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The advertising platform competition in the Bilateral market of TV media

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Abstract: TV media industry is a typical bilateral market, which takes TV station as the platform and the audience and advertising enterprises are its both side. In the competition between TV platforms, there are program innovation and imitation competition, differentiated program quality competition among TV stations. Competition among TV platforms is conducive to improving the quality of programs, however, the higher quality the TV station is, the higher advertising density would be, which would reduce the utility of consumers. Therefore, it's necessary to control the period and density of advertising insertion in TV stations.

Key Words: Television Media Industry; Advertising Platforms; Two-sided Markets

1.RESEARCH QUESTIONS

Despite the impact of the Internet advertising, supply of television advertising has still been the lead in all kinds of advertising media with a rising price year by year. The price of CCTV and provincial TV advertising is not the same at the same period of time. Take the advertising price of 19:32-20:25 for example in year 2010, Hunan TV's, Jiangsu TV's, Shandong TV's and Anhui TV's is 20,800 RMB per 5 seconds, 22,700 RMB per 5 seconds, 19,200 RMB per 5 seconds and 12,600 RMB per 5 seconds. But CCTV 1's quotation is 85,300 RMB per 5 seconds at 19:55. It is worth noting that with the growing influence of provincial TV in recent years, Hunan TV and Jiangsu TV became two competent rival of CCVT. The quotation in CCTV was rising on the table but decreasing under the table in prime time (around weather forecast time) during year 2010-2011. What are the standards for TVs to offer their prices to enterprises? What are the main factors which lead different prices in different TV? And how TVs attract and compete for advertising supply? Analyzing this problem can enrich the pricing mechanism of advertising and competition mechanism of TV.

Many scholars have done researches on television advertising price mechanism. Researchers from China had put emphasis on strategies of television adopted and regarded the advertising price is only attributed to enterprises' rising demand and television brand value (Luo, 2006; He, 2004). However, they did not explain the specific price mechanism of both television brand value and advertising.

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Recently, foreign scholars use two-sided markets to explain television advertising price mechanism (Anderson, S. P. & J. J. Gabszewicz, 2004; Jonas Häckner & Sten Nyberg, 2008; Gabszewicz, 2006; Godes, Ofek & Sarvary, 2009). They started from the crossing external network of television platform and studied television advertising price model from the angle of the interaction between enterprises and audience. Although such researches analyzed the qualification competition between different TVs in order to win more audience and consumers, the imitation of television programs are neglected. That means the television programs have no property rights protection and once the television began to improve the qualification to appeal investment, other televisions seem to imitate such program. For example, a famous dating show "Fei Cheng Wu Rao" (If You Are The One) of Jiangsu TV has been intimated by several provincial TVs. Thus, researches on two-sided markets must take innovation and imitation factors into consideration.

2. TWO-SIDED MARKET

Since Rochet and Tirole (2003) put forward bilateral market theory, bilateral market Become a frontier and hot issue in current industrial organization. Many researchers did intensive study on this issue of various industries. Armstrong (2004) focused on characteristics and pricing mechanism of bilateral market, while Anderson and Coate (2005) analyzing the welfare of bilateral roles of business broadcast industry and proposed a business broadcast and its advertising theory. Gabszewicz, Laussel and Sonnac (2001) concluded the pricing mechanism by investigating the bilateral market in newspaper industry. In China, Cheng (2008), Xu(2008), Li and Chen(2008) and Qu, Zhou and Zhou(2010) analyzes the bilateral market in media industry, bank card organization and software information industry, E-commerce platform and TV media respectively.

According to Rochet and Tirole (2003), bilateral market means that when the platform charges from both demanding sides and the general price level (P=PB+PS)is still (PB stands for the price of B while PS stands form the price of S.), any price flux of both sides will directly influence the total demand and volume of the platform. And the platform market is the bilateral market. The reason why bilateral market becomes the frontier issue of academic circle is that bilateral market present several characteristics compared with one-sided market. The first characteristic is cross-group network externalities. Traditional network externality is that the value of certain kind of product and service is positively correlated with its consumption scale. However, distinguished differences of network externality exist between in bilateral market and traditional industry organization. In bilateral market, network externality is crossing. Cross-group network externalities is referred to that users number of one side will affect the uses number and volume of the other side. Cross-group network externality is a prerequisite of the formation of bilateral market as well as an important index to define whether the market is bilateral or not. For example, the demand for Windows system of Office developers depends on how much users are using the Windows operating system, and on the other side, the consumers' demand for Windows depends on the quantity of software can match the system.

