Research on Optimization of Webcast Income Distribution Based on Game Theory
Wei LU and Hao-peng QIN
Communication University of China, Beijing, China

Keywords: Live webcast, Income distribution, Game model, Network, Externality.

Abstract. The unique business model enables the live webcast platform and the anchor to have the special income distribution way. This article takes the live webcast business model as the breakthrough point, carries on the analysis to the existing income distribution way, and studies the income distribution relations between the network webcast platform and the anchor. Through the construction of game model, the formation process of income distribution relationship is generally explained. The results obtained in this paper can be used for preliminary evaluation of income distribution methods and reasonable analysis of live publicity data.

Introduction
With the rise of the concept of Web2.0 and the optimization of mobile internet environment, webcast is a new industry which has been developing rapidly in China. However, the research results of webcast management are few, mainly focused on the development mode and mechanism, and lack of in-depth research on the distribution of live webcast.

This paper studies the distribution mode of net live income, combined with the actual problems of webcast industry, according to the network externality characteristics of network live, analyzes the distribution pattern of net live income by game theory, and studies the regular pattern of income distribution in the network webcast industry, combining with the existing webcast platform. The optimal allocation strategy of the anchor and live webcast platform is proposed.

Business Mode and Income Distribution Mode of Webcast Platform

Business Model of the Webcast Platform
The essence of webcast platform is to provide real-time live video sites, and take the webcast platform as the core to form an industrial chain. The upstream of the webcast platform is a broadband telecom operator, the downstream is the user watching live webcast, and the object of cooperation is to provide the original content of the anchor, advertisers to pay advertising costs and the need to promote the game developers.

A webcast platform has many live rooms, and each live webcast needs an anchor to provide live content. The broadband cost of live webcasting is provided by live webcasting platform, and the advertising expenses of users between live rooms and advertisers are also directly obtained by webcast platforms. Live webcast platforms and anchors regularly allocate income for live webcast. Users can see that live webcast is free, and other related purchases are entirely based on users' willingness. The platform can get the cost of buying virtual gifts from small users. Most of the free live users can bring a better user experience to the former, and can also make the game direct webcast platform indirect advertising costs, game promotion costs, commercial advertising costs, and so on.

The webcast platform is responsible for the technical maintenance, front end back-end design and daily operation management of each live webcast, and the anchor is responsible for providing live webcast content. This structure can be based on the unlimited expansion of the market, and can integrate all anchors and all the audience resources to form an industry. While there are multiple live webcast platforms with this structure in the market, they can provide the same services and lack obvious differences.
Cooperative Mode of Webcast Platform and Anchors

The resources of live webcast platform are audiences and anchors, while the partners only have anchors. On the one hand, because most of the webcast is provided free of charge to the audiences, the cooperation with the audience cannot be controlled the cooperation with the advertisers and the game developers is an additional link. On the other hand, the webcast platform must have a good relationship with the audiences by anchors. The anchors are the ties of the two parts.

The initiative to watch and pay is completely in the hands of the audience. The content and interactive anchors will try to win the audience's attention and pay, and the live webcast platform has nothing to do with it. The new audience began to contact the live webcast because it was interested in the live webcast content provided by a direct seeding anchor. After a period of familiarity with the live audience, there was a trend to become an audience belonged to a webcast platform. To truly communicate with the anchor, improve the participation of live content, and get social networking, the audience should not only have enough time to see the live webcast, but also send enough virtual gifts. If this trend occurs, the webcast platform will eventually get a part of the platform - dependent audience; the anchor can also get a part of the audience that is more dependent on the anchor. However, if the live content is not enough to attract the audience, it will lead to the loss of the audiences. Similarly, a large number of users of the live webcast platform can also bring many viewers to live rooms, which may become fans of anchor. This is the reason why the webcast platform and the anchor must establish good cooperation. The cooperative relationship between the webcast platform and the anchor is based on the interest - related, and their cooperation is win-win, but the relationship is loose and has the characteristics of the network externality.

Current Model of Income Distribution

The process of establishing the cooperative relationship between the webcast platform and the anchor: the anchor first enters a webcast platform, and then the live webcast platform chooses the anchor to cooperate. If the cooperation is distributed, the webcast platform will be paid to the anchors based on the income distribution of the live webcasting platform; otherwise, the anchor will not get any income.

The relationship between webcast and its anchor is mainly based on loose cooperative relationship. The two sides have coordinated direct webcast to get the common interests of income, and there is also a competition relationship between interests distribution. Before the cooperation begins, the anchor and the webcast platform make a two-way selection: the anchor chooses a live webcast platform between the live webcasting platforms of different income distribution modes, and the webcast platform will choose to cooperate with the anchor in financial aspects while the conditions are reached. The cooperation and profit distribution of webcast platform and anchor are in a live room. After obtaining the proceeds, the two sides allocate the proceeds. Therefore, there is a cooperative game relationship between the live webcasting platform and the anchor.

