

# Game Analysis on Supervision of Quality Problems of Live Goods with Short Video Platform Participation

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## Abstract

The rapid rise of short video platform has created a broad platform for live delivery, which has become a very hot new way of shopping, so many businesses and individuals have brought goods and sold goods through various online live delivery platforms. However, some businesses sell fake and shoddy goods through live broadcasts without conscience. Based on the idea of game theory, this paper constructs a mixed strategy game model with the participation of the supervision department and merchants of short video platform, analyzes the Nash equilibrium of the mixed strategy of the game model, and further constructs a mixed strategy model with the participation of government regulators, short video platform regulators and merchants. It is found that the lower the supervision cost of short video platform and the higher the fine, the smaller the probability of merchants selling unqualified goods. The probability of strict supervision of short video platform is affected by the size of its fine; The lower the detection cost of government supervision department and the greater the reward for strict supervision of short video platform, the higher the probability of strict supervision of short video platform; The probability of random inspection by government supervision departments is influenced by its punishment, detection cost and strict supervision cost of short video platform.

## Keywords

Live Delivery, Commodity Quality, Mixed Strategy, Nash Equilibrium, Short Video Platform, Live Goods

## 1. Introduction

With the improvement of people's living standard and the development of logis-

tics industry, a brand-new way of shopping is popular all over the country—live broadcast with goods. Live delivery of goods refers to a new service mode of using live broadcast technology for close-range commodity display, consultation and reply, and shopping guide through some short video platforms; or the store itself opens a live broadcast room, or the professional anchor gathers for promotion.

Under the background of the rapid development of Internet, the rapid rise of short video platform has created a broad platform for live broadcast. In this COVID-19 epidemic, live broadcast with goods played an important role in promoting economic recovery, helping agriculture and poverty alleviation (Deng, 2020), getting rid of poverty (Ma et al., 2021) and driving employment (Hu & Yang, 2021). According to the statistics of iiMediaResearch, the domestic live delivery market has expanded rapidly from 19 billion yuan in 17 years to 433.8 billion yuan in 19 years, an increase of 226.2% compared with 2018. In 2021, the domestic live delivery market reached 1316.5 billion yuan. With the rapid development of the cargo economy, many problems also come along, such as: The “deceive merchants and consumers at the same time” incident in “online celebrity Live Delivery” not only affected the public’s consumption experience, but also caused many public opinion disputes (Guo et al., 2021); A series of commodity quality problems, such as “the proliferation of fake goods, no door for after-sales”, have also aroused the extensive attention of people in China and even all over the world (Wang, 2019a). There are many factors that lead to the quality problems of live goods, such as the low threshold of live goods market (Gong & Xu, 2021); The supervision of the regulatory authorities on the live broadcast merchants is not in place, and the punishment system for the merchants is not strict. Under the condition that all parties aim at maximizing their own interests, the phenomenon of platform inaction, unqualified or even fake and shoddy goods sold by merchants has become more and more serious. Live delivery, as a new thing, has been criticized for its uneven content, short life cycle of online celebrity promoters, lagging supervision, etc. Its market order needs to be regulated, and it needs to be strengthened to promote the healthy development of e-commerce live broadcast industry (Li & Li, 2021).

In order to solve these problems, based on the game theory, this paper constructs a game model to analyze the influence of various factors of live delivery on the probability of commodity quality supervision, so as to further standardize the market order of live delivery and improve the quality of live delivery.

## 2. Analysis of the Research Status of Live Broadcast Goods

At present, scholars’ research on short video platform live delivery mainly focuses on the development and driving force analysis of live delivery (Zhong, 2020; Zhang & Li, 2020) and the advantages and disadvantages analysis of live delivery (Xiao & Guo, 2020; Liu et al., 2020): First of all, in terms of the development and driving force analysis of live broadcast goods: Hamilton et al. (2016)

