Research on Network False Public Opinion Regulatory Countermeasures from the Perspective of Evolutionary Game

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Abstract

False sensation emerges in today's cyberspace, which has a very negative impact on the good development of China's network environment. Through the use of evolutionary game theory, this paper constructs a three-party evolutionary game model of government, network platform and false public opinion makers, and explores the impact of netizen groups on the equilibrium results of the entire game model. Through Jacobian matrix analysis, the main factors affecting the choice of game subjects are discussed, and the conditions for behavior strategies to be stable are discussed. The research shows that the Internet platform, false public opinion makers and netizens have certain autonomy to the false information of the network. The governance effect depends largely on the media literacy level of the netizens; only when the netizen's media literacy level is low. The government's participation in the network's false information governance is more effective. Finally, based on the above results, long-term and short-term recommendations are made for the false grievances of the government governance network.

Keywords

Network false public opinion governance; evolutionary game; netizen media literacy; multi-party participation.

1. Introduction

The outstanding characteristics of network information dissemination are fast speed, wide coverage, low cost of information release, low threshold, and greatly accelerate the formation of public opinion. With the development of the network, the use of these network information dissemination features purposeful confusion, misleading public opinion, and even fueling different opinions, and finally guiding the development of public opinion in a specific direction, that is, "false lyrics" emerge one after another, causing the regulators and The researchers attach great importance to it. The main manifestations of this hazard are: (1) the fabrication, falsification and distortion of objective facts. (2) Suppression of different speeches and speech attacks on specific targets. (3) Encourage partial speech and incite group emotions. (4) Misleading and falsifying the true lyrics. (5) Presenting an organized and large-scale trend, and increasing the breadth and depth of the impact. According to the 43rd "Statistical Report on Internet Development in China" issued by CNNIC, as of December 2018, the number of Internet users in China reached 829 million [1], and the monthly active users of WeChat and Sina Weibo reached 1.082 billion [2] and 465 million [3] is enough to show that China should give higher attention to the netizens when it deals with the problem of false information on the network. Based on the analysis of the logic of subjective behavior of false information governance, this paper applies the theory of management and communication to present the false information governance process of the network in the new media era through the three-party evolutionary

game model, and based on the model and simulation analysis results. Advice on the issue of false information on government governance networks.

2. Literature Review

Evolutionary game theory, also known as evolutionary game theory, is a combination of classical game theory and ecological theory. It takes the group of bounded rational participants as the research object and uses dynamic analysis methods to incorporate various factors affecting the behavior of participants into the model. And to examine the evolutionary trend of group behavior from the perspective of system theory. With the deepening of network public opinion research, some scholars try to use the evolutionary game method to analyze the game relationship between the parties involved in network public opinion supervision. Wei Fangfang, Chen Fuji (2016) established a government-enterprise-citizen game model for the problem of increasing sales and disseminating false information, and concluded that product citizens who will disseminate false information will eventually not purchase [1] . Chen Fuji, Huang Jiangling (2016) put forward the strategy of managing this phenomenon through the analysis of the evolutionary game analysis between enterprises, network promoters and government. [2]; Zhou Fei, Guo Ren (2017) The evolutionary game method is introduced into the strategic research field of the government's response to the network public opinion, and the three-party game relationship between the government, the media and the netizens is analyzed, and the government's reasonable response to the network public opinion is proposed [3]. Chen Fujii, Wang Yuxian (2019) divided the stakeholders of Weibo supervision into government, microblog operators and netizens, and established an evolutionary game model between the three subjects, and then proposed Weibo supervision from the perspective of the government. Strategy [4].

3. Three-Party Game Model of Network False Public Opinion Governance

3.1. Subject analysis

3.1.1. False Sensation Maker

Ordinary netizens refer to individuals who are active on the Internet. The directness, immediacy, and anonymity of the network weaken the publisher's sense of responsibility for the truthfulness or accuracy of the speech. Netizens can make speeches anytime and anywhere, and through the spread of the Internet, it is possible to form online public opinion. In the capacity of netizens, the dissemination of various false or distorted news, partial speech or the use of technical means to tamper with some individuals or organizations that mislead the development of online public opinion is the maker of false grievances. Their public identity may be the network of large V, network reds, network public relations companies, online advertising companies, forum moderators, and even hidden behind the scenes into a network of water accounts.

