

Research on Cooperative Governance of "Live Streaming with Goods" Based on Game Theory

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Keywords: Platform economy; Sell goods through livestreaming; Collaborative governance

Abstract: In response to issues such as counterfeit products, there are exaggerated advertising, and misleading consumers in the "live streaming sales" industry. Research shows that the benefits and regulatory costs of live streaming platforms are the driving forces for game participants to ultimately choose stable strategies. In view of this, establishing a sound regulatory system and unblocking channels for consumer rights protection are conducive to promoting the healthy development of the "live streaming sales" industry.

1. Introduction

The platform economy relies on new generation information technologies such as the Internet and big data to connect the supply side with the demand side, sensitively respond to demand information, improve transaction efficiency, and promote value co creation among users (enterprises and consumers).^[1] It has become one of the fastest growing formats in the digital economy. However, many problems have also been exposed in its development, with the quality issues of trading products and services being the most prominent. According to data released by the State Administration for Market Regulation, the GMV of live streaming e-commerce across the entire network reached 3.5 trillion yuan in 2022, a year-on-year increase of 48.21%. It is expected that the total scale of the live streaming e-commerce industry will reach 5 trillion yuan in 2023; In 2022, online shopping demands increased by 56.38% year-on-year, including 220900 live streaming demands, a year-on-year increase of 1.15 times and 5.01 times compared to 2020. Therefore, it is necessary to conduct in-depth governance of the "live streaming sales" industry in order to better promote the orderly development of the industry.

2. Game equilibrium analysis of "sell goods through live streaming"

2.1 Construction of expectation function of "sell goods through live streaming"

The live streaming platform connects the bilateral markets of producers and consumers, and producers enter the live streaming platform.^[2] The live streaming platform provides a series of services such as online display, consultation and Q&A, and sales guidance, and through negotiation and cooperation with producers, seeks benefits such as prices and gifts for consumers. As a trade

platform in the bilateral market, products produced by proxy producers are selected and purchased by consumers on the platform. Therefore, the behavioral strategies of live streaming platforms include (standardized operation, non-standard operation).^[3] Assume that the probability of the live streaming platform choosing standardized operation is β , $\beta \in [0,1]$. The probability of not reviewing product information or adopting monopolistic behavior is $(1 - \beta)$.

The expected benefits of setting up a live streaming platform to choose the behavior strategy of "reviewing product quality or competition" are U_{1P} . If the expected return of choosing the "no review of product quality or monopoly" behavior strategy is U_{2P} , then the average return of the live streaming platform is U_P .

$$U_{1P} = [\alpha \quad 1 - \alpha] \begin{bmatrix} U_d - P_D & U_d - P_D \\ U_d - P_S & U_d - P_S - L_d \end{bmatrix} \begin{bmatrix} \gamma \\ 1 - \gamma \end{bmatrix}$$

$$U_{2P} = [\alpha \quad 1 - \alpha] \begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix} \begin{bmatrix} \gamma \\ 1 - \gamma \end{bmatrix}$$

$$U_P = \beta U_{1P} + (1 - \beta) U_{2P}$$

In the formula, P_D is the consumer's purchase price; P_S is the production cost of the producer; U_d is the utility for consumers to obtain goods; L_d refers to losses incurred by consumers due to abnormal behavior of producers and unregulated behavior.

2.2 The replication dynamic equation of evolutionary game model

The replication dynamic equation for selecting the "standardization" strategy on live streaming platforms is as follows.

$$F(\beta) = \frac{\partial \beta}{\partial t} = \beta(U_{1P} - U_P) = \beta(1 - \beta)(U_{1P} - U_{2P})$$

$$= \beta(1 - \beta)[U_d - \alpha P_D - (1 - \alpha)P_S - (1 - \alpha)L_d(1 - \gamma)]$$

2.3 Game Equilibrium Analysis

Based on the stability theorem of differential equations, the stability of the game is analyzed. If the game subject adopts a stable state strategy, then:

$$F(\beta) = 0, F'(\beta) = \frac{\partial F(\beta)}{\partial \beta} < 0$$

$$\text{wherein, } F'(\beta) = \frac{\partial F(\beta)}{\partial \beta} = (1 - 2\beta)[U_d - \alpha P_D - (1 - \alpha)P_S - (1 - \alpha)L_d(1 - \gamma)]$$