pointed out that with the emergence of more and more social platforms, new channels of interaction have emerged between consumers and businesses, and these social platforms have also become a stage for businesses to create customer value. Hsu et al. (2017) summarized the key factors of online celebrity's goods delivery as: purchase intention, trust and brand trust. Yan and Gong (2020) believe that the explosive growth of live goods is driven by consumers and suppliers. The participation of online celebrity, hosts, grassroots leaders and virtual idols has promoted the diversified development of live goods. However, with the effective prevention and control of the epidemic and the good recovery of social order, the carnival of live goods will gradually retreat. Shen (2020) believes that live delivery of goods has gone through the development stage of "rising-barbaric growth-standardization", and the main driving factors for its development are encouragement at the national level, technological innovation, traffic boost, upgrade of shopping experience, grasp of consumers' psychology, broadening of social channels, etc. Liu and Shi (2020) analyzed the live broadcast marketing method, and thought that the live broadcast marketing method affected consumers' decision-making in the three stages of attention, interest and search, while excellent live broadcast content, perfect incentive mechanism, unique charm of anchors, good interaction and preference and trust for anchors could have a significant positive impact on consumers' purchase decisions.

Secondly, in the analysis of advantages and disadvantages of live delivery: Loureiro et al. (2017) think that live delivery of goods is a kind of relationship-based marketing. In the process of delivering goods, the online red anchor enhances the public's awareness of the brand, and as an explicit and implicit endorsement of the brand, it will significantly affect consumers' purchase decisions. Xia and Song (2020) pointed out that "live broadcast with goods" has broken the restrictions of regions, places and time, and has a huge flow that traditional sales behavior can't match. Geng and Hao (2021) think that live selling goods has the advantages of strong sense of reality, wide experience scenes, high interaction efficiency, strong fan economic benefits, and being able to effectively break through the limitations of time and space. At this stage, it has become an important mode of traditional retail transformation and upgrading. Huang and Luo (2021) think that live delivery of goods has constructed a new marketing model of "deep embedded marketing" from the perspectives of interpersonal relationship, product interaction and sales experience, thus creating a new sales labor, generating a new consumption concept and reconstructing the relationship between sellers and consumers. Deng and Gao (2020) think that the sustainable development of live webcast delivery of goods expands and innovates the scope and channels of deep integration between traditional media and new online media, but there are also many problems that need to be solved urgently, such as how to define the identity and qualification of the delivery person and how to ensure the product quality of the delivered goods. Cheng et al. (2021) think that the lack of supervision, uneven quality of live delivery products, un-

clear division of responsibilities of each subject of live delivery goods, difficulty in accountability, and unreasonable sharing mode among each subject of live delivery goods are the key problems that restrict the sustainable development of live delivery goods. Mei and Hou (2021) think that live delivery of goods provides a new business model for the society, but also brings a new impact to the current network governance mechanism. Nowadays, the e-commerce live broadcast industry is facing severe challenges in four areas: cross-border integration of anchors, rectification of live broadcast chaos, coordination of governance thinking and unification of old and new norms. Han (2021) thinks that although live broadcast with goods broadens shopping channels, improves shopping experience and plays an important role in promoting market economic growth, its drawbacks, such as fraudulent network traffic, false publicity and preferential policies, a large number of fake and inferior products flooding the live broadcast room, high return rate, and difficult consumer complaints and rights protection, also frequently occur.

From the analysis of the above literature, it can be seen that most scholars are very concerned about the quality problems of goods with live broadcast, but the emphasis is on qualitative analysis of the advantages and disadvantages of goods with live broadcast from a macro perspective, while the game model is used to analyze the quality problems of goods with live broadcast from a quantitative perspective, especially the supervision problems. Based on this, this paper, from the perspective of game theory, uses the mixed strategy game model to analyze the process of government supervision departments, short video platforms and merchants participating in decision-making, to study the influence of various parameters on improving the quality of goods, and to put forward some suggestions on the supervision of commodity quality.

### 3. Mixed Game Model of Supervision Department and Merchants

#### 3.1. Basic Assumptions of Model

Take short video platform and merchants as the research object of supervision system. Among them, the participants in the game include short video platforms and merchants. According to the actual situation, for the convenience of research, the following assumptions are made on the model:

Assumption 1: All players are rational, and they all guide their own behavior for the purpose of maximizing their own interests.