At present, there are two kinds of income methods for large scale webcast platform: one is to distribute a certain proportion according to the reward of the pepper direct seeding, and the other is to allocate “Douyu” as an example, and to distribute it according to other factors. The income distribution of “Huya” and “Zhanqi” can be regarded as a total distribution according to reward and a larger part is equivalent to a part of the signing bonus of well-known anchors.

In addition to the big platform, some small start-ups will add irresponsible base salary to attract anchors on the basis of these income distributions. The Laifeng webcast platform is an example. The Laifeng platform is divided into two parts according to the webcast time and the commissions. The anchor is 10 RMB per hour, and the top is 1000 RMB. The proportion of the Exchange Commission is 42%.
Game Model of Basic Income Distribution

Model Description

As the research object, as the audience and advertisers do not participate in the income distribution, the participants of the whole game only include the webcast platform and the anchor. The participation steps are as follows: the anchor chooses a platform to broadcast live, then the anchors form a certain audience in the process of live broadcast, and the platform collaborates with the anchor. If you choose business cooperation, according to the cooperative strategy, the anchor is broadcast live to make the platform get the reward and advertising fee, then the platform and the anchor distribution income; if no business cooperation is chosen, the anchor will choose the other webcast platform, and the platform will also inspect the new anchor.

The process of many anchors and many webcast platforms can be regarded as a game process that the anchor and a direct seeding platform repeat different strategies. The game information of both sides is complete. The equilibrium situation of the repeated game strategy is exactly consistent with the feasible individual physical situation in the one-time game. There are two strategies anchors group and two live broadcast platform groups. In the process of income distribution, both sides aim at maximizing their own income, and they have a competitive relationship.

The income distribution strategy of the platform is “reward sharing” and “mixed salary”. The reward of the anchor is only from the audience’s reward, the salary comes from the total income of the whole live broadcast, and the more platform income distribution strategy is the reward share. Some platforms are allocated by reward sharing, while others take part in rewards and rewards, while others use other allocation methods.

The strategies adopted by the anchor are “normal live broadcast” and “negative live broadcast”. The anchor in the broadcast live negative by decreasing the content quality, live in the studio to use Alipay selling things, reduce the time of the live broadcast platform harmful behavior, resulting in the loss of number of live or live normal. Compared with normal live broadcast, negative live broadcast will cause the loss of live broadcast, but it can bring additional benefits to the anchor.

The model assumes that (1) the participants are rational, their utility is equal to their remuneration, and (2) the strategy of direct seeding platform does not affect the audience directly; (3) the correlation between numerical values is assumed to be linear.

Model Analysis

There is a positive correlation between reward cost and advertising cost, and it is approximately proportional. Suppose the number of viewers is $n$, the ratio of reward is $\alpha$, $(0<\alpha<1)$, the income is $n$, and the proportion of advertising revenue is $\beta$ $(0<\beta<1)$ mixed salary $\beta n$. The cost of live webcast platform includes the cost of network bandwidth, the payment to the anchor and the cost of managing live webcast. The network bandwidth cost of live webcast depends on the maximum number of bearable people, which can be approximately represented by the number of viewers. The cost of managing direct seeding is fixed. The cost of the platform includes the constant cost $c$ and variable cost $dn$.

While the strategy of live webcast platform $A$ is to reward and divide, the strategy of anchor $B$ is normal live webcast, and get the utility of $A_1$ and $B_1$ of $A$ and $B$. Reward sharing is directly related to the reward income of live webcast, and has nothing to do with other income. The webcast platform $A$ divides the anchor $B$ into $k$ $(0<k<1)$:

$$A_1 = (\alpha - \alpha k + \beta - d)n - c \ ; B_1 = k\alpha n$$

(1)

While the strategy of live webcast platform $A$ is mixed salary, the strategy of anchor $B$ is normal live webcast, and get the utility of $A_2$ and $B_2$ of $A$ and $B$. Mixed salaries are related to reward income and advertising revenue. The live webcast platform $A$ rewards the anchor $B$ into $f$ $(0<f<k<1)$, and the advertising revenue is divided into $m$ $(0<m<1)$, and the income of the anchor is respectively $f \alpha n$ and $m \beta n$:

$$A_2 = (\alpha - \alpha f + \beta - \beta m - d)n - c \ ; B_2 = (\alpha f + m\beta)n$$

(2)
While the anchor plays a passive live webcast strategy, the number of people who lose the live webcast is x (x<n), and the additional revenue of the anchor is ex (e<1). Get the utility of A and B, A3, B3 and A4, B4:

\[ A_3 = (\alpha - \alpha k + \beta - d)(n - x) - c ; B_3 = k\alpha(n - x) + ex \]  
\[ A_4 = (\alpha - \alpha f + \beta - \beta m - d)(n - x) - c ; B_4 = (\alpha f + m\beta)(n - x) + ex \]

Table 1. A and B Payoff Matrix.

