad avoidance

Currently, there are various types of ads accompanying motion pictures provided via the Internet. It is possible to provide not only the instream ad format (i.e., inserting ads between programs) but also ad overlays, which show ads continuously alongside video contents.⁷ Moreover, it is possible to interrupt ad avoidance behavior in movie distribution systems through the Internet.⁸

In the following section, we analyze WTP for eliminating various types of ads. Specifically, we examine users' disutility from different types of ads.

For question (2), we showed three cards combined randomly with items associated with three attributes and asked users to select the best and second-best cards among them (ordered choice), assuming no limitations in movie distribution service for a month (Table 2).

Table 2. Attribution for ordered choice

Attribute 1	Advertisement (overlay type)	With/Without
Attribute 2	Advertisement (instream type)	0 (0 min), 2 (6 min), 4 (12 min), 6 (18 min), 8 (24 min) (times)
Attribute 3	Price	0, 50, 100, 250, 500, 1000 (¥)

⁷ Although it is still not common with movie-streaming services, overlay ads are already common in the case of free application software, such as YouTube.

⁸ It can also be said that movie distribution via the Internet made it possible to transfer advertising control from the viewer side to the supply side.

Using collected data, we implemented ordered logit estimation and examined users' preferences corresponding to the different types of ads. Our estimation results are shown in Table 3.

Table 3. Estimation results from ordered logit model

Variables	Estimated Value	Standard Error	
Ordered Logit Model			
Constant	1.168	0.052	***
Advertisement (overlay)	-0.359	0.032	***
Advertisement (instream)	-0.113	0.005	***
Price	-0.0002	0.000	***
Age	0.000	0.001	
Personal income	0.002	0.006	
Sex (male = 1)	-0.009	0.031	

No. of respondents	1,200	No. of samples	18,000
Maximum likelihood	-19,256.240	McFadden's Pseudo R2	0.026
Restricted likelihood	-19,775.021	Prob ChiSq > value	0.000

The star symbols ***, **, and * indicate statistical significance at 1, 5, and 10% respectively.

We observed the significant and negative values of coefficients for choice probability with respect to both the overlay and instream ads. In addition, we observed significantly negative coefficients for price, as we expected. Note that a coefficient for an instream ad is larger than that of the overlay type, resulting in a large WTP value for ad overlays. Calculating WTP based on ordered probit estimation results, we identified ¥1977 as the WTP for eliminating overlay ads and ¥624 for eliminating instream ads (a threefold difference). These results show that users' disutility from ads seems to be largely different depending on the display method used in advertising.

Since the coefficients of price and ads were negative, it means that

the choices of paying a fee for ad avoidance and viewing ads (for no fee) were in an alternative relationship as a means for enjoying content. However, the degree of WTP for avoiding ads was low, and the proportion of users who intended to avoid ads for a fee was limited. Users were strongly aware of pricing, and those who wished to pay for ad avoidance were limited. This finding suggests that users' disutility from ads was relatively low, and the ad volume may have been too small compared to the optimal level.

4.3 Relationship between content volume and ad volume

Here, we raise the question regarding measuring the relationship between content volume, users' disutility from advertising, and the fee for eliminating ads.⁹ In this study, we combined options from three attributes (Table 4) and asked respondents to select the most desirable card from three options including "no choice," assuming a counterfactual Internet movie distribution service (single choice).

Table 4. Attributes for choice-based conjoint model

Attribute 1	Price	0, 250, 500, 1000 (¥)
Attribute 2	Available Contents	10, 30, 50, 70 (hours)
Attribute 3	Advertisement	With (A three-minute ad is inserted every 15 minutes) / Without

⁹ The concrete question is as follows: "Suppose the Internet streaming service permits you to see movie contents— including up-to-date movies currently screened in theaters—as frequently as desired for a month. You may use this streaming service or a combination of the service with a subscription fee and available content hours as follows. Please choose the most desirable option among the following three choices. Note that 'with commercial' means three-minute commercials are inserted and programs are interrupted every 15 minutes—a format already adopted by current commercial terrestrial broadcasting stations. Available content hours are not changed by inserted commercial time."