Stability analysis of live streaming platform strategy:

Make $F(\beta) = 0$, then:

$$\beta_1 = 0, \beta_2 = 1, \gamma^* = 1 - \frac{U_d - \alpha P_D - (1 - \alpha)P_S}{(1 - \alpha)L_d}$$

Therefore, the solution that satisfies $\begin{cases} F(\beta) = 0 \\ \frac{\partial F(\beta)}{\partial \beta} < 0 \end{cases}$ is an equilibrium solution, which is discussed in the

following three cases:

① When $\gamma^* = 1 - \frac{U_d - \alpha P_D - (1 - \alpha)P_S}{(1 - \alpha)L_d}$, $F(\beta) = \frac{\partial \beta}{\partial t} \equiv 0$. No matter what value α is taken, it is a stable state.

② When $\gamma^* < 1 - \frac{U_d - \alpha P_D - (1-\alpha)P_S}{(1-\alpha)L_d}$, $F'(0) < 0, F'(1) > 0$. At this time, $\beta = 0$, it is a stable strategy, the live streaming platform will choose standardized operation.

③ When $\gamma^* > 1 - \frac{U_d - \alpha P_D - (1-\alpha)P_S}{(1-\alpha)L_d}$, $F'(0) > 0, F'(1) < 0$. At this time, $\beta = 1$, it is a stable strategy, the live streaming platform will not choose standardized operation.

The dynamic reset phase diagram of the evolution of live streaming platforms is shown in Figure 1:

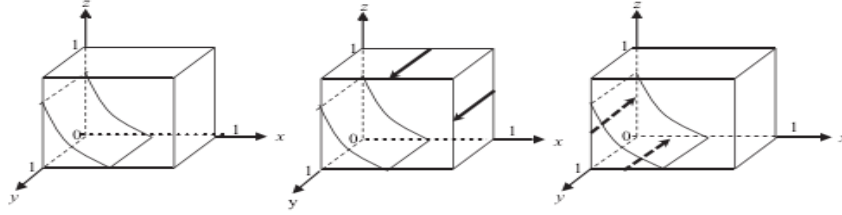


Figure 1: Dynamic reset phase diagram of live streaming platform evolution

$$\gamma^* = 1 - \frac{U_d - \alpha P_D - (1-\alpha)P_S}{(1-\alpha)L_d} \quad \gamma^* > 1 - \frac{U_d - \alpha P_D - (1-\alpha)P_S}{(1-\alpha)L_d} \quad \gamma^* < 1 - \frac{U_d - \alpha P_D - (1-\alpha)P_S}{(1-\alpha)L_d}$$

The evolution strategy of live streaming platforms will be influenced by both producers and consumers, as well as the social trust that live streaming platforms receive due to reviewing product quality and the legal risks they bear due to not reviewing product quality. [4] When a live streaming platform chooses standardized operation, there are:

$$\gamma^* < 1 - \frac{U_d - \alpha P_D - (1-\alpha)P_S}{(1-\alpha)L_d}$$

At this point, if we increase the economic benefits of cooperation between live streaming platforms and producers, reduce the cost borne by live streaming platforms in reviewing product quality, increase the social trust benefits gained by live streaming platforms in reviewing product quality, and the cost borne by live streaming platforms in not reviewing, it will lead to live streaming platforms adopting a strategy of not choosing standardized operations, which means:

$$\gamma^* > 1 - \frac{U_d - \alpha P_D - (1-\alpha)P_S}{(1-\alpha)L_d}$$

2.4 Game Stability Analysis

For live streaming platforms, we increase the value of platform standardization cost C_n and reduce the value of platform non standardization cost C_y . We need to improve the social benefits gained by live streaming platforms by reviewing product quality and avoiding monopolistic behavior, while reducing the time and economic costs borne by live streaming platforms due to product reviews. Specifically, on the one hand, live streaming platforms gain more platform users and generate incremental returns to scale by reviewing product quality; Or we need to avoid monopoly behavior, consciously accept supervision and assume social responsibility, so as to win the trust of users and the reputation of the live broadcasting platform. On the other hand, live streaming platforms should be equipped with professional review teams to improve the efficiency of product quality review, reduce the costs borne by product review, and make live streaming platforms more inclined to choose the motivation and motivation of "reviewing product quality". [5]

2.5 Data simulation and analysis: the impact of main parameters on equilibrium

The impact of changes in revenue and cost of live streaming platforms: Other parameters remain unchanged. When the economic and social benefits obtained by the live streaming platform by choosing the "review product quality" strategy increase, i.e. by increasing U_2 and T_2 , the simulation is shown in Figure 2.

