Frontiers in Economics and Management Volume 6 Issue 5, 2025
ISSN: 2692-7608 DOI: 10.6981/FEM.202505_6(5).0001

The Evolutionary Game of Deception and Supervision in Social E-commerce Supply Chains Considering the Impact of Public Opinion

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Abstract

Social e-commerce is booming nowadays, and the extremely low marketing cost makes the phenomenon of merchant misreporting frequent. Aiming at the misrepresentation phenomenon of current social e-commerce merchants, we establish a tripartite evolutionary game model with social e-commerce platform, platform merchants and consumers as the main bodies, and study the strategic choices of each game body under different environmental conditions. The results show that the cost of social e-commerce supply chain system construction, reputation gain, extra income and the amount of punishment for violating merchants will have an impact on the tripartite game behavior; the violation of business profits and punishment are the key factors affecting the decision of misreporting by merchants.

Keywords

Social E-commerce; Misinformation Regulation; Online Public Opinion; Evolutionary Game.

1. Background of the Study and Literature Review

1.1. Background of the Study

Due to the characteristics of online media with low dissemination cost, large influence range and different cognitive level of the audience, social media has become the main battleground for the fermentation and dissemination of online public opinion. The economic activities of social e-commerce are originally based on its own social media platform, so the main bodies in the supply chain of social e-commerce are more susceptible to the influence of network public opinion. Social e-commerce with the help of platform live broadcast, short video, graphics for commodity marketing, these social characteristics make it easier for merchants to misrepresent their behavior. In the current ecological network of social e-commerce supply chain, the problem of misrepresentation of information by merchants such as false publicity and the creation of false word of mouth is common, which gradually dissolves the trust of consumers in the social e-commerce marketing model. The lack of trust will cause significant reputational damage to the social e-commerce value chain, which is not conducive to the benign development of the social e-commerce supply chain. In order to promote the high-quality, healthy and sustainable development of the social e-commerce supply chain, social e-commerce platforms are required to regulate the business behavior of their merchants, adopt more reasonable and effective regulatory measures, and optimize the social e-commerce market environment.

Based on the above background, this paper considers the social e-commerce supply chain under the influence of public opinion, and establishes an asymmetric three-party dynamic evolutionary game model for social e-commerce platforms, platform merchants and consumers

ISSN: 2692-7608 DOI: 10.6981/FEM.202505_6(5).0001

in response to the phenomenon of misrepresentation of information by social e-commerce merchants, and discusses the stability of evolutionary strategies, in order to put forward reasonable proposals for the regulation of the social e-commerce supply chain.

1.2. Review of Relevant Literature

Current scholars' research results on the problem of misinformation in social e-commerce are richer, and most of them are based on the live broadcast model. Song et al.[1] pointed out that there are information asymmetry problems in the development of live e-commerce, such as false prosperity of data and ineffective supervision of live platforms, which should be regulated accordingly . Li[2] observed that live-streaming hosts often promote exaggerated products, triggering consumer frustration and subsequent complaints, negative reviews, or returns when expectations are unmet. Such behaviors jeopardize the long-term stability of live-streaming e-commerce supply chains. Arnab et al.[3] find that there are a large number of fake users in the social network to influence the judgment of real users' choices, and an effective monitoring mechanism should be established to reduce the impact of the effects of false information.

For the regulation of information misreporting in social e-commerce supply chain, most of the related studies are based on the live e-commerce supply chain or related studies from the perspective of government and law.Miao et al.[4] suggests that the regulator should implement " additional rewards and punishments " according to the specific behavioral performance of the regulated person, instead of the one-size-fits-all reward and punishment model. Guo et al.[5] constructed a three-party evolutionary game model of live streaming e-commerce and found that the revenue-based parameters play a significant role in influencing the equilibrium state, which should be the focus direction of regulation . He et al.[6] for the live e-commerce supply chain information misreporting and not easy to regulate and other issues, to build the brand, MCN and e-commerce platform as the main body of the tripartite evolutionary game model, the study found that the standardized operation of the live e-commerce supply chain will be affected by a variety of factors.