Assumption 2: There are only two strategies for short video platform, and the strategy set is (strict supervision, not strict supervision).

Assumption 3: Merchants have only two strategies, and their strategy set is selling goods (qualified and unqualified).

Assumption 4: The income of the merchant from selling goods is  $u$ , the cost of selling qualified goods is  $c_1$ , and the cost of selling unqualified goods is  $c_2$ , in which  $c_1 > c_2$ , the fine for selling unqualified goods is  $f$ .

Assumption 5: The cost of strict supervision of goods by short video platform is  $c_3$ , but it will not cost if it is not. The probability of strict supervision by short video platform is  $p_1$ , the probability of not strict supervision is  $1 - p_1$ , the probability of merchants selling unqualified goods is  $p_2$ , and the probability of merchants selling qualified goods is  $1 - p_2$ .

Assumption 6: When a merchant sells unqualified goods, the short video platform can be monitored under strict supervision, but it can't be monitored without strict supervision.

### 3.2. Model Establishment and Solution

Through the assumption of the model, we can get that the benefit of selling qualified goods is  $u - c_1$ , the benefit of selling unqualified goods and being monitored by short video platform is  $u - c_2 - f$ , the benefit of selling unqualified goods and not being monitored is  $u - c_2$ . When the short video platform is strictly monitored and the income of merchants selling qualified goods is  $-c_3$ , when merchants sell unqualified goods and are strictly supervised, the net benefit of the short video platform is  $f - c_3$ . When the short video platform is not strictly supervised, the revenue of the short video platform is 0 regardless of whether the goods sold by the merchants are qualified or not. Therefore, the Payoff Matrix of each player can be obtained, as shown in **Table 1**.

From the Payoff Matrix: If the short video platform chooses not to be strictly supervised, the merchants will definitely choose to sell the unqualified goods. Therefore, the strategic choices of the players are (Sell unqualified goods, Not strict supervision), (Sell qualified goods, Strict supervision) and (Sell unqualified goods, Strict supervision). In order to improve the quality of goods, we must find ways to reduce the probability of merchants selling unqualified goods. Study the relationship between  $p_2$  and each element.

When the short video platform is strictly supervising the merchants with the probability of  $p_1$ , the merchants sell the unqualified products with the probability of  $p_2$ . The expected return of short video platform is  $E_1$  under strict supervision, and  $E_2$  under non-strict supervision. From the Payoff Matrix:

$$E_1 = (1 - p_2)(-c_3) + p_2(f - c_3) \quad (1)$$

$$E_2 = (1 - p_2)0 + p_2 0 \quad (2)$$

**Table 1.** Two-party game payoff matrix.

		The short video platform	
		Strict supervision	Not strictly supervision
merchants	qualified	$(u - c_1, -c_3)$	$(u - c_1, 0)$
	unqualified	$(u - c_2 - f, f - c_3)$	$(u - c_2, 0)$

Note: the origin of Payoff Matrix is referred to Xie, Z. Y. (2002). *Economic Game Theory* (3<sup>rd</sup> ed.). Fudan University Press.

The Nash equilibrium point of mixed strategy can only be obtained when the short video platform chooses the behaviors of strict supervision and lax supervision with equal benefits, that is, when  $E_1 = E_2$ :

$$p_2 = \frac{c_3}{f} \quad (3)$$

When the short video platform is strictly regulated with a probability of  $p_1$ , and merchants sell unqualified goods with a probability of  $p_2$ , the expected return of merchants choosing to sell qualified products is  $E_3$ , and the expected return of selling unqualified products is  $E_4$ . From the Payoff Matrix:

$$E_3 = p_1(u - c_1) + (1 - p_1)(u - c_1) \quad (4)$$

$$E_4 = p_1(u - c_2 - f) + (1 - p_1)(u - c_2) \quad (5)$$

The Nash equilibrium point of mixed strategy can be obtained only when the return of the merchants' choice of selling qualified goods is equal to that of selling unqualified goods. From  $E_3 = E_4$ , the solution is:

$$p_1 = \frac{c_1 - c_2}{f} \quad (6)$$

To sum up, the mixed strategy Nash equilibrium is:

$$\left( \frac{c_1 - c_2}{f}, \frac{f - c_1 + c_2}{f} \right), \left( \frac{c_3}{f}, \frac{f - c_3}{f} \right)$$