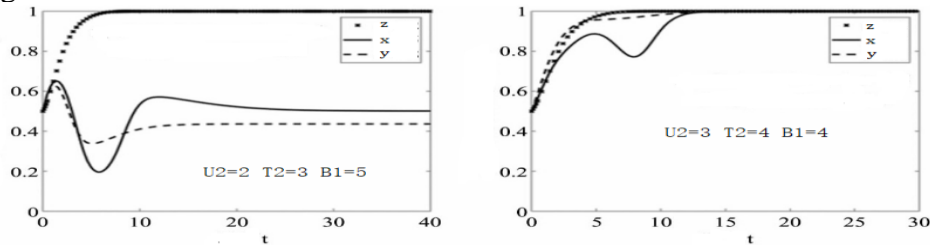


Figure 2: The influence of the change of revenue cost on the evolution trend of live broadcasting platform

The economic and social benefits brought by choosing to review product quality on live streaming platforms far outweigh the costs borne by not reviewing product quality, thus losing the motivation to take the risk and choose the "not reviewing product quality" strategy. At the same time, live streaming platforms are in need of business development and market expansion, and will actively cooperate with producers to achieve a win-win situation and bring more economic benefits to consumers. Similarly, when increasing the economic, social, and legal responsibility of live streaming platforms not reviewing product quality, i.e. increasing B_1 , $B_1 > U_2 + T_2$, live streaming platforms will also choose the strategy of "reviewing product quality" in order to seek benefits and avoid harm. When increasing the time and economic costs borne by live streaming platforms in reviewing product quality, that is, increasing D_2 , live streaming platforms may be in a fluke mentality and considering economic benefits, and may tend to choose the strategy of "not reviewing product quality". It can be seen that the revenue and violation costs of live streaming platforms are positively correlated with the speed of approaching a gradual stable point, while the cost of reviewing product quality is negatively correlated with it.

3. Countermeasure and suggestion

3.1 Improvement of laws and regulations

As a new marketing model in the platform economy, "live streaming with goods" has not yet been relatively well-established in terms of institutional and legal norms, especially in terms of monopolistic behavior, business norms, and regulatory aspects of live streaming platforms. Therefore, it is necessary to clearly define the legal attributes of participants in online live streaming sales, improve legal norms for related issues, and avoid the brutal growth of the live streaming sales industry.

3.2 Intensify anti-monopoly efforts

On the basis of achieving a legal basis for restricting the monopolistic behavior of platform enterprises, we should increase law enforcement efforts, strengthen normalized supervision of the behavior of relevant platform enterprises, and promptly curb and punish illegal monopolies, abuse of market dominance, and other behaviors; At the same time, it is necessary to prevent the lack and abuse of administrative power, ensure strict law enforcement, and investigate violations to improve law enforcement efficiency. We need to modernize the ability of anti-monopoly supervision, promote

fair competition among digital platform enterprises, stimulate the vitality of innovation and creativity, and promote the high-quality development of the platform economy.

3.3 Establish industry entry barriers

We need to improve the industry access system: on the one hand, examine the qualifications of live streaming platforms and anchors, and rectify or suspend the operations of live streaming platforms that do not comply with regulations and have substandard hardware and software facilities, as well as anchors with low quality and poor live streaming content. On the other hand, it is necessary to clarify the obligations of live streaming platforms and anchors, and not to market products with poor quality or prohibited by the state. During the live streaming period, anchors should pay attention to their personal qualities, strengthen professional and professional training for anchors, improve their own qualities, and jointly create a good online live streaming environment.

Acknowledgement

Fund project: Research on Accelerating the Development of Modern Industrial System in Longjiang during the 14th Five Year Plan Period (20JYH064). The central government supports high-level talent projects funded by the reform and development of local colleges and universities: Digital technology empowers research on the high-quality development of manufacturing industry in Heilongjiang Province.

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