3.1.2. Network Social Platform

The network social platform is the main information dissemination bridge in the network era. Their content media is mainly network and different from traditional media with paper and film as the main medium. With the continuous development of network and software technology, from the portals represented by Sina and Sohu, to BBS forums, blogs, Weibo, and mobile social media represented by WeChat and Facebook. It not only has the mass communication function and characteristics of traditional media, but also continuously expands the public's discourse space and time freedom. It is also because of the convenience and freedom of information published by online media, which makes it easy to cause information loss, check and supervision, and increases the possibility of false grievances. On

the other hand, due to the increase in the degree of freedom, the competition of online media is more intense than that of traditional media. In order to attract the attention of the public, some websites increase the click-through rate, do not supervise the information on the website, and let the various false information traverse on the website. It is also one of the reasons for the proliferation of false grievances.

3.1.3. Government

The government refers to the relevant government agencies that have the authority to supervise, manage, intervene and guide. Although the network is different in form from traditional media, it is the same in accepting legal constraints and government supervision. The government has the responsibility to maintain public safety including network life, manage the network according to law, purify the network public opinion environment, maintain the network order and the interests of the majority of netizens.

3.2. Model Hypothesis

Hypothesis 1: In the game of government, network platform and self-media, the probability of government choosing supervision is x, the probability of network platform choosing positive review is y, and the probability that false public opinion maker chooses to report is z, in which time is all The function of t.

Hypothesis 2: The cost of government supervision is the fixed cost for investment supervision, the media literacy for netizens, which is a constant, representing the government's own regulatory capacity. When the netizens are literate, they represent the public to completely replace the government departments to exercise supervision functions. You only need to invest a fixed cost. When the network space is clear, the government gains social benefits; when the network space is dirty, the false information is flooded, causing the loss of public interest.

Hypothesis 3: The cost required for the network platform to control false public opinion is the fixed cost invested by the network platform to control false public opinion. It is a constant, representing the platform's own auditing ability. When the overall quality of the netizens, the netizen completely replaces the network platform to play the auditing function. At this point, the platform only needs to invest a fixed cost.

Hypothesis 4: The network platform environment is stable, the false grievances are scarce or contained, and the platform gains, including the positive evaluation of netizens and the steady improvement of the user base. There is false sensation in the platform, user satisfaction decreases, user base decreases and user stickiness decreases, resulting in loss h. In the case of input power control, the government penalizes the network platform b, and does not control its penalty d (d> b).

Hypothesis 5: The benefits of the false essay maker's normative reporting include long-term attention and trust from netizens. After considering the needs of a certain audience, the false essay maker chooses the false report to obtain the income as a constant, indicating the ability of the false essay maker to increase the income through the flow, falsely reporting the relevant news, causing the cyberspace pollution to cause the platform to punish or the government to order the platform. Punish g, stop the account if it is limited, or permanently stop it.

Hypothesis 6: In the case of supervision, the government has the possibility to discover false grievances; the network platform has the probability of detecting false grievances under the control of the situation.

3.3. Payment Function

According to the above assumptions, in the case where all three parties are bounded rational and information is asymmetric, the payment matrix is listed, as shown in Table 1.

Table 1. Payment Matrix

			Network Platform	
			Control	Not Controlled
Government	Supervision	False sensation maker — Normative report	$R_1 - C_k,$ $R_2 - C_s,$ R_3	$R_1 - C_k,$ $R_2,$ R_3
		False report	$(1-p_1p_2)R_1 - C_k - p_1p_2a,$ $(1-p_1p_2)R_2 - C_s - (1-p_1)b - p_1p_2h,$ $R_m - (1-p_1p_2)\,g$	$(1-p_1)R_1 - C_k - p_1a,$ $R_m - (1-p_1)d - p_1h,$ $R_m - (1-p_1)g$
	Not Regulated	False sensation maker — Normative report	$R_1,$ $R_2 - C_s,$ R_3	$R_1,$ $R_2,$ R_3
		False report	$(1-p_2)R_1 - p_2a,$ $(1-p_2)R_2 - C_s - p_2h,$ $R_m - (1-p_2)g$	$-a,$ $R_m - h,$ R_m