### 3.3. Game Analysis of Short Video Platform Supervision Department and Merchants

Proposition 1: The probability  $p_2$  of merchants selling substandard goods is related to the fines  $f$  imposed by regulatory authorities. The greater the fines  $f$ , the smaller the probability  $p_2$  of merchants selling substandard goods.

Prove: According to formula (3), the partial derivative of the fines  $f$  is obtained to get  $\frac{\partial p_2}{\partial f} = -\frac{c_3}{f^2} < 0$ , that is,  $p_2$  decreases with the increase of  $f$ , and the proof is complete.

Proposition 2: The probability  $p_2$  of merchants selling substandard goods is related to the cost  $c_3$  of short video platform supervision. The higher the cost  $c_3$  of short video platform supervision, the greater the probability  $p_2$  of merchants selling substandard goods.

Prove: According to formula (3), the partial derivative of the cost  $c_3$  of short video platform supervision is obtained to get  $\frac{\partial p_2}{\partial c_3} = \frac{1}{f} > 0$ , that is,  $p_2$  increases with the increase of  $c_3$ , and the proof is complete.

Proposition 3: The probability  $p_1$  of strict supervision of short video platform is related to the fine  $f$ . The less the fine  $f$  of strict supervision, the higher the probability  $p_1$  of strict supervision of short video platform.

Prove:  $\frac{\partial p_1}{\partial f} = -\frac{c_1 - c_2}{f^2}$  is obtained by taking the partial derivative of the fine  $f$  in formula (6), and  $c_1 - c_2 > 0$  is known, so  $\frac{\partial p_1}{\partial f} < 0$ , that is,  $p_1$  decreases with the increase of  $f$ , and the proof is complete.

#### 4. Tripartite Mixed Strategy Model of Government Supervision Department, Short Video Platform and Merchants

In the process of studying the mixed strategy game between short video platforms and merchants, it is not difficult to find that there are many factors that will lead merchants to sell unqualified goods. Especially with the explosive growth of short video platforms, the competition between platforms is getting worse. In order to attract merchants, increase total sales, maintain traffic and maximize their own interests, the platforms will secretly negotiate with merchants, and there will be behaviors of platform inaction and merchants selling unqualified products wantonly. Therefore, in order to ensure the quality of goods, safeguard consumers' rights and interests, and improve the supervision and management mechanism, government supervision departments must join in. Only in this way can we manage the short video platform strictly and effectively, and thoroughly rectify the chaos of the short video platform in the process of live delivery. Therefore, the establishment of a mixed strategy game involving the government regulatory authorities, short video platform and merchants can further ensure the quality of goods.

##### 4.1. Basic Assumptions of Model

According to the actual situation, for the convenience of research, the following assumptions are made for the model:

Assumption 1: The probability of random inspection of merchants by government regulatory authorities is  $p_3$ , the probability of no random inspection is  $1 - p_3$ , and the cost of each random inspection is  $w$ .

Assumption 2: If the merchant's goods are found to be unqualified, the merchant will be fined  $f$ . At this time, if the short video platform is strictly supervised, the platform will be awarded  $z$ , and if the short video platform is not strictly supervised, the corresponding short video platform will be fined  $y$ .

Assumption 3: If the government regulatory department draws qualified products and the short video platform does not act, the merchant will be rewarded with  $z$ .

Assumption 4: If the government supervision department fails to conduct spot checks in one stage and the short video platform is still strictly supervised, the short video platform will be rewarded with  $z$ .

Assumption 5: When the government supervision department conducts random inspection on commodities and the short video platform is strictly supervised, the merchants will not sell unqualified commodities.