The second characteristic is the price asymmetry. The achievement of a deal involves buyers, sellers and platform enterprises. As we mentioned above, when the platform charges from both demanding sides and the general price level (P=PB+PS) is still and the total price should be distributed between the bilateral user, rather than be determined in accordance with the principle of price equal to marginal cost.

Thirdly is interdependence and complementarity. The buyer from bilateral market has demands for the products and service provided by platform seller, so as the seller from bilateral

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market has demands for the products and service provided by platform buyer. Only when both sides have demands for products and services, the value of the products and services of platform enterprise can be realized. Otherwise when only one or both sides have no demand, the products and services of platform enterprise have no value.

3. BILATERAL MARKET STRUCTURE IN TV MEDIA

Television media industry has strong bilateral market characteristics from the angle of the demand side of advertising services (enterprises) and the interactive relationship between the audience and TV. In television media market, there are three main market players. One is the TV enterprise， one is the demand side of advertising service (the enterprises) and the last one is audience who are also the consumers of products provided by enterprises. The interaction between enterprises and audience will be achieved via the TV platform. At the meantime, enterprises provide advertising service are also influenced by the TV audience. As the audience represents the potential consumer, the more audience the TV attracts, the more economic benefits the advertising on TV.

3.1 Platform-Television

Televisions are institutions that provide programs with entertainment and information, but they can't be accounted as platform of bilateral market if the televisions are only provide entertainment and information products. Unlike E-commerce bilateral market that provide bilateral trade of products and services between enterprises and consumers, the television platform attracts audience by programs through which the program and advertising join together and make the enterprise produce indirect interactions with the audience.

To the common acknowledgment, advertising can't exist alone. Kaldor (1950) argued that advertising often linked with products and there is no independent market that consumers would like to buy advertising itself in reality. Furthermore, Kaldor regarded that advertising and entertainment which are usually combined together as lots of advertisements are conveyed to consumers via media market. Becker and Murphy(1993) also pointed out that advertising does not separated from products to sell directly to consumers. On the contrary, advertising should be given (such as direct email advertising is distributed free of charge) or sold with other products. In television media, advertising through shows is common form.

On both sides of the television media, the media companies charges enterprises the advertising service for providing a certain amount of advertisements, which are usually counted by length of time to get more potential customers. Of course the TV need to pay operation cost when the advertising are broadcasted. On the other hand, the TV media charges license fee from audience and provide them with entertainment and information programs, and at the same time provide advertising in the form of joint supply or bundling.

Media companies need to bear the production expense. The higher the quality of a program, the higher the production cost. At the same time, the higher the quality of a program, the higher the audience rating. As a result of more audience, the media are more capable of negotiating with the demanding side of advertising business.

3.2 Demanding side of advertising - Enterprises

In the TV bilateral market, assuming that advertisements can lead to the expansion of demand and the enterprises can issue advertisement through TV media, the advertisements can tell the information of production or change audience's preferences. At the meantime, due to the existence of network externalities, if a program wins a higher audience rating, the more potential audience the company who issue the advertising will be attracted, the more investment returns from the enterprise's advertising. This is due to the effect of network

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externality of bilateral market. Armstrong (2004) regarded that the bilateral market network externalities manifest one side's net utility increases with the grow of the number of the users on the other side.

3.3 Entertainment and information demanders and advertising audience (consumers)

It is very obviously that the aim of the audiences watching TV programs is not for the advertising but for the utility via appreciating the programs. However, the advertising and programs are supplied together which means audience can hardly avoid advertising when they watch programs. Audiences have to pay some cost to watch the TV advertisements in order to get the utility of a program.

Becker and Murphy (1993) introduced directly the advertising spending A of commodity X into utility function U = U (A, X, Y). In a certain range, when the marginal utility of advertising is positive ($U_A > 0$), this advertising is regarded as " desirable goods". But when the marginal utility of advertising is negative ($U_A < 0$), this advertising is "bads".

If audience's aim to watch TV is to gain entertainment and information, the audience will show aversion to advertising thus a distaste cost will exist. To ensure that the audience does not change the channel, TV media companies have to bundle advertising and entertainment program and provide higher quality programs as well Figure (1).