3.4. The Replication Dynamic Equation of the Three-Party Evolutionary Game

The expected returns of the government's choice of "regulatory" and "non-regulatory" strategies are respectively, and the average expected return is:

$$E_{11} = z(R_1 - C_k) + (1-z)y[(1-p_1p_2)R_1 - C_k - p_1p_2a]$$
$$+ (1-z)(1-y)[(1-p_1)R_1 - C_k - p_1a]$$

$$E_{12} = zR_1 + (1-z)y[(1-p_2)R_1 - p_2a] - (1-y)(1-z)a$$

$$\overline{E_1} = xE_{11} + (1-x)E_{12}$$

The replication dynamic equation for constructing a government behavior strategy is:

$$F(x) = \frac{dx}{dt}$$
$$= x(1-x)(E_{11} - E_{12})$$
$$= x(1-x) * \begin{bmatrix} -zC_k + (1-z)y[(1-p_1p_2)R_1 - C_k - p_1p_2a - (1-p_2)R_1 + p_2a] \\ + (1-y)(1-z)[(1-p_1)R_1 - C_k - p_1a + a] \end{bmatrix}$$

Similarly, the expected returns of the "control" and "no control" strategies of the network platform are respectively, and the average expected return is:

$$E_{21} = z(R_2 - C_s) + (1-z)x[(1-p_1p_2)R_2 - C_s - p_1p_2h - (1-p_1)b]$$
$$+ (1-x)(1-z)[(1-p_2)R_2 - C_s - p_2h]$$

$$E_{22} = zR_2 + (1-z)x[R_m - (1-p_1)d - p_1h] + (1-x)(1-z)(R_m - h)$$

$$\overline{E_2} = yE_{21} + (1-y)E_{22}$$

The replication dynamic equation for constructing a network platform behavior strategy is:

$$F(y) = \frac{dy}{dt}$$
$$= y(1-y)(E_{21} - E_{22})$$
$$= y(1-y)$$
$$* \begin{bmatrix} -zC_s + (1-z)x[(1-p_1p_2)R_2 + (1-p_2)p_1h + (1-p_1)(d-b) - R_m - C_s] \\ + (1-x)(1-z)[(1-p_2)R_2 - C_s - p_2h - R_m + h] \end{bmatrix}$$

The expected returns of the false essay makers who choose the "normative report" and "false report" strategies are respectively, and the average expected return is:

$$E_{31} = R_3$$

$$E_{32} = xy[R_m - (1 - p_1p_2)g] + (1 - y)x[R_m - (1 - p_1)g]$$
$$+ (1 - x)y[R_m - (1 - p_2)g] + (1 - x)(1 - y)R_m$$

$$\overline{E_3} = zE_{31} + (1 - z)E_{32}$$

The replication dynamic equation for constructing a self-media behavior strategy is:

$$F(z) = \frac{dz}{dt}$$
$$= z(1 - z)(E_{31} - E_{32})$$
$$= z(1 - z) * \begin{bmatrix} R_3 - xy[R_m - (1 - p_1p_2)g] - (1 - y)x[R_m - (1 - p_1)g] \\ -(1 - x)y[R_m - (1 - p_2)g] - (1 - x)(1 - y)g \end{bmatrix}$$

3.5. Evolutionary Game Path Analysis

In the previous game analysis, the probability that the government, the network platform and the false public opinion maker adopt the strategy x, y, z are the parameters related to the time t, and the solution domain of the replicating dynamic equations is $[0, 1] * [0, 1] * [0, 1]$. In the game, a total of 14 equilibrium points are obtained, namely: $N_1(0,0,0)$, $N_2(1,0,0)$, $N_3(1,1,0)$, $N_4(1,0,1)$, $N_5(0,1,0)$, $N_6(0,1,1)$, $N_7(0,0,1)$, $N_8(1,1,1)$, $N_9(0, Z_y, Y_z)$, $N_{10}(1, Z_y, Y_z)$, $N_{11}(Z_x, 0, X_z)$, $N_{12}(Z_x, 1, X_z)$, $N_{13}(Y_x, X_y, 0)$, $N_{14}(Y_x, X_y, 1)$, and the first eight equilibrium points constitute the boundary of the three-party evolutionary game solution domain, that is, after Six equilibrium points exist within the three-dimensional spatial solution domain, satisfying the situation where the government, network platform, and false public opinion makers have a policy change rate of zero. The partial derivatives of the replication dynamic equations of the government, the network platform, and the false public opinion makers respectively yield the Jacobian matrix.

$$J = \begin{array}{ccc} \dfrac{\partial F(x)}{\partial x} & \dfrac{\partial F(x)}{\partial y} & \dfrac{\partial F(x)}{\partial z} \\[2mm] \dfrac{\partial F(y)}{\partial x} & \dfrac{\partial F(y)}{\partial y} & \dfrac{\partial F(y)}{\partial z} \\[2mm] \dfrac{\partial F(z)}{\partial x} & \dfrac{\partial F(z)}{\partial y} & \dfrac{\partial F(z)}{\partial z} \end{array}$$

The Jacobian matrix is solved to obtain the eigenvalues corresponding to the equilibrium points, as shown in Table 2.