Assumption 6: When the government regulatory authorities don't spot check the commodities and the short video platform is not strictly supervised, the merchants won't choose to sell the qualified commodities.

#### 4.2. Strategy Combination of Participating in Three-Party Game Model

According to the strategy set of government regulatory authorities, short video platforms and merchants, we can get eight strategy combinations that the three parties participate in at the same time: (Spot check, Strict supervision, Unqualified); (Spot check, Strict supervision, Qualified); (Spot check, Not strictly supervised, Unqualified); (Spot check, Not strictly supervised, Qualified); (No spot check, Strict supervision, Unqualified); (No spot check, Strict supervision, Qualified); (No spot check, Not strict supervision, Unqualified); (No spot check, Not strict supervision, Qualified). According to the basic assumptions 5 and 6 of the model, the strategy combination (Spot check, Strict supervision, Unqualified) and (No spot check, No strict supervision, Qualified) do not exist. Therefore, in fact, six strategies are combined, and the corresponding Payoff Matrix can be obtained, as shown in **Table 2**.

The Payoff Matrix of mixed game involving government regulatory authorities, short video platforms and merchants can be obtained:

When the probability  $p_1$  of strict supervision of short video platform and the probability  $p_2$  of merchants selling unqualified goods remain unchanged, the total expected income of random inspection and non-random inspection by government regulatory authorities is recorded as  $E_1$ :

$$E_1 = p_3 p_1 (1 - p_2)(-w - z) + p_3 p_2 (1 - p_1)(f + y - w) + p_3 (1 - p_2)(1 - p_1)(-w - z) + (1 - p_3) p_1 p_2 (-z) + (1 - p_3) p_1 (1 - p_2)(-z) \quad (7)$$

**Table 2.** Tripartite game payoff matrix.

Payoff Matrix	
Game strategy	Payoffs outcome
(Spot check, Strict supervision, Qualified)	$(-w - z, z - c_3, u - c_1)$
(Spot check, Not strictly supervised, Unqualified)	$(f + y - w, -y, u - c_2 - f)$
(Spot check, Not strictly supervised, Qualified)	$(-w - z, 0, z + u - c_1)$
(No spot check, Strict supervision, Unqualified)	$(-z, z + f - c_3, u - c_2 - f)$
(No spot check, Strict supervision, Qualified)	$(-z, z - c_3, u - c_1)$
(No spot check, Not strict supervision, Unqualified)	$(0, 0, u - c_2)$

Note: the origin of Payoff Matrix is referred to Xie, Z. Y. (2002). *Economic Game Theory* (3<sup>rd</sup> ed.). Fudan University Press.

According to formula (7), the partial derivative of the probability  $p_3$  of random inspection by the government quality inspection department is obtained to get:

$$\frac{\partial E_1}{\partial p_3} = p_1 z + p_2(z + f + y) - p_1 p_2(f + y - w) + (w + z) = 0 \quad (8)$$

When the probability  $p_3$  of spot check by the government supervision department and the probability  $p_1$  of strict supervision by the short video platform remain unchanged, the total expected income of merchants from selling qualified and unqualified goods is recorded as  $E_2$ :

$$\begin{aligned} E_2 = & (1 - p_2) p_3 p_1 (u - c_1) + (1 - p_2)(1 - p_1) p_3 (z + u - c_1) \\ & + (1 - p_2)(1 - p_3) p_1 (u - c_1) + p_2 (1 - p_1) p_3 (u - c_2 - f) \\ & + p_2 (1 - p_3) p_1 (u - c_2 - f) + p_2 (1 - p_3)(1 - p_1)(u - c_2) \end{aligned} \quad (9)$$

According to formula (9), the partial derivative of the probability of  $p_2$  merchants selling unqualified goods is obtained to get:

$$\begin{aligned} \frac{\partial E_2}{\partial p_2} = & p_3 (c_1 - z - u - f) + p_1 (c_1 - u - f) \\ & + p_1 p_3 (z + c_2 - c_1 + 2f) + u - c_2 \\ = & 0 \end{aligned} \quad (10)$$