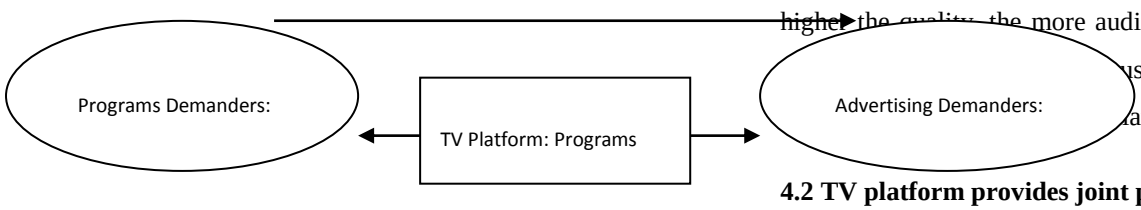

Figure (1) TV Media Bilateral Market Structure

4. Characteristics of TV Media Bilateral Market

4.1 Indirect Unilateral Interaction

In most bilateral market researches, the distinguishing feature of bilateral market is the interaction of platform participation. Bilateral markets' interaction is usually direct, such as in e-commerce platform, for example, taobao.com or jingdong.com. Under these circumstances, consumers and businesses use e-commerce platform for direct interaction and trade. Similarly, in the Unionpay platform, merchants and consumers are also trading directly. But the TV media displays different features, that is the interactivity between enterprise and the audience is not show the direct trading relationship, but a unilateral indirect relationship.

From the perspective of enterprises, their motivations of advertising are related with the audience rate. The higher the rate, the more audience and the more motivated that the enterprises advertise on TV. But from the perspective of audience, their motivation on watching TV programs are not determined by the advertising but by the program quality. The higher the quality, the more audience the program attracts as well as the advertising. Thus, the interaction between enterprises and audience are unilateral.

From the perspective of enterprises, their motivations of advertising are related with the audience rate. The higher the rate, the more audience and the more motivated that the enterprises advertise on TV. But from the perspective of audience, their motivation on watching TV programs are not determined by the advertising but by the program quality. The higher the quality, the more audience the program attracts as
us, the interaction between
lateral.

4.2 TV platform provides joint products and cross subsidy

In most bilateral markets, platforms can charge bilateral groups to realize profit maximization. Take Unionpay for example, the

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platform charges from banks at one side while charges swipe fee from consumers at the other side. Another example is that the e-commerce platform charges online shop rent for maximum profit. However, in the TV platform, the main business is to provide program and information, thus advertising should use programs as carriers to from bilateral market. Up to now, for vast majority of television management, it is unprofitable, even at a loss for TV's survival only relies on producing entertainment and information programs. In order to increase audience rate, TV will try hard to improve program quality by investing a lot of money on producing or purchasing on excellent programs. The higher the quality of a program and audience rate, the higher pricing negotiation ability and the advertising income the enterprises own. Thus, as a bilateral market platform, the way to maximize TV's profit is to subside the purchase or the loss of production through advertising income. But a basic premise is that the rise of the cost on buying or making high-quality programs is less than the rise of advertising revenue due to the rise of program quality.

4.3 Uncertainty of cross network externality

Cross network externality in bilateral market refers to the number of users of one side will affect the number of users and trading volume of the other side. But due to the horizontal externality and demand uncertainty of the same brand in the industry, the demands for products caused by TV advertising are uncertain as well.

First is the horizontal externality. Although the enterprises are charged for advertisements on TVs with high audience rate, brands have to face strong alternatives due to the multiple brands in one industry. Take the LED color TV for example, the company A which produces LED color TV launches ads on TV platform, and after the audience knows the LED color TV's functions, they may turn to the other enterprise B to get a new one.

Second is the indirect interaction of TV media platform analyzed above. Advertising on TV does not mean that the proportion of increase in demand will be accordance with the great number of audience. Advertising can arouse the audience's purchase desire, but can't change the audience to a real buyer completely.

Last is that the audience watching TV is to get entertainment and information. Advertising is presented to audience as a by-product and bundle sale. Generally speaking, the audience is aversion to advertising and advertising will have a negative network externality on audience. Assuming there are several TV platforms, the audience will switch between these platforms to avoid annoying advertisements. This will make the advertising efficiency greatly declined and the demand that the advertising brings is more uncertain.

