PRICING PROBLEM OF MOVIE PRODUCT PLACEMENT BASED ON TWO-SIDED MARKETS

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ABSTRACT. *Product placement is one of the essential elements in the movie market. How much product placement should be embedded in the movie and how to make the best price decisions of the product placement are the biggest problems about which movie producers concerned. This paper firstly established the price model of the product placement that has a monopoly position in the movie market from the perspective of two-sided market, and then explored the price structures made by the producers to the implanted advertisers and audience on condition that social welfare and manufacturers should achieve the profit maximization. Concerning the two aspects, it is concluded that the two prices have been affected by each other's quantity and affected by the positive and negative network effects. All of these guide the movie producers to make the price decisions about the product placement.*

Keywords: Product placement, Pricing structure, Positive and negative network effects, Two-sided markets

1. **Introduction.** With the cultural competition as an important indicator to measure a country's overall national strength, promoting the development of cultural industry has become an important strategy to enhance their "soft power". As a core part of cultural industry, the movie industry of our country has been developed rapidly in recent years. China's total box office reached 44.069 billion yuan in 2015, only next to North America, and continued to maintain the level of second position in the world. In the background of the movie commercialization, implantable advertising has become an essential element in commercial movies. Take the currently domestic box office champion, the Mermaid as an example. In a short span of 93 minutes, there are as many as 13 significant product placements. Although product placement can bring a certain profit for the movie producers and provide cultural and media support to advertisers, too many product placement will inevitably reduce audience's viewing experience and affect the public's evaluation of the movie itself. So the number of product placement in the movies and how to make optimal pricing decisions for the product placement have become a major concern of the movie producers.

From the perspective of industry characteristics, the movie industry is a typical industry of feature of "two-sided markets". Two-sided market refers to the user's trading activities on both sides of this market carried out through the platform, the platform to provide products or services to both users. According to Evans on two-sided market classification, the movie is a typical audience creative two-sided market, its mode of operation is no longer the traditional vendors and consumers, prices and demand structure, platform-type structure but interrelated each side users [1]. Due to the lack of a clear specification of the current hard production industry in China's movie implant advertising standards, throughout the current movie implant advertising, there exist excessive advertising implants, rigid implants, the phenomenon of negative implants. The first criterion

for judging the success or failure of the movie marketing is to ensure the integrity of the movie narrative and visual style, and to avoid the negative impact of the audience because of the negative impact of the advertising implants. Movie producers have attracted the audience by making a high level of movie, so that advertisers are willing to product placement and related information in the movie. Although the market participants are concerned with different aspects: the audience care about the quality of the movie, advertisers care about the number of shadow, producers concern about the final movie return, the ultimate goal of the three participants is to obtain the maximum utility through the movie.

Now the study on movie product placement mainly concentrated in the implantation method [2-4] and operation skill [5,6], communication effect [7,8] and influence factors [9,10]. Although the results of these researches provide important theoretical methods and research perspective to comprehend the movie product placement, the literature from the economic point of view to explore the movie product placement is relatively rare under the background of the movie commercialization. All these researches failed to elucidate the economic impact on movie product placement producers and advertisers and audience. The product placement pricing model in the movie still did not have a set of perfect standard for reference. Based on the theory of two-sided market, this paper, using the analysis framework of pricing advertising on two-sided market made by Armstrong, explores the pricing strategy of movie producers in the movie industry in the case of monopoly for advertisers and audience, establishes the pricing model of product placement considering that the positive and negative network effects in the two-sided market are related in the actual situation, and analyzes the pricing structure made by movie producers to advertisers and audience under the conditions of the maximization of social welfare and the maximization of profits, through the model analysis movie producers for advertisers and the audience pricing of the main influencing factors.

2. The Two-Sided Market Monopoly Pricing Model of Movie Product Placement.

2.1. **Model assumptions.** From the market perspective, the characteristics of the movie industry have the monopoly competition. However, due to the complexity and originality of the movie itself, especially for a commercial movie with monopoly Copyright, such as Marvel's American Super Hero Theme [11], in a period of specific screenwriter, director and idol star exclusive resources created in the movie the one and only feature, which makes the movie and other movie competition weakened, it means that the structure characteristic of the movie has a monopoly market for advertisers and audience.