When the probability  $p_3$  of random inspection by the government quality inspection department and the probability  $p_2$  of merchants selling unqualified goods remain unchanged, the total expected revenue of short video platform under strict supervision and lax supervision is recorded as  $E_3$ :

$$\begin{aligned} E_3 = & p_1 p_3 (1 - p_2)(z - c_3) + p_1 p_2 (1 - p_3)(z + f - c_3) \\ & + p_1 (1 - p_2)(1 - p_3)(z - c_3) + (1 - p_1) p_2 p_3 (-y) \end{aligned} \quad (11)$$

According to formula (10), the partial derivative of the probability  $p_1$  of strict supervision of short video platform is obtained to get:

$$\frac{\partial E_3}{\partial p_1} = p_2 f + p_2 p_3 (c_3 - z - f + y) + (z - c_3) = 0 \quad (12)$$

The equations can be obtained by combining Equations (8), (10) and (12) as follows:

$$\begin{cases} p_1 z + p_2(z + f + y) - p_1 p_2(f + y - w) + (w + z) = 0 \\ p_3(c_1 - z - u - f) + p_1(c_1 - u - f) + p_1 p_3(z + c_2 - c_1 + 2f) + u - c_2 = 0 \\ p_2 f + p_2 p_3(c_3 - z - f + y) + (z - c_3) = 0 \end{cases} \quad (13)$$

The values of  $p_1$ ,  $p_2$  and  $p_3$  obtained by solving equation group (13) are:

$$p_1 = 2 + \frac{-w - c_3}{z} \quad (14)$$

$$p_2 = \frac{z(2w - z - c_3)}{z(f + y + z) + (2z - w - c_3)(w - z - f - y)} \quad (15)$$

$$p_3 = \frac{w(z - f - y - c_3 + w) + c_3(f + y - z) - zf}{z(f - c_3 + y)} \quad (16)$$

### 4.3. Analysis of Mixed Strategy Game Model

Through the analysis of the mixed strategy of government supervision department, short video platform and merchants' tripartite game, the related proposition about the quality supervision of goods sold by merchants is obtained.

Proposition 1: When the relevant reward  $z$  given by the government supervision department to the short video platform remains unchanged, to improve the supervision of the short video platform, it is necessary to reduce the detection cost  $w$ ,  $c_3$  of the government supervision department and the short video platform; The bigger the reward  $z$  of the government short video platform, the more favorable it is for the short video platform to supervise the merchants.

Prove: It can be known from formula (14)  $p_1 = 2 + \frac{-w - c_3}{z}$  that when  $z$  is constant, the larger  $w$  and  $c_3$  are, the smaller  $p_1$  is; Take the partial derivative of  $z$  of formula (14) to get:

$$\frac{\partial p_1}{\partial z} = \frac{1}{z^2}(w + c_3) \quad (17)$$

And  $\frac{\partial p_1}{\partial z} > 0$ , so it's is increasing function. Therefore, when the relevant reward  $z$  given by the government supervision department to the short video platform with greater strength, the probability  $p_1$  of the platform strictly supervising merchants will be greater, and the certification will be completed.

Proposition 2: When the detection cost  $w$  of government supervision department is higher than the penalty  $f + y$  for short video platforms and merchants, and the penalty  $f + y$  for short video platforms and merchants is greater than the strict supervision cost  $c_3$  of short video platforms, the greater the reward  $z$  of government departments for platforms, the greater the probability  $p_3$  of random inspection by government departments. When the penalty  $f + y$  for short video platforms and merchants is less than the cost  $c_3$  for strict supervision of short video platforms, the greater the reward  $z$  of government regulatory authorities, the smaller the sampling probability  $p_3$  of government regulatory authorities.

Prove: The partial derivative of  $z$  in formula (16) is:

$$\frac{\partial p_3}{\partial z} = \frac{c_3(w - f - y) + w(f + y + w)}{z^2(f + y - c_3)} \quad (18)$$

When  $f + y > c_3$ ,  $w > f + y$ , the greater the reward  $z$  of the government supervision department to the short video platform, the greater the probability  $p_3$  of random inspection by the government department; When  $f + y < c_3$ ,  $w > f + y$ , the greater the reward  $z$  of the government supervision department to the short video platform, the smaller the probability  $p_3$  of random inspec-

tion by the government department, and the certificate is completed.