The current domestic and international research on the impact of public opinion on social e-commerce is less, mainly from the perspective of word-of-mouth effect to analyze the consumer's willingness to buy.Wen et al.[7] used regression model to investigate and analyze the factors that consumers decide to repurchase the willingness to buy in social e-commerce, and the results show that the key opinion leaders (KOL) have a significant moderating effect on the effect of interaction, and the traffic experience will be on the impact on the consumer's willingness to buy. Liu et al.[8] pointed out that the negative public opinion of head KOL in social e-commerce can have a profound impact on the short-term performance of e-commerce enterprises, and the positive public opinion is difficult to make up for the damage caused by the negative public opinion on the enterprise.

In this paper, we consider the effect of public opinion on each subject in the social e-commerce supply chain, and explore the evolution path of relying on social e-commerce platforms and consumers to realize the regulation of merchants' misrepresentation behavior. In addition, it analyzes the behavioral characteristics of social e-commerce platforms, resident merchants and consumers at different stages, and puts forward reasonable suggestions for social e-commerce supply chain regulation.

2. Modeling and Assumptions

2.1. Description of Problem

This paper focuses on the three-party evolutionary game model of social e-commerce platform, platform merchants and consumers. The strategy selection space of the platform is {strict regulation, loose regulation}; the strategy selection space of the merchants is {honest operation,

ISSN: 2692-7608 DOI: 10.6981/FEM.202505_6(5).0001

illegal operation}; and the strategy selection space of the consumers is {positive regulation, negative regulation}. When the platform adopts strict regulation, it will increase the frequency of commodity sampling and inspection, and increase the intensity of punishment, and establish more strict punishment rules; when it adopts loose regulation, it will reduce the frequency of sampling and inspection, and use more lenient punishment rules. Merchants on the social e-commerce platform can choose to operate in good faith or violate the law when they advertise on the platform, i.e., whether to disclose the true information about their goods. After purchasing the corresponding goods, consumers on the platform can choose whether to actively publicize the integrity of the merchants' operation and actively combat the merchants' false publicity, misrepresentation of goods or even the sale of counterfeits.

2.2. Model Assumptionsand Parameters Descriptions

In order to better study the evolutionary game process among social e-commerce platforms, stationed merchants and consumers, this paper constructs the necessary model assumptions, and the relevant symbols and descriptions of the three-party evolutionary game model involved are shown in Table 1.

Table 1. Parameter symbols and descriptions

Parameters	Explanation
R_1	Revenue from the day-to-day operation of the platform
R_2	Basic Benefits for Resident Merchants When Promoting in Good Faith
R_3	Utility gained by consumers from purchasing products from platform merchants
C_1	Regulatory costs incurred when platforms are strictly regulated
C_2	Costs of promotion within the platform for resident merchants
C_3	Regulatory costs of active consumer regulation
λ	the strength of the influence of public opinion. $\lambda > 1$
λL_1	Reputational damage to the merchant's own reputation if the merchant is found to be operating in violation of the law
L_2	Loss of revenue suffered by consumers as a result of a merchant's non-compliance with the law
λL_{21}	Reputational damage to the platform as a result of consumers exposing misrepresentation of information by the platform's merchants
λB_1	Reputational gains from investigating and punishing non-compliant merchants when the platform is strictly regulated
B_2	Additional revenue for platform merchants for non-compliance with the law
B_{31}	Additional reputational benefits to the platform from consumers actively promoting the honest behavior of merchants
B_{32}	Additional reputational benefits for on-boarded merchants as consumers actively publicize the merchants' honest behavior
k	Platform "free-rider" gain factor. $0 < k < 1$
α	the incentive strength of the platform. $0 < \alpha < 1$
αF_1	Platform incentives for merchants to promote honesty and integrity
αF_2	Platform incentives for consumers to actively participate in regulation
β	Penalties for platforms, $0 < \beta < 1$
βP_1	The amount of penalties imposed by the platform on non-compliant merchants for misrepresentation of merchant information when they are found to be in violation of the law
P_2	Merchant compensation to consumers when misrepresentation of merchant information is discovered

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Hypothesis 1 The social e-commerce platform, platform merchants and consumers are all limited rational actors and cannot obtain economic results in the instant of choosing strategies.