(1) It is assumed that the movie product placement pricing model is based on the monopoly of the movie market, the audience watching different movies have completely different viewing experience, and advertisers in the choice of movies are subject to a single ad placement.

(2) It is assumed that the audience all belong to the type of advertising, that is, the insertion of advertising in the movie will bring the audience a loss of utility, while allowing the movie market is not completely covered.

(3) It is assumed that the quality of the movie is proportional to the capital invested by the producer when the movie is finally released, and the funds referred to in this paper only refer to the cost of advertising from the movie.

2.2. **Setting parameters.** Movie implanted advertisers M and movie audience N, M_a and N_b respectively, said the number of two categories of users; P_M is the movie producers to receive advertising agency price, and P_N is the movie studios to the audience of the movie fare collection. If that producers provide viewers with movie quality is the direction of function, $F(M_a, P_M) = M_a \bullet P_M$ and $\frac{\partial F}{\partial M_a} > 0$, $\frac{\partial F}{\partial P_M} > 0$ the implantation of advertising

revenue for advertisers; implantation movie audience is two-sided, audience prefer video content of high quality and hate placement in the movie, when the number of movie implanted advertisers increases, on the one hand, movie producers will have more capital to hire big star and director of the shooting team and get better quality of the movie, showing the positive effect of the network; on the other hand, because increasing of the number of placement in the movie will inevitably lead to the audience emotional decline thus affecting the overall evaluation of the movie market, and showing the negative network effect, positive and negative network effects exist at the same time and the mutual connection. β_a represents a per unit mass movie audience to increase the effectiveness, and β_b expressed per unit implant, loss of advertising to the audience; α represents each audience to advertisers bringing utility increases.

2.3. **Setting model.** The utility function is the utility function of the implanted advertiser and the movie audience:

$$\begin{aligned} U_M &= \alpha N_b - P_M \\ U_N &= \beta_a \bullet F(M_a, P_M) - \beta_b \bullet M_a - P_N \end{aligned} \tag{1}$$

Suppose that the number of advertisers and audience is the increasing function of the effectiveness of their movies:

$$\begin{aligned} M_a &= \varphi_M(U_M), \ \varphi'_M(U_M) > 0 \\ N_b &= \varphi_N(U_N), \ \varphi'_N(U_N) > 0 \end{aligned} \tag{2}$$

The marginal costs of movie producers to provide services for advertisers and audience were f_M and f_N, then the profit function of the movie's producers for (for the convenience of study, we only consider the producers obtained from the implanted advertisers and audience profit):

$$\pi = M_a(P_M - f_M) + N_b(P_N - f_N) \tag{3}$$

Put Formulas (1) and (2) into Formula (3), and get the profit function of the movie producer:

$$\begin{aligned} \pi &= \varphi_M(U_M)[\alpha \bullet \varphi_N(U_N) - U_M - f_M] \\ &\quad + \varphi_N(U_N)[\beta_a \bullet \varphi_M(U_M) \bullet P_M - \beta_b \bullet M_a - P_N - f_N] \end{aligned} \tag{4}$$

According to the definition of "social welfare maximization" in welfare economics, the maximum behavior of the producer in the movie placement advertisement is defined, and the overall effectiveness of the social members is the largest, that is, the Pareto optimal. Armstrong put single ownership monopoly two-sided market decision-making behavior to distinguish two aspects of welfare and profit maximization, and the welfare level of platform definition for profit and two-sided participants of consumer surplus, and according to the envelope theorem, participants' two-sided consumers remaining meet: $V'_M(U_M) \equiv \varphi_M(U_M)$; $V'_N(U_N) \equiv \varphi_N(U_N)$. Therefore, the total social welfare can be expressed as:

$$W = \pi(U_M, U_N) + V_M(U_M) + V_N(U_N) \tag{5}$$

The condition of social welfare maximization is that first derivative of the variable W with respect to independent variable U is zero ($\frac{\partial W}{\partial U_M} = 0, \frac{\partial W}{\partial U_N} = 0$):

$$\begin{aligned} U_M &= N_b(\alpha + \beta_a \bullet P_M - \beta_b) - f_M \\ U_N &= M_a(\alpha + \beta_a \bullet P_M - \beta_b) - f_N \end{aligned} \tag{6}$$