Proposition 3: The penalty imposed by government regulatory authorities on short video platforms and merchants selling substandard goods is defined as government penalty  $(f + y)$ , the greater the value, the greater the penalty, and the smaller the value, the smaller the penalty. When the cost  $w$  of spot check by the government supervision department is less than the cost  $c_3$  of short video platform supervision, the greater the punishment  $(f + y)$  of the government, the smaller the probability  $p_3$  of spot check by the government supervision department; On the contrary, when the cost  $w$  of spot check by government departments is greater than the supervision cost  $c_3$  of short video platform, the greater the punishment  $(f + y)$  of government, the greater the probability  $p_3$  of spot check by government departments.

Prove: The partial derivative of the punishment force  $(f + y)$  defined in (16) gives:

$$\frac{\partial p_3}{\partial (f + y)} = \frac{-zc_3(c_3 - w)}{[z(f + y) - zc_3]^2} \quad (19)$$

When  $c_3 > w$ , formula (19)  $\frac{\partial p_3}{\partial (f + y)} < 0$ , so the probability  $p_3$  of random inspection by government departments decreases with the increase of punishment  $(f + y)$  of government departments; When  $c_3 < w$ , formula (19)  $\frac{\partial p_3}{\partial (f + y)} > 0$ , therefore, the probability  $p_3$  of random inspection by the government supervision department increases with the increase of the punishment  $(f + y)$  of the government supervision department, and the certificate is completed.

## 5. Conclusion

Based on the background of short video platform live delivery, this paper uses the mixed strategy game model, and builds the Payoffs Matrix of short video platform supervision department and live delivery merchants. On this basis, it studies the mixed strategy Nash equilibrium of short video platform supervision department and merchants, and analyzes the relationship between each factor and the probability of strict supervision and the probability of selling unqualified goods; Furthermore, a tripartite mixed strategy model of government supervision department, short video platform and merchants is constructed, and how each factor affects each probability in commodity quality supervision is analyzed. It is found that the lower the supervision cost of short video platform and the higher the fine, the lower the probability of merchants selling unqualified goods; The probability of strict supervision of short video platform is affected by the fine; The lower the detection cost of government regulatory authorities and the greater the reward for strict supervision of short video platforms, the higher the probability of strict supervision of short video platforms; The probability of

random inspection by government departments is affected by its punishment, detection cost and strict supervision cost of short video platform.

## 6. Suggestions

According to the conclusion of this study, the following suggestions are put forward:

### 6.1. The Short Video Platform Should Appropriately Increase the Punishment and Reduce the Supervision Cost

Give severe punishment to the live broadcast merchants who illegally sell substandard goods. No matter whether the anchor of carrying goods is a star or an official, it should be treated as the same. Live carrying goods are not a legal blind spot, so you must abide by the legal provisions when carrying out live carrying goods (Li, 2021). We should increase the punishment for illegal live broadcast of fake and shoddy goods, and reduce the probability of illegal live broadcast of fake and shoddy goods again by increasing the fine and closing the live broadcast room.

Strengthen the system connection between short video platform and merchants, promote the construction of intelligent supervision system, build a data monitoring platform, and make full use of new generation information technology means such as cloud computing, machine learning and big data analysis. Starting from further optimizing and perfecting the design of the top-level system, clarifying the supervision objects involved in the live delivery of goods, constructing the collaborative governance mode of live delivery of goods by platform merchants, improving the supervision process of live delivery of goods by platform merchants, and establishing a mechanism matching with the supervision of live delivery of goods by platform merchants, a set of scientific and reasonable supervision and management system of live delivery of goods by short video platform merchants is formed (Wang, 2019b). Review and handle consumer complaints and reports in time, and do a good job of normalization supervision, so as to achieve the purpose of controlling the supervision cost, and then effectively reduce the probability of selling fake and inferior goods with live broadcast of short video platform.