Hypothesis 2 When the social e-commerce platform adopts loose regulation and the merchants operate in good faith, there is the phenomenon of "free-riding" on the platform, and the coefficient of "free-riding" gain is k ($0<k<1$), and the consumers actively publicize the merchants' good faith behavior will also bring the platform an extra amount kB_{31} of reputation gain.

Hypothesis 3 The reputational benefits of positive public opinion B_{32} can only be realized if both inbound merchants and consumers adopt honest and positive strategies, and increase with the strength of public opinion λ, denoted as λB_{32} , $\lambda>1$.

Hypothesis 4 Public opinion relies on external causes, and its effects are reflected in reputational gains and reputational losses for platforms and merchants. Comments left by consumers after transactions on the platform can create a certain word-of-mouth effect, but it is not the same as online public opinion. Strict regulation by the platform or active regulation by consumers can result in additional reputational losses for the offending merchant λL_1.

Hypothesis 5 Based on the platform's self-interest and the reality of the situation, the platform's incentives for consumers should be smaller than the platform's penalties for non-compliant merchants, i.e. $\alpha<\beta$

2.3. Modeling

Based on the above assumptions, the payoff matrix of the three-party game model under different strategy choices is shown in Table 2.

Table 2. Triple Subject Mixed Strategy Return Matrix

Strategic choice		Consumer Active Regulation z	Consumer Negative Regulation 1-z
Platforms are strictly regulated x	Businessmen Integrity y	$R_1-C_1+B_{31}-\alpha F_1-\alpha F_2$ $R_2-C_2+B_{32}+\alpha F_1$ $R_3-C_3+\alpha F_2$	$R_1-C_1-\alpha F_1$ $R_2-C_2+\alpha F$ $R_3-C_3+\alpha F_2+P_2-L_2$
	Businessmen violate regulations 1-y	$R_1-C_1+\lambda B_1-\alpha F_2+\beta P_1$ $R_2+B_{32}-C_2$ R_3-C_3	$R_1-C_1+\beta P_1$ R_2-C_2 R_3-L_2
Lax regulation of platforms 1-x	Businessmen Integrity y	$R_1+kB_{31}+\beta P_1$ $-C_2+B_2-\beta P_1-P_2-\lambda L_1+R_2$ R_3	R_1 $-C_2+B_2-\beta P_1-P_2-\lambda L_1+R_2$ $R_3+P_2-L_2$
	Businessmen violate regulations 1-y	$R_1+\beta P_1-\lambda L_{21}$ $R_2-C_2+B_2-P_2-\lambda L_1$ R_3	R_1 $R_2-C_2+B_2$ R_3-L_2

The expected returns when social e-commerce platforms adopt a strict regulatory strategy are:

$$E_{p1}=yz(R_1-C_1+B_{31}-\alpha F_1-\alpha F_2)+y(1-z)(R_1-C_1-\alpha F_1)+(1-y)z(R_1-C_1+\lambda B_1-\alpha F_2+\beta P_1)+(1-y)(1-z)(R_1-C_1+\beta P_1) \quad (1)$$

The expected returns when social e-commerce platforms adopt a lax regulatory strategy are:

ISSN: 2692-7608 DOI: 10.6981/FEM.202505_6(5).0001

$$E_{p2} = yz\left(R_1 + kB_{31} + \beta P_1\right) + y\left(1-z\right)R_1 + \left(1-y\right)z\left(R_1 + \beta P_1 - \lambda L_{21}\right) + \left(1-y\right)\left(1-z\right)R_1 \tag{2}$$