5. COMPETITIONS BETWEEN TV PLATFORMS

5.1 Innovation and Imitation Competition

In some bilateral markets, platforms are highly monopolized, such as telecommunications industry, transmission network in electric power and etc., but the TV media bilateral markets carries the characteristics of multiple platforms competition. In China, there are national television stations, all kinds of provincial level television stations and the municipal and county level TV stations. From the perspective of technology, TV competitions exist under the same signal cover.

The higher quality of television programs, the higher audience rate and the more audience they attract. Furthermore, the enterprises are willing to pay more for advertising on TV. Thus, the competition between TV stations is characterized by competition for more audiences and competition for audience directly reflect the program quality competition. That means the higher quality of the program, the higher pricing of TV platforms when it negotiates with enterprises.

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Program quality can be regarded as program innovation and only innovations can improve the program quality. So, the competition between TV stations manifests the competition among different TV programs. However, a new and innovated program sometimes is not patent protected, when a high audience rate program appears on the market, other TV stations are inevitably to intimate. A conclusion can be reached that the TV bilateral market competitions are the program innovation and imitation competitions.

5.1.1 Basic Assumptions

Assumption 1: TV stations' competitions manifest the program's quality and innovation competitions. As TV series are homogeneous products which TV stations can purchase, the competition of the TV series' quality is not considered.

Assumption 2: Due to the fact that the distaste cost will be generated by the advertisements during the shows, we assume that C refers to the distaste cost and C also represent the number of advertisements. If the audience's distaste cost is εc, that means audience watch ε units of advertising and also the total cost that the audience pay for the TV shows.

Assumption 3: As the high quality program can attract more advertising from enterprises, TV stations' innovated programs are produced to attract more audience and enterprises' advertisements, that is the output of innovated quality program of TV station attracts the number of audience q. The more audience the program attracts, the more willing the enterprises advertise on TV stations. Thus it is assumed that the audience number and enterprises advertising presents a linear positive correlation, that is $\varepsilon(q) = \delta(q)$ $\varepsilon(q) = \delta(q)$.

5.1.2 Models

Considering the vertical differentiation, the quality of audience watching TV programs denotes z and the audience's utility function is:

$$U = z\theta - \varepsilon c \quad U = z\theta - \varepsilon c \qquad \text{Formula (1)}$$

If the audience does not watch TV shows, the utility is zero. The utility of the audience is determined by the quality of program and the advertising distaste costs. $\theta(\theta \in R_+)$ denotes the evaluation parameter of innovative programs made by audience. θ denotes audience types and evenly distributed among $[0, \beta]$. θ can also be regarded as the evaluation audience make for the program quality. The higher the θ value, the more willing the audience watch high quality programs.

The audience demand for watching programs under the circumstance that the quality of program z and the number of advertising during programs ε, is equal to the evaluation parameters θ and the number of all the audience which meet the conditions $z\theta > \varepsilon c$.

Television stations are faced with the problem how to choose the quality level and market positioning when they are making the decisions about innovation. There are also a series of factors that influence decisions about innovation. Firstly, TV stations have to deal with the cost $K(z)$ that caused by the innovation to improve quality. Assuming $K(z)$is suck cost and convexity, and both$K'(z)$ and $K''(z)$ are greater than zero. It is also assumed that the marginal cost is a constant and the value is 0. Due to the uncertainty of demanding, the TV station has to take the risk in innovating to improve quality, because sometimes the extra demand caused by quality improvement can not compensate for the higher suck cost.

But considering the potential competition with other stations' imitations, innovation strategies to improve programs' quality are enormously appealing to TV station. That is because the imitation cost is related with the original innovation cost. Assuming that the imitation cost is $\lambda(0 < \lambda < 1)$ times of innovation cost. If the innovation TV station choose a higher quality, such as hiring famous hosts and show planner, more delicate stage set and production, the imitation's cost will be

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λK(z). Just like the innovation TV program, the imitation cost grows higher with the quality improvement. Thus, the innovation to improve quality of the innovation TV not only increase the cost of the innovation TV itself but also the imitation cost from competitions.

Innovation and imitation is a continuous process which can be divided into three stages. At the first stage, the innovation TV choose a program at quality z and the suck cost is $K(z)$. At the second stage, if audience's watching demand is growing and become very strong, we can say that the β value can be observed. When the market scale is large enough, imitators will enter the market and imitate the innovative programs. If the imitation TV station provide the same quality of innovation ones, its cost will be λK(z). At stage three, as imitation TV station can also provide the some quality program, this can be viewed as the competitions of ads number under the same products' quality. Besides, the innovation TV station is the first market entrant and it will be the pioneer in Stackelberg model. After imitators or followers observe the advertising decisions by pioneer TV station, equilibrium is reached finally.