Table 2. Characteristic values

Equilibrium point	Eigenvalues		
$N_1(0,0,0)$	$(1 - p_1)(R_1 + a) - C_k$	$(1 - p_2)(R_2 + h) - C_s - R_m$	$R_3 - R_m$
$N_2(1,0,0)$	$C_k - (1 - p_1)(R_1 + a)$	$(1 - p_1p_2)R_2 + (1 - p_2)p_1h + (1 - p_1)(d - b)$ $- R_m - C_s$	$R_3 + (1 - p_1)g - R_m$
$N_3(1,1,0)$	$C_k - (1 - p_1)p_2(R_1 + a)$	$R_m + C_s - (1 - p_1p_2)R_2 - (1 - p_2)p_1h$ $- (1 - p_1)(d - b)$	$R_3 + (1 - p_1p_2)g$ $- R_m$
$N_4(1,0,1)$	C_k	C_s	$R_m - R_3 - (1 - p_1)g$
$N_5(0,1,0)$	$(1 - p_1)p_2(R_1 + a)$ $- C_k$	$C_s + R_m - (1 - p_2)(R_2 + h)$	$R_3 + (1 - p_2)g - R_m$
$N_6(0,1,1)$	$-C_k$	C_s	$R_m - R_3 - (1 - p_2)g$
$N_7(0,0,1)$	$-C_k$	$-C_s$	$R_m - R_3$
$N_8(1,1,1)$	C_k	$-C_s$	$R_m - R_3 - (1 - p_1p_2)g$
$N_9 \sim N_{14}$	There are eigenvalues with different symbols, no longer detailed		

In the game system, each equilibrium point corresponds to an equilibrium selection. For the eigenvalues of the Jacobian matrix J, there is a negative real part, and its corresponding equilibrium point is a stable point; the equilibrium point corresponding to the real part is an unstable point. That is to say, when the eigenvalues are all negative, the corresponding equilibrium point is the evolutionary stability strategy of the system; when the eigenvalues are positive, the corresponding equilibrium points are unstable points [20]; when the eigenvalues are one negative two When positive or positive and negative, the corresponding equilibrium point is the saddle point.

For each of the three eigenvalue symbols of each point, it is impossible to have three eigenvalues being positive or negative at the same time, so the six equalization points are saddle points. Note that these six points will not become the equilibrium point of the system, no matter how the value of the system changes. The local stability of the boundary equilibrium point is analyzed. It is found that there are obviously eigenvalues that are not negative. For example, one of the eigenvalues is because, in the model hypothesis, each parameter is set to a positive value, it must not be an equilibrium point, and so on, and is not a system equilibrium point.

3.6.   Key Parameter Analysis

Combine these five boundary equilibrium points with real-world situations to find out the key parameters that influence the government, network platform and false public opinion makers' strategic choices:

3.6.1. Key Parameters Affecting Government Strategy Selection

Among the five boundary equilibrium points, the value in the middle is significantly less than 0, so it is not analyzed in this section. The comparison shows that in the case of false false producers choosing false reports, the key factor affecting the government's choice of "regulatory" strategy is the size of supervision costs, combined with the corresponding realistic scenario analysis, under the higher regulatory costs, namely the media quality of netizens. When the level is low, regardless of the strategy adopted by the network platform, the expected return of the government's choice of supervision is less than zero. Therefore, changing the government's strategy in the game system to the ideal state requires improving the media literacy level of netizens and weakening the breeding and spread of false information. Effectively reduce the cost of false supervision of the government's regulatory network.