The average return on social e-commerce platform strategy selection is:

$$\overline{E_p} = xE_{p1} + (1-x)E_{p2} \tag{3}$$

The expected revenue when the platform's inbound merchants have an honest business strategy is:

$$E_{s1} = xz\left(R_2 - C_2 + B_{32} + \alpha F_1\right) + x\left(1-z\right)\left(R_2 - C_2 + \alpha F_1\right) + \left(1-x\right)z\left(R_2 + B_{32} - C_2\right) + \left(1-x\right)\left(1-z\right)\left(R_2 - C_2\right) \tag{4}$$

The expected revenue of the platform's inbound merchants when they adopt a non-compliant business strategy is:

$$\begin{aligned} E_{s2} = {} & xz\left(-C_2 + B_2 - \beta P_1 - P_2 - \lambda L_1 + R_2\right) + x\left(1-z\right)\left(-C_2 + B_2 - \beta P_1 - P_2 - \lambda L_1 + R_2\right) + \\ & \left(1-x\right)z\left(R_2 - C_2 + B_2 - P_2 - \lambda L_1\right) + \left(1-x\right)\left(1-z\right)\left(R_2 - C_2 + B_2\right) \end{aligned} \tag{5}$$

The average return on the platform's inbound merchant strategy options is:

$$\overline{E_s} = yE_{s1} + (1-y)E_{s2} \tag{6}$$

The expected benefit to platform consumers when they adopt an active regulatory strategy is:

$$E_{c1} = xy\left(R_3 - C_3 + \alpha F_2\right) + x\left(1-y\right)\left(R_3 - C_3 + \alpha F_2 + P_2 - L_2\right) + \left(1-x\right)y\left(R_3 - C_3\right) + \left(1-x\right)\left(1-y\right)\left(R_3 - L_2\right) \tag{7}$$

The expected benefit to platform consumers when they adopt a negative regulatory strategy is:

$$E_{c2} = xyR_3 + x\left(1-y\right)\left(R_3 + P_2 - L_2\right) + \left(1-x\right)yR_3 + \left(1-x\right)\left(1-y\right)\left(R_3 - L_2\right) \tag{8}$$

The average return on platform consumer strategy choice is:

$$\overline{E_c} = zE_{c1} + (1-z)E_{c2} \tag{9}$$

According to the evolutionary game theory pioneered by Maynard , the dynamics of the strategic choices of social e-commerce platforms, on-boarding merchants and consumers are adjusted as:

$$\begin{cases} F(y) = \dfrac{dy}{dt} = y\left(E_{s1} - \overline{E_s}\right) = -y\left(y-1\right)\left[\left(B_{32} + P_2 + \lambda L_1\right)z + \left(P_2 + \alpha F_1 + \beta P_1 + \lambda L_1\right)x + \left(\lambda L_1 - P_2\right)xz - B_2\right] \\ F(z) = \dfrac{dz}{dt} = z\left(E_{c1} - \overline{E_c}\right) = z\left(z-1\right)\left[\left(P_2 - \alpha F_2\right)x + P_2 y - P_2 xy + C_3 - P_2\right] \\ F(x) = \dfrac{dx}{dt} = x\left(E_{p1} - \overline{E_p}\right) = x\left(x-1\right)\left[\left(\alpha F_1 + \beta P_1\right)y + \left(\alpha F_2 - \lambda B_1 + \beta P_1 - \lambda L_{21}\right)z + \left(\lambda B_1 + \lambda L_{21} + kB_{31} - B_{31}\right)yz + C_1 - \beta P_1\right] \end{cases} \tag{10}$$

ISSN: 2692-7608 DOI: 10.6981/FEM.202505_6(5).0001

Let the replicated dynamical equations F(x)=0, F(y)=0, F(z)=0, the pure strategy equilibrium (0,0,0),(0,1,0),(0,0,1),(0,1,1),(1,0,0),(1,1,0),(1,1,0),(1,0,1),(1,1,1),(1,1,1),(1,1,1), and the mixed-strategy equilibrium (x*,y*,z*) of the 3D dynamical system are obtained, according to Ritzberger and Weibull. In this paper, we only discuss pure strategy equilibria.