Assuming that the cost grows with the growth of programs' quality and imitators imitate innovative programs without changes, innovation TV's problem is maximize expected profit under the quality level z according to the imitations. To solve the problem, we can research from the third stage. As audience's demand can be observed at the second stage, the demand parameter β is known and there are competitive imitators of n number under the innovation's quality level z. Stackelberg equilibrium means that the number of audience that innovation TV programs attract is q_L q_L and the number of audience that imitation TV program attract is q_F q_F. At the third stage, we can get the formula:

$$q_L = \frac{1}{2}\ldots,\ldots q_F = \frac{1}{2(n+1)}$$

$$q_L = \frac{1}{2}, q_F = 1/2(n+1)$$

$$\pi_F = \frac{p_F}{2(n+1)} - \lambda K(z)\cdots; \quad \pi_L = \frac{p_L}{2} - K(z) \qquad \pi_F = \frac{p_F}{2(n+1)} - \lambda K(z) \; ; \; \pi_L = \frac{p_L}{2} - K(z)$$

Formula（2）

From the assumption of 3 and 4, we can get: $p_L = \rho\frac{1}{2}$、$p_F = \rho\frac{1}{2(n+1)}$. Thus the profit of innovation and imitation TV program respectively is:

$$\pi_L = \rho\frac{1}{4} - K(z)\cdots \pi_F = \frac{\rho}{4(n+1)^2} - \lambda K(z)$$

$$\pi_L = \delta\rho\frac{1}{4} - K(z) \; ; \; \pi_F = \frac{\delta\rho}{4\ (n+1)^2} - \lambda K(z)$$

Formula（3）

As the number of advertisement of two television stations is also a Stackelberg equilibrium, and it is assumed that ads are evenly distributed in unit time and the program's time is t, the utility of audience who watch innovation program in unit time is $U_L = (z_L\theta_L - \frac{\varepsilon_L c}{2})t$ $U_L = (z\theta - \frac{\varepsilon_1 c}{2})t$ and the utility of audience who watch imitation program in unit time is $U_F = (z_L\theta_F - \frac{\varepsilon_F c}{2(n+1)})t$ $U_L = (z\theta - \frac{\varepsilon_2 c}{2(n+1)})t$.

Although the innovation TV stations can attract more audience, but the TV cannot spot commercial intensively, otherwise

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audience will switch to imitation TV stations. Here the constraint condition is $U_L \geq U_F$ $U_L \geq U_F$, that is

$$z_L\theta_L - z_F \geq \frac{\varepsilon_{LC}}{2} - \frac{\varepsilon_F c}{2(n+1)} \varepsilon_1 \leq {}^{1}/_{(n+1)}$$

The condition whether the other TV stations decide to imitate or not is

$$\pi_F = \frac{\rho}{4(n+1)^2} - \lambda K(z) = 0$$

,

that is $n = \frac{1}{2}\sqrt{\frac{\rho}{\lambda K(z)}} - 1$ $\pi_F = \frac{\delta\rho}{4\ (n+1)^2}$-λK(z) = 0n = $\sqrt{\frac{\delta\rho}{\lambda K(z)}}$-1 Formular（4）

From Formular (4), we can tell that δ、ρ 和 λ are all exogenous. As the imitation costs rise with the rise in quality, the quality rise of innovation programs is z which will increase the cost of imitation λK(z), and this will effectively prevent other TV stations to imitate. The higher the quality of program innovation, the fewer imitation programs exist. This behavior will make the innovation TV station more monopoly and attract more audience, more ads demands from enterprises and more prices at last.