To further calculate the price level for the movie producer in the maximization of social welfare for advertisers and audience:

$$\begin{aligned} P_M &= \frac{f_M + N_b \bullet \beta_b}{1 + N_b \bullet \beta_a} \\ P_N &= f_N - \alpha \bullet M \end{aligned} \tag{7}$$

2.4. **Model analysis.** Armstrong [12] pointed out that in a one-time payment mode, the level of the user's utility on one side of the bilateral market will change with the number of users on the side and the level of one-time charges. with the pricing model, in which the advertising is implanted among the movie, it can be seen from Formula (1), the producers bring the improvement of movie quality by implanting advertising among the movie, thereby increasing the utility of the audience [13]. Because the audience are offensive to the advertising implanted among the movie, it is natural leading the loss of the utility of the audience. The change of the number of advertisers shows the change of exposure rate of product placement among the movie, and the higher placement rate will affect audience's viewing experience to greater extent, making both their satisfaction and utility level decrease. Furthermore, when the utility generation mechanism of the bilateral user is asymmetric to the degree of the interdependence, there will be an asymmetry in bilateral price structure, which suggests that the audience utility level is related to the amount of implanting advertisers, and the related strength of each other is not equal. From Formula (7) it can be found in the condition of the maximization of the social welfare, the equilibrium price made by the producers connecting advertisers and audience is always composed of two parts. In the first part, it is related to the marginal cost, of which the producer provides service for the bilateral users, and the pricing structure distinction of the bilateral users is mainly related to the positive and negative network effects generated by the second parts.

(1) According to the calculation $\frac{\partial P_N}{\partial M_a} = -\alpha < 0$, with the increasing number of product placement, the production side of the audience will gradually reduce the charges. Because the movie in the implantation of advertising to the audience's viewing experience produced a utility loss, which will affect the entire movie market for the movie's score, the movie score will lead to a decrease in the number of audience. Producers in order to attract more audience to watch their movies, to reduce the charges for the audience has become the most direct means [14]. By $\frac{\partial P_M}{\partial N_b} > 0$, we can know that the larger the number of audience is, the higher the number of producers to advertisers is. It is the reason that with the increasing viewing number, the possibility with the movie implanted advertiser product information delivering to their own target customers will increase.

In the monopoly movie market of product placement, the producers will reduce the fee on the audience with the increasing number of product placement; the number of audience is of positive correlation to the charge on the advertisers from producers. From the producer's point of view, in the movie through the implantation of advertising to obtain a certain advertising revenue conditions, how to ensure the movie's audience has become a big problem. Producers choosing well-known director, outstanding star actor, professional shooting team, will have a huge appeal to the audience, also the producers in the movie before the preheating marketing will also affect the movie's audience [15]. If the production side of the movie is to be taken by the movie release of a movie, the movie's box office model will provide some guidance for its pricing decisions.

(2) The effects of positive and negative network effects on the pricing of the placement of advertisers and movie audience: by the $\frac{\partial P_N}{\partial \alpha} = -M_a < 0$, it is known that the greater the positive network effect of the audience to advertisers is, the lower the price of the producer to the audience is. By $\frac{\partial P_M}{\partial \beta_a} < 0$, $\frac{\partial P_M}{\partial \beta_b} > 0$ it shows that the greater the positive network effect of the movie's product placement on the audience is, the lower the production side of the advertisers is. And the greater the negative network effect of the product placement on the audience is, the higher the production side of the advertisers is.

The significance of management: product placement in the movie produced by the positive and negative network effects indirectly affects the producers of advertisers and audience pricing structure. If the producers under the prerequisite of not compressed into the number of ads need to make a comprehensive assessment of implantation of

advertising content, it is necessary to assess the product placement effect on the brand value of the advertising business, but also evaluate the placement of the movies themselves. In addition, in order to reduce the effect on the audience of the product placement, the producers need to cooperate with the movie's plot fusion higher advertisers, and avoid the rigid implanted and negative product placement.