(iv) Stability analysis of the equilibrium point of the three-party evolutionary game system

The stability of the equilibrium point of the system is determined using the Lyapunov's first law[9] The Jacobian matrix (J) is constructed as follows:

$$J=\begin{bmatrix} \partial F(x)/\partial x & \partial F(x)/\partial y & \partial F(x)/\partial z \\ \partial F(y)/\partial x & \partial F(y)/\partial y & \partial F(y)/\partial z \\ \partial F(z)/\partial x & \partial F(z)/\partial y & \partial F(z)/\partial z \end{bmatrix} \tag{11}$$

Among them:

$$\begin{aligned} &\partial F(x)/\partial x=(2x-1)\left[\beta P_1-C_1-(\alpha F_1+\beta P_1)y-(\alpha F_2-\lambda B_1+\beta P_1-\lambda L_{21})z-(\lambda B_1+\lambda L_{21})yz\right] \\ &\partial F(x)/\partial y=x(x-1)\left[\alpha F_1+\beta P_1+(\lambda B_1+\lambda L_{21})z\right] \\ &\partial F(x)/\partial z=x(x-1)\left[\alpha F_1+\beta P_1+(\lambda B_1+\lambda L_{21})z\right] \\ &\partial F(y)/\partial x=-y(y-1)\left[P_2+\alpha F_1+\beta P_1+\lambda L_1+(\lambda L_1-P_2)z\right] \\ &\partial F(y)/\partial y=(2y-1)\left[(B_{32}+P_2+\lambda L_1)z+(P_2+\alpha F_1+\beta P_1+\lambda L_1)x+(\lambda L_1-P_2)xz-B_2\right] \\ &\partial F(y)/\partial z=-y(y-1)\left[B_{32}+P_2+\lambda L_1+(\lambda L_1-P_2)z\right] \\ &\partial F(z)/\partial x=z(z-1)(C_3-C_3y) \\ &\partial F(z)/\partial y=z(z-1)(C_3-C_3x) \\ &\partial F(z)/\partial z=(2z-1)\left[(C_3-\alpha F_2)x+C_3y-C_3xy\right] \end{aligned} \tag{12}$$

According to Lyapunov's first method, the stability of the system can be judged by the positive and negative situation of the eigenvalues of each equilibrium point. Substituting the above eight pure strategy points into the Jacobi matrix respectively, the local stability conditions can be judged, as shown in Table 3:

Table 3. Eigenvalues and stability analysis of equilibrium points

Balance point	Eigenvalue (math.) λ		
	λ_1	λ_2	λ_3
$E_1(0,0,0)$	βP_1-C_1	$-B_2$	P_2-C_3
$E_2(0,1,0)$	$-C_1-\alpha F_1$	$B_2>0$	0
$E_3(0,0,1)$	$\lambda B_1-\alpha F_2-C_1+\lambda L_{21}$	$B_{32}-B_2+P_2+\lambda L_1$	C_3-P_2
$E_4(0,1,1)$	$B_{31}-C_1-\alpha(F_1+F_2)-\lambda B_{31}-\beta P_1$	$B_2-B_{32}-P_2-\lambda L_1$	$C_3>0$
$E_5(1,0,0)$	$C_1-\beta P_1$	$P_2-B_2+\alpha F_1+\beta P_1+\lambda L_1$	αF_2-C_3
$E_6(1,1,0)$	$C_1+\alpha F_1>0$	$B_2-P_2-\alpha F_1-\beta P_1-\lambda L_1$	αF_2-C_3
$E_7(1,0,1)$	$C_1+\alpha F_2-\lambda(B_1+L_{21})$	$B_{32}-B_2+P_2+\alpha F_1+\beta P_1+\lambda L_1$	$C_3-\alpha F_2$
$E_8(1,1,1)$	$C_1-B_{31}+\alpha(F_1+F_2)+kB_{31}+\beta P_1$	$B_2-B_{32}-P_2-\alpha F_1-\beta P_1-\lambda L_1$	$C_3-\alpha F_2$