5.2 Program Quality Differentiation Competition

Considering two different types of programs provided by two TV station, audience's preference for different type programs is between [0, 1]。Television 1 is located at terminal 0 and television 2 is located at terminal 1. At the some period, TV stations will spot commercial during programs and TV station is located at any t between [0, 1]. Assuming that audience total scale is 1 and among the audience some dislike a while others accept TV commercials. The probability of all audiences or one audience who dislike or dislikes ads is $\phi \in [0,1]$ ∅ ∈ [0,1]。When $\phi = 0$ ∅ = 0,that means all audience accept TV commercials. When $\phi = 1$ ∅ = 1, that means all audience dislike TV commercials. Considering common situation, when ∅ > 1/2 $\phi > 1/2$, that means audience who dislike TV ads are in majority and vice versa. Audience utility decreases when they dislike ads and increases when they accept. The more ads cut in the program, the utility of audience who dislike ads decreases as well but the utility of audience who accept ads increases. Thus, the utility of an audience who located at spot t (to the left end) of TV station 1 is

$$u_1 = \partial z_1 - t^2 - \phi\beta c d_1 \quad \beta\epsilon[-1,1] \qquad \text{Formula (5)}$$

The utility of an audience who watch program of TV station 2 is

$$u_2 = \partial z_2 - (1-t)^2 - \phi\beta c d_2 \qquad \text{Formula (6)}$$

z_1、z_2 z_1 denotes to program quality of TV stations respectively, ∂ can be viewed as the quality evaluation made by audience. The greater the number of ∂, the more willing the audience will watch the TV show. d_1、d_2 d_1 denotes to the proportion that ads of enterprises in programs accounts for the total number of enterprises' ads in a TV station and assuming that every enterprise only delivers one advertisement. c denotes for the distaste cost of per advertisement.

β β denotes to the audience's aversion level of TV commercials, , βϵ[-1,1] , and when $\beta = -1$ β = -1 , it means the audience dislike ads completely. When $\beta = 1$ β = 1 , it means he audience accept ads completely. Assuming that

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all audience share the same level of dislike on ads, attitudes to ads is the only difference in audience (represented as probability ∅).

The indifferent condition for an audience to watch TV station 1 or 2 is:

$$\partial(z_1 - z_2) - \phi\beta c(d_1 - d_2) - t^2 + (1-t)^2 = 0$$

Formula (7)

If TV station 1 wins a better quality to TV station 2, there will be 3 circumstances:

If audience who dislike advertising are in majority, that is $\phi > 1/2$ $\emptyset > 1/2$, then $\phi\beta < 0$ $\emptyset\beta < 0$, thus we can reach the following formula：

$$|\phi\beta c(d_1 - d_2)| < \partial(z_1 - z_2) - t^2 + (1-t)^2 \quad \text{Formula (8)}$$

If audience who accept advertising are in majority, that is $\emptyset < 1/2$ and $\phi\beta > 0$ $\emptyset\beta > 0$, thus

$$\phi\beta c(d_1 - d_2) > \partial(z_1 - z_2) - t^2 + (1-t)^2 \quad \text{Formula (9)}$$

Circumstance 1: If audiences who dislike advertising are in majority, from Formula (8), we can reach the conclusion that the higher the program's quality, the more ads from enterprises they will get. However, the gap of number of advertisements between higher and lower quality TV programs is smaller than the gap of two programs' quality. The reason is that although the higher quality TV shows can attract more ads, distaste cost will be produced by advertisements and if there are too much TV commercials, the total utility will be less than the utility when audience watch lower quality shows. The boundary that TV stations with higher quality programs attract audience and run advertisements is that when the higher or lower quality programs produce the same utility.

Circumstance 2: If audience who accept advertising are in majority, from Formula (9), we can reach the conclusion that the difference on two programs' quality is smaller than the number of ads they get. Thus the higher the quality, the more TV commercials the TV station will get. When all audience accept ads, the high quality programs can cover the full market.

6. CONCLUSIONS

The higher the program's quality, the more advertising the TV station can get from enterprises. But how much the number of TV commercials of higher quality programs than the number of lower quality is determined by the number of audience who accept or dislike advertising. Thus, TV stations which owns a higher quality program will encourage the enterprises to invite celebrity as the spokesperson or easy accepted and more delicate TV advertising in order to attract more audience than the station with lower quality program. This kind of advertisements can decrease the distaste cost and increase audience number, thereby attract more ads to the higher quality program and TV station. Another solution is that the TV station can extend its industry chain and set up a commercial production company which provides enterprises with higher and more acceptable advertisements.

There is no doubt that competitions can improve programs' quality and innovation TV has the motivation to do so. However, it is not easy for innovation program to apply for patent protection and competitors' imitation will decrease the rate of return of innovation. So, it is essential to build the protection mechanism of TV programs under the condition that entry regulation in TV media in China. However, programs' quality improvement will enhance the advertising spots density which will decrease consumers' utility. Thus, TV media regulation institutions should regulate advertising spots time and density to improve consumers' welfare.

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