### 6.2. The Short Video Platform Should Establish an Appropriate Disciplinary Mechanism

When the punishment of short video platform increases, the probability of merchants selling fake and inferior goods decreases. At this time, the revenue of short video platform for strict supervision of merchants decreases, which leads to the probability of strict supervision of short video platform. At this time, there will be some speculative businesses selling fake and inferior commodities. In order to prevent this from happening, the short video platform should reasonably set the penalty, but blindly increasing the fine may eventually lead to the oppo-

site result, therefore, in addition to the supervision department, the short video platform should set up a higher department to implement the supervision accountability system for the supervision department. For employees who don't do anything, the punishment should be increased. Meanwhile, the construction of the supervision team should be strengthened, and an appropriate disciplinary mechanism should be established to promote the healthy development of the short video platform live delivery industry. The reward and punishment measures implemented by the supervision subject should be related to the purpose of live broadcast supervision on short video platform. It is strictly forbidden to link the supervision purpose lacking reasonable connection with the supervision measures, so as to avoid the phenomenon of widespread use and abuse of supervision (Song & Huang, 2020).

### **6.3. Government Regulatory Authorities Should Reduce the Testing Cost and Increase the Rewards for Short Video Platforms**

Government supervision departments should combine the visible hand with the invisible hand, strengthen legislation, establish a transparent process supervision mechanism, strengthen the technical support of the supervision process (Zhou, 2021), and reduce the testing cost. At the same time, government supervision departments should pay more attention to the supervision behavior of short video platforms by means of sampling inspection and big data analysis, and give corresponding rewards and punishments according to the supervision of short video platforms, which can effectively improve the probability of strict supervision of short video platforms and reduce the probability of merchants selling fake and inferior goods.

### **6.4. Government Regulatory Authorities Should Adopt Dynamic Reward and Punishment Methods for Short Video Platforms and Businesses**

As the sampling probability of the government supervision department is influenced by the strict supervision cost of short video platform and the relationship between the government supervision department and the rewards and punishments of the government supervision department, therefore, market regulators choose appropriate rewards and punishments according to different situations (Liang & Fu, 2021), which can not only effectively reduce the supervision cost, but also encourage short video platforms to strictly supervise the quality of goods to the maximum extent, thus reducing the probability of merchants selling fake and inferior goods. For the regulatory authorities, the healthy and benign development of the short video platform live delivery market needs the joint efforts of many stakeholders, which requires the establishment of a multi-party collaborative governance mechanism. Among them, the basic information audit of goods before the live broadcast of merchants, the payment method

of consumers, the real-time tracking of delivery orders, and the after-sales service of brand owners should be made public to the regulatory authorities and supervised by them. Government regulatory authorities should regularly disclose to the public the supervision of commodity quality by short video platforms (Li et al., 2018), and publicize the penalties for bad platforms. Only when all stakeholders actively participate in perfecting the supervision mechanism and cooperate with each other in governance can we effectively promote the development of the live broadcast industry to a benign and sustainable direction.

## 7. Limitations

To simplify the discussion, this study only analyzes the game behavior of short video platform, merchants and government departments. Future research should focus more on the consumer behavior, the competition among short video platforms and the influence of relevant policies on the quality of live goods. First of all, consumers' own behavior has the most direct impact on the quality of live goods. Increasing consumers' vigilance and strengthening their awareness of rights protection can effectively reduce the probability of selling fake and inferior goods in live broadcast. Secondly, the competition among short video platforms will urge the platforms to strengthen the supervision of the quality of goods sold by merchants, so as to improve the overall quality of goods sold by the platforms and optimize the platform's own evaluation, thus better competing for the market. In addition, the relevant policies have a great impact on the live delivery of goods, and favorable policies can greatly increase the probability of merchants selling qualified goods.

In addition to the above, the setting of the entry threshold of short video platform merchants, the media's exposure to the bad behavior of the platform and merchants, etc. will have a certain impact on the quality of live goods. Future research should consider the influence of these factors.

## Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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