Since the stable equilibrium points require that the eigenvalues are all negative, the equilibrium points E2 , E4 , E6 are not evolutionary stable equilibrium points. In this paper, we will discuss the conditions for stable equilibrium at equilibrium points E1 , E3 , E5 , E7 , E8 in each case.

ISSN: 2692-7608 DOI: 10.6981/FEM.202505_6(5).0001

3. Simulation Analysis

In order to understand the analysis results more intuitively, this paper combines the real situation to simulate the model, the initial assignment is shown in Table 4. Specific analysis is as follows:

Table 4. Initial assignment of parameters

C_1	C_3	B_1	B_2	B_{31}	B_{32}	α	F_1
200	100	100	800	100	100	0.4	100
F_2	β	P_1	P_2	λ	L_1	L_{21}	L_1
100	0.6	200	800	3	50	50	0.2

Case 1 The equilibrium point $E_1(0,0,0)$ is the evolutionary stabilization strategy (ESS) needs to satisfy $C_1 > \beta P_1$ and $P_2 < C_3$, take $C_3 = 200$, $P_2 = 200$, and the rest of the parameters are assigned the same value, the evolutionary simulation results are shown in Fig. 1.

When platform merchants are caught misrepresenting product information, they are penalized less severely, i.e., the cost of misrepresentation for merchants is lower than the cost of strict platform supervision and active consumer supervision, the system will evolve to lax platform supervision, business violation, and negative consumer handling. From the perspective of the total profit of the supply chain, such a situation is obviously not conducive to the healthy development of the social e-commerce supply chain in the future. At this point, in the face of the chaos of false propaganda, platforms and government departments should take strong measures to combat this phenomenon, and online media can also expose the relevant events to raise public awareness, and use the power of public opinion to prompt the relevant departments to manage and rectify the social e-commerce market.

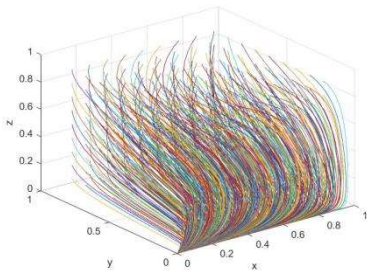


Fig. 1 Scenario 1 evolutionary path

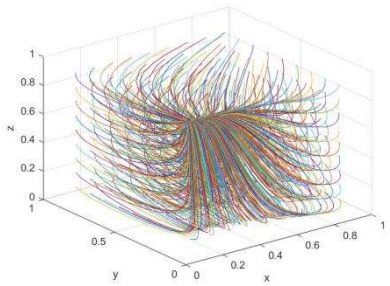


Fig. 2 Scenario 2 evolutionary path

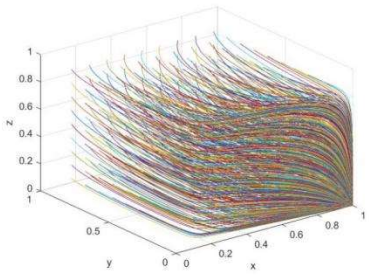


Fig. 3 Scenario 3 evolutionary path

Case 2 The equilibrium point E3(0,0,1) is the evolutionary stabilization strategy (ESS) needs to satisfy $\lambda(B_1 + \lambda L_{21}) < \alpha F_2 + C_1$, $B_{32} + P_2 + \lambda L_1 < B_2$ and $C_3 < P_2$, take $P_2 = 400$, $\lambda = 1$, and the rest of the parameters are assigned the same value, and the evolutionary simulation results are shown in Fig. 2.