<table>
<thead>
<tr>
<th>Anchor strategy</th>
<th>Webcast platform strategy</th>
<th>Mixed salary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal live webcast</td>
<td>A1, B1</td>
<td>A2, B2</td>
</tr>
<tr>
<td>Negative live webcast</td>
<td>A3, B3</td>
<td>A4, B4</td>
</tr>
</tbody>
</table>

Compare the utility size of A and B under each condition:

Known as A1>A3, A2>A4.

1. If \( k\alpha > f\alpha + m\beta \), then B1>B3, B2>B4, A1<A2, A3<A4, the best strategy for live webcasting platform is mixed salary. Under this condition.
   - While e> f\alpha + m\beta, then B3>B1, B4>B2, the best policy of the anchor is the negative live webcast, they are balanced at A4, B4;
   - While e< f\alpha + m\beta, B3<B1, B4<B2, the master's policy is the normal live webcast, they are balanced.

2. If \( k\alpha < f\alpha + m\beta \), then B1>B2, B3<B4, A1>A2, A3>A4, the best strategy of webcast platform is to reward and divide. Under this condition.
   - While e> k\alpha, then B3>B1, B4>B2, the best policy of the anchor is the negative live webcast, they balance A3, B3;
   - While e< k\alpha, B3<B1, B4<B2, the master's policy is the normal live webcast, they are balanced in A1, B1.

Result Analysis

Both sides of the game will make clear strategy choices according to the parameters, even if one side changes the strategy, it cannot interfere with the other's choice. In the model, most of the anchor and webcast platforms will choose the same strategy to make them more effective. But everyone wants to cooperate with others who choose other strategies to make them more effective. This kind of game result has not been reasonably coordinated and balanced, and the total utility is low. Because there is no incentive to change the behavior of both sides of the game, the strategy under different conditions is always Nash equilibrium, and the result can always reach the Pareto optimum. The result of this model can be regarded as the result of negotiation without any leeway.

The direct reason for the result of the game is that all the relationships in the model result have nothing to do with the audience number n, which makes the audience choose a strategy that is favorable to them after choosing a platform, and the platform can always find a better strategy for their own. According to the different parameters, the strategies of the two bureaus are obviously good or bad.

The deeper reason for the obvious advantages and disadvantages of the strategy is that there is no correlation between the strategy choice of the anchor and the webcast platform in the model. In other words, there is no essential difference between reward sharing and mixed pay. The anchor's selection of live webcast platform depends on the correlation coefficient between income and audience size. The direct webcast and negative direct seeding also show obvious advantages and disadvantages in strategy selection, which reflects that the platform lacks the ability to restrict anchors. The lack of correlation between platform and anchor strategy makes them lack of game in competition, and the game model should be enriched and strengthened.
There is no substantial difference between the reward income sharing and the total income sharing, and their comparison depends only on the ratio of the income of the participants to the audience.

Case Analysis

Take the existing income distribution method as an example, the higher proportion of live webcast platforms are Douyu TV, Huajiao Webcast and Laifeng Webcast. Their income distribution methods are: \((0.5\alpha +0.08\beta)n, 0.7\alpha n, 0.42\alpha n+1000\), in which \(\alpha\) is the ratio of the audience to the audience, and the ratio of the advertising revenue to the audience. Only analysis of short-term behavior:

It is assumed that the live webcast market only consists of TV and Huajiao Webcast, and the income distribution method is \((0.5\alpha +0.08\beta)n\) and \(0.7\alpha n\). If \(0.08\beta >0.2\alpha\), in the short term, most of the main anchors choose the fish fighting TV, and the Douyu TV first selected the anchor of the normal live webcast, and the rest of the main seeding and the Huajiao prickly live distribution. If \(0.08\beta <0.2\alpha\), in the short term, most of the main anchors choose Huajiao Webcast, and the direct seeding of the Huajiao prickly seeding is selected as the anchor of the normal live webcast. The rest of the anchor and the Douyu TV are assigned to the income distribution.

Summary

The basic income distribution model is built in this paper. According to the existing model of large platform income distribution, the result of the game is that both sides of the game have the best strategy, and the income distribution has not been properly coordinated and balanced. This shows that there is no essential difference between reward sharing and mixed pay. Under the assumption of the model, it is concluded that only the live webcast market of the large webcast platform cannot get a reasonable distribution of income in the short run. The essential reason for the above results is that there is no correlation between the choice of the anchor and the live webcast platform in the model.

Acknowledge

This project is supported by the Research Cultivation and Foundation of Communication University of China, “The Research of the Movie Copyright based on the Big Data” (Item NO:CUC15 A37) and “The Research of Smart Media based on the Big Data”.

Reference

[1] The concept, characteristics and embarrassment of webcast live daily. [J/OL].