(3) The condition that the first derivative of the profit maximization of the movie producer is zero, can get the pricing structure of the producer in the maximum profit:

$$P_M = \frac{f_M + N_b \bullet \beta_b}{1 + N_b \bullet \beta_a} + \frac{\varphi_M(U_M)}{\varphi'_M(U_M)}$$
$$P_N = f_N - \alpha \bullet M + \frac{\varphi_N(U_N)}{\varphi'_N(U_N)} \tag{8}$$

Formula (8) shows that under the conditions of profit maximization, the movie producers are positively correlated with the marginal cost when pricing the two-sided users. Different from the pricing of social welfare maximization, it is also affected by the factor related to the utility elasticity of two-sided users.

Movie producers would transfer the initial charge on the users of the two sides after the first charge to advertisers and audience, which is based on the price subsidies on the charge to the audience from the asymmetry of the audience and the implanted advertisers, available to the users of cross price elasticity to measure [16], assume proportion of subsidies to the audience is γ, $(1 - \gamma)P_N + (P_M + \gamma P_N) = P_N + P_M$ placement of the price is $P'_M = P_M + \gamma P_N$. Therefore, after the implementation of the transfer price of the movie producer, you can get the final price of the implanted advertisers:

$$P_M = \frac{f_M + N_b \bullet \beta_b}{1 + N_b \bullet \beta_a} + \gamma(f_N - \alpha \bullet M_a) \tag{9}$$

By Formula (9), we can find that the movie producers in the pursuit of the maximization of social welfare, there is a cumulative effect [17]; in other words, more implanted advertisers join the producers to reduce their asking price.

2.5. **Example verification.** This paper uses the product placement in the movie "Crazy Stone" as the object of model validation. Product placement pricing model established according to this paper in the movie mainly proves that the factors affecting the pricing of product placement verification are consistent with theoretical conclusions of the model. The producer of the "Crazy Stone" is Chinese Warner Hengdian Movie Company. The movie implanted 13 brand product placements, which reached number 13. According to the pricing model, with the increasing number of product placement in the movie, the producers of the audience's fees will be gradually reduced. For a domestic small budget movie, the number of 13 product placements has been enough to impact the evaluation on the whole movie. The producer hired the most professional director and actor of the movie team in order to ensure the number of people viewing, finally achieving 23.5 million box office. For example, the brand of Coca-Cola implanted in this movie, and it appeared 4 times, which is designed as a part of the movie. The presentation form of the brand implantation adopts the shooting way of big lens, emphasizing the appearance and the label of the production. Coca-Cola is the brand of the longest exposure time, which is totally 28 seconds according to the data statistics. The pricing model points out that the bigger the positive network effect on the audience of the implanted advertisers in the movie is, the lower the cost on the advertisers of the producers is, while the bigger the negative network effect on the audience of the product placement is, the higher the cost on the advertisers of the producers is. In a movie, deliberately highlighting a brand would inevitably lead the audience to generate aversion on movie. According to the final data, Coca-Cola's advertising costs are the largest of all the brands.

3. **Conclusions and Prospects.** In this paper, we use the basic model made by Armstrong about the advertising price of the monopoly market to construct a model of the monopoly price based on the two-sided markets. In the end, the authors come to a conclusion that:

(1) With the increasing number of product placement in the movie, the producers will reduce the charge to the audience, while the number of the movie audience and the advertiser's fees paid to the producer present a positive correlation;

(2) The positive and negative network effects have an indirect effect on both the price of the advertisers and the audience;

(3) Under the condition of maximum profit, the price made by the producer to each side relates to the demand elasticity: the greater the elasticity of the demand is, the lower the price of the platform is. In the process of pursuing the maximization of social welfare, the movie producers have accumulated effect, that is, the addition of more implanted advertisers will impel the producers to reduce the price to the advertiser.

Compared with the existing research on product placement, this paper explores the economic impact of the product placement on the three participants from the perspective of economics, establishes the monopoly price models of product placement based on two-sided markets, and considers the positive and negative network effects of two-sided markets, which will help the movie producers to solve the balance between the quantity of the product placement and the quality of the movie by pricing the product placement. In terms of the movie product placement, it is a combination of the two characteristics of advertising creativity and media communication, so the pricing standard of product placement should include two dimensions – the advertising itself and the effect of the spreading. Box office is the most direct measure of the communication effect which is the number of audience in the pricing model in this paper. The following research will focus on how to quantify the effect of product placement communication itself, and be combined with the existing box office prediction model, so as to establish product placement pricing model which is closer to the objective value.

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