When the above conditions hold, the cost of monitoring social e-commerce platforms is higher than the reputational effect of investigating and punishing unscrupulous merchants, so platforms are more likely to favor lax regulation to save costs. The profits from misrepresentation of product information by merchants far outweigh the costs, so merchants may choose to rely on false advertising to make huge profits. Consumers are willing to actively

ISSN: 2692-7608 DOI: 10.6981/FEM.202505_6(5).0001

participate in regulation because they can make up for the loss of buying counterfeit goods by reporting unscrupulous merchants.

In this case, even if consumers report the bad behavior of the relevant merchants and receive compensation, but due to the low impact of public opinion, the misrepresentation of the merchants can not be exposed to a wide range of other consumers "to avoid the mine", so the phenomenon of misrepresentation of the merchants on the platform can not be effectively curbed, the merchants chose to do The "one-time business" will cause a large number of customers to be lost in the future, destroying the platform's social e-commerce market.

Case 3 Equilibrium point $E_5(1,0,0)$ is the evolutionary stabilization strategy (ESS) needs to be satisfied when $C_1 < \beta P_1$, $\alpha F_2 < C_3$ and $P_2 + \alpha F_1 + \beta P_1 + \lambda L_1 < B_2$, take $C_1 = 100$, $C_3 = 200$, $B_2 = 1200$, $P_1 = 400$, $P_2 = 200$, and the rest of the parameters are assigned unchanged, and the evolutionary simulation results are shown in Fig. 3.

In this case, the platform merchants in the misrepresentation of profits is still higher than the cost of misrepresentation and integrity of business profits, and consumer reporting costs are higher, so even if the merchants encountered the goods are not the right board, blatant sales of counterfeiting, but also unwilling to pay the extra cost of feedback to the platform. The platform to take a more stringent means of supervision, more penalties for bad merchants, you can use the social e-commerce platform's own technical means to limit the flow of bad merchants stores, more to the user side of the platform merchants recommended integrity management, to help consumers screen high-quality stores, rectify the platform of the social e-commerce market.

Case 4 Equilibrium point $E_7(1,0,1)$ is the evolutionary stabilization strategy (ESS) needs to be satisfied whe $C_1 + \alpha F_2 < \lambda(B_1 + L_{21})$, $B_{32} + P_2 + \alpha F_1 + \beta P_1 + \lambda L_1 < B_2$ and $C_3 < \alpha F_2$, take $C_3 = 50$, $B_2 = 1200$, $F_2 = 300$, $P_2 = 200$, and the rest of the parameters are assigned the same value, the evolutionary simulation results are shown in Fig. 4.

When the above conditions hold, both social e-commerce platforms and consumers can profit from regulating merchants' misrepresentation behavior, so both are willing to actively invest in regulation. As the merchants' misrepresentation can generate huge profits in a short period of time, they will still choose to misrepresent their products even if the platform strictly investigates the merchants' misbehavior.

Although platforms and consumers are regulated in this situation, they still cannot curb the phenomenon of merchants misrepresenting themselves. As the threshold for opening a store on social e-commerce platforms is low, the operating costs of merchants are also low, so many unscrupulous merchants are likely to close their stores quickly after making a profit on the platform. At this time, the interests of consumers on the platform cannot be effectively protected, and the positive exposure of consumers and the public opinion effect on the platform will exacerbate the massive loss of platform users. Therefore, in order to combat the chaos of merchant misrepresentation, it is not enough to rely on regulation alone, and it is necessary to take the necessary means to raise the cost of misrepresentation of unscrupulous merchants. For example, the platform can strengthen the qualification of merchants to enter the audit, and increase the penalty for non-compliance; platforms and consumers can also seek help from government departments to accurately crack down on non-compliant merchants, tracing back to the individual, so as to deter other merchants and individuals wanting to profit by unscrupulous means.