3.6.2. Key Parameters Affecting the Choice of Network Platform Strategy

Among the five boundary equilibrium points, the value in the middle is significantly less than 0, so it is not analyzed in this section. The analysis of the remaining four boundary equilibrium points shows that the ideal state of the government and network platform should be supervision and control in the case where false public opinion makers choose false reports. In order to meet the conditions, the media quality level of netizens should be improved, and the audience of false information should be reduced while reducing the cost of platform review, which in turn reduces the revenue from the false information released by the media and the cost of the platform to audit false information. Secondly, the government should choose to increase the degree of punishment according to the strategy of the new media platform. If the platform controls false grievances, even if there is false grievances, it should be less severely penalized; on the other hand, if the platform is not controlled, it should be Heavy penalties allow the platform to choose a control strategy.

3.6.3. Key Parameters Affecting the Choice of the Makers of False Public Opinion

In the supervision of the false public opinion makers and the information review issued by them, the most ideal state should be: in this state, the government chooses not to supervise, the network platform chooses not to control, and the false public opinion maker chooses to standardize the reporting of news information, that is, no need Regulators make regulatory

strategies, false public opinion makers take the initiative to choose to report relevant information, the whole industry has embarked on the road of self-discipline, the decisive factor is that the false report's income is less than the normative report, that is, when the netizen's media literacy level is high, The higher recognition level of false information makes the false information audience narrow, and encourages false essay makers to consciously choose standardized reports to obtain long-term follow-up and affirmation of netizens. In the three boundary equilibrium points, regardless of whether the government and the platform are supervised or not, false false makers choose false reports. In order to avoid this, the punishment for false reports by false creators should be increased to make false grievances The expected return of the false report is less than 0, in order to increase the cost of false and sensational makers to provoke false lyrics and ensure the stability and harmony of the network environment.

4. Conclusion

By establishing a three-party evolutionary game model and adding the media literacy level as a regulation parameter, this paper analyzes the problems existing in the process of network false public opinion governance. The research shows that:

(1) The media literacy level of netizens plays a crucial role in the strategic choice of the participants in the false and public opinion governance of the network. The media literacy level of the netizens affects the cost of government supervision network information, the network platform controls the false public opinion cost, and the way that the false grievance makers and their affiliated platforms cause false public sentiment gains, which affects the strategic choice of the three parties to some extent.

(2) The more obvious the difference between the government and the network platform, the more the platform tends to choose the strategy of controlling false grievances. When there is false grievance in the platform, the government has less punishment for controlling the false lyrics of the online platform, and it has a greater punishment for the network platform that does not control the false grievances. It can effectively promote the cyber platform to consciously adopt a strategy of controlling false grievances.

(3) The punishment of the false information published by the false platform makers on the network platform can effectively avoid the false reporting strategy, but the decisive factor affecting the false public opinion publisher strategy is still the media quality level of the netizens.

According to the above research results, in order to improve the effectiveness of China's false information governance, we have the following management implications:

In the long run, we will play the role of government education, improve the media literacy level of netizens, and achieve long-term stability in the network society. In the new media era, everyone is the publisher and disseminator of information. The government should actively disseminate relevant knowledge to the majority of Internet users in the fields of law and science, and prepare for long-term guidance. Secondly, when a hot event occurs, the government should respond positively to gain the trust of netizens. On the one hand, it will improve the satisfaction of netizens with government administration. On the one hand, it will publicize the scientific knowledge behind the incident and guide netizens in a timely manner to view the development of events.

In the short term, the government should distinguish and widen the punishment for the control of false grievances on the network platform. The network platform should increase the punishment for false information makers to issue false information. The network platform has the responsibility and obligation to review the false information manufacturer's release of information, but driven by the interests, the network platform and the false public opinion

makers conspire to adopt a strategy of no control, so the network platform that does not control false grievances should be severely punished. In the new media era, the amount of information in the cyberspace is huge. Even if the network platform adopts a control strategy, a small number of false grievances can escape the supervision of the government and the platform to a certain extent. In this case, the government should impose certain penalties on the network platform as appropriate. , but should not be higher than the punishment of the platform when adopting the control strategy, thus urging the platform to adopt a control strategy to regulate the false public opinion makers to release real information. On the other hand, false essay makers publish false information in order to satisfy the needs of the audience in order to obtain illegal income. At this time, the penalty for false information issued by false creators should be increased, and the cost of false information by false essay makers should be increased. Therefore, the attention of the false information manufacturer to the information is directed to the rational audience to ensure the stability and harmony of the network space.

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