Many respondents in this study chose the option “no choice of any service” if the price was not zero and the sample distribution was quite skewed; therefore, we eliminated samples with zero WTP and estimated using the mixed logit model. We asked each person the same question four times (with different combinations of the three attributes). We regarded respondents who chose “option 3: no choice” every time as a disturbance and eliminated them. As a result, 400 of 1,200 respondents were dropped. Results are shown in Table 5.

Table 5. Estimation results from mixed logit model

Variables	Estimated Value	Standard Error	
Random Parameters in Utility Function			
Advertisement	-0.387	0.076	***
Content Volume	0.004	0.002	**
Price	-0.005	0.0004	***
Non-random Parameters in Utility Function			
Option1× Age	0.013	0.003	***
Option1× Sex	0.120	0.129	
Option1× Income	0.105	0.026	***
Option2× Age	0.016	0.003	***
Option2× Sex	0.148	0.119	
Option2× Income	0.125	0.025	***
Derived Standard Deviation of Parameter Distribution			
Advertisement	0.318	0.444	
Contents Volume	0.010	0.008	
Price	0.003	0.0003	***

No. of respondents	800	No. of samples	3200
Maximum likelihood	-2929.220	McFadden's Pseudo R2	0.168
Restricted likelihood	-3515.559	Prob ChiSq > value	0.000

The star symbols ***, **, and * indicate statistical significance at 1, 5, and 10% respectively.

With respect to first and second formulations, we obtained a positive sign for the coefficient of content volume (as we expected), but

they were not significant. On the other hand, we obtained a significantly positive sign, consistent with our expectations, in the third case (where we dropped the constant term in each option). We obtained unstable results for the coefficient of content volume compared to those for ads or price.

Our results provided in this section are summarized as follows:

- (i) We obtained a significantly negative sign on the coefficient of price by equations (1)–(3).
- (ii) We obtained a significantly negative sign for the coefficient of ad volume by estimations (2) and (3), whereas (1) showed ambiguous results. In addition, we showed that users' disutility from ads seemed to be largely different, depending on the method of displaying ads in (2).
- (iii) We obtained unstable results for the coefficient of content volume compared to those for ads or price.

5 Summary and remaining tasks

We will discuss the remaining tasks here.

In this analysis, we focused only on users' attitudes. However, it is characteristic that the media market is also affected by the effectiveness of advertisers. In the model, it is said that users with a large disutility from ads will choose to pay for eliminating ads; thus, there will be an increase in users who choose to pay for contents (and a decrease in users who choose to watch ads), directly leading to a reduction in advertisers' WTP. However, even if a user with a large disutility from advertising avoids ads, the advertiser's marginal WTP (ad effectiveness) may be hardly affected.

Further, both ad effectiveness and users' disutility from advertising are affected by the competitive relationship among media

firms. The greater the number of competing media, the easier it is for users to avoid ads and the less disutility from them. In addition, Since it is difficult to observe how ads are forced upon users, measures must be taken to reduce disutility from ads. If the market becomes competitive and the disutility from advertising declines, each medium may eventually provide more ads.

On the other hand, as the market becomes competitive—that is, as the number of alternative media increases—ad effectiveness per unit decreases. This situation will be an incentive to promote fee-based services for users. When the market becomes competitive, there are two aspects: one is to increase the necessity of choosing to pay a fee through the decline in ad effectiveness, and the other is to promote advertising by lowering its negative utility.¹⁰.

After all, to grasp the characteristics of the media market, it is necessary to analyze not only the attitudes on the user side but also ad effectiveness for the advertiser and the influence of the competitive market environment . We would like to analyze these aspects in the future.

Acknowledgement

This research is partially supported by Grant-in-Aid for Scientific Research(C)(16K03687, 17K03694) and Hoso Bunka Foundation (FY2018).

¹⁰ Note that if ad avoidance becomes easier and disutility from ads declines, ad effectiveness will eventually decrease.

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