ISSN: 2692-7608 DOI: 10.6981/FEM.202505_6(5).0001

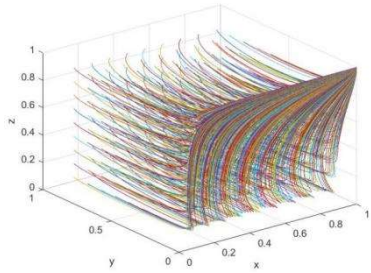


Fig. 4 Case IV evolutionary path

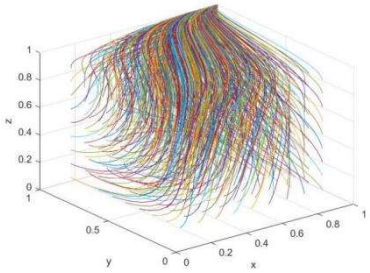


Fig. 5 Case V evolutionary path

Case 5 The equilibrium point $E_8(1,1,1)$ is the evolutionary stabilization strategy (ESS) needs to satisfy $B_{32}+P_2+\alpha F_1+\beta P_1+\lambda L_1>B_2$, $C_1+\alpha(F_1+F_2)+kB_{31}+\beta P_1<B_{31}$ and $C_3<\alpha F_2$, take $C_1=100$, $C_3=50$, $B_{31}=650$, $F_2=300$, and the rest of the parameters are assigned unchanged, and the results of the evolutionary simulation are shown in Fig. 5.

When the above conditions are met, platforms will benefit from investigating and punishing unscrupulous merchants more than the cost of supervision, merchants will benefit from operating in good faith more than violating the law, and consumers will benefit from actively publicizing and reporting on the relevant merchants. In this case, platforms, merchants, and consumers work together, and all three parties can benefit from it, so that the social e-commerce supply chain can develop in a healthy and virtuous way. At this point, the reputation of the platform, the interests of merchants and the value of consumers have been maximized, and this win-win situation is the result of active exploration by managers and the benign development of the supply chain.

Based on the above findings, this paper puts forward the following suggestions: First, social e-commerce platforms and consumers should cooperate with each other to help platforms establish a more appropriate regulatory system. Second, platforms and merchants should invest part of their funds in controlling public opinion on platforms, for example, platforms can increase the number of positively oriented posts on platforms through technical means, and merchants can actively encourage consumers to publish "grass" posts with corresponding labels on platforms, so as to increase their own revenues by taking advantage of the public opinion effect on platforms. Thirdly, while reducing the threshold for merchants to enter the platform, the platform should also improve its ability to cope with business risks, actively utilize its social attributes to maintain the trading environment within the platform, and encourage merchants and consumers to publish real product promotion and grass-raising information.

4. Conclusion

In this paper, by constructing an evolutionary game model of social e-commerce platforms, platform-entered merchants and consumers, and taking the influence of public opinion into account in the model, we conduct an evolutionary game analysis and simulation analysis, and draw the following conclusions: The cost of building the social e-commerce supply chain system, reputational gains, additional gains, and the amount of punishment for violating merchants will have an impact on the behavior of the three-party game; the reputational gains, the compensation for violating merchants and the Regulatory costs have an important impact on the strategic choices of social e-commerce platforms and platform consumers, when the compensation, subsidies and other benefits are greater than the cost of participating in regulation, social e-commerce platforms and consumers will choose strict and positive regulatory strategies, and vice versa will choose lax and negative regulatory strategies; for the merchants who are stationed in the platform, the profit from illegal operations and penalties

ISSN: 2692-7608 DOI: 10.6981/FEM.202505_6(5).0001

are the key factors affecting their decision-making, and retaining a certain degree of space for illegal operations It can mobilize the enthusiasm of merchants and the purchase desire of consumers, and the punishment of violators can ensure the benign competition in the social e-commerce market and maintain the market environment. Based on the research in this paper, subsequent studies can carry out more detailed sensitivity analysis of the model to clarify the effect of each influencing factor on the main body of the evolutionary game.

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