Evolutionary Analysis of Multi-party Dynamic Behaviors in Online Fundraising Models: A Post-print from a Tripartite Game Perspective

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Abstract

[Purpose / Significance] Internet fundraising is a new charitable donation model that has emerged in the "Internet Plus" era, but serious information asymmetry exists among participating entities due to its anonymity and concealment. [Method / Process] Based on a tripartite dynamic evolutionary game model, we construct an interactive game model among three behavioral agents—fundraising entities, internet fundraising platforms, and donors—to analyze the strategic behaviors, evolutionary trends, and equilibrium states of each game player in internet fundraising. [Results / Conclusion] By taking appropriate measures to control certain parameter values, the fundraising entity choosing to release authentic information, the internet fundraising platform choosing not to verify information, and the donor choosing to donate constitute the evolutionarily stable strategy of the game; the decision-making behaviors of multiple agents collectively influence the healthy development of internet fundraising. Therefore, we should construct a social mechanism for the collaborative action of multiple behavioral agents, establish a sound trust system, and work together to resolve the trust crisis in internet fundraising.

Full Text

Multi-player Dynamic Behavior Analysis in the Mode of Internet Donation—Based on Three-party Game Perspective

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Abstract

[**Purpose/Significance**] Internet donation is a new charitable donation model emerging in the "Internet+" era. However, its anonymity and concealment have led to severe information asymmetry among participating entities. [**Method/Process**] Based on a three-party dynamic evolutionary game model, this study constructs an interactive game model among three behavioral agents—donation subjects, internet donation platforms, and donors—to analyze strategic behaviors, evolutionary trends, and equilibrium states of each party in internet donation. [**Results/Conclusions**] By taking appropriate measures to control certain parameter values, the evolutionarily stable strategy of the game consists of donation subjects choosing to publish authentic information, internet donation platforms choosing not to verify information, and donors choosing to donate. The decision-making behaviors of multiple parties jointly influence the healthy development of internet donation. Therefore, we should construct a social mechanism for multi-party behavioral coordination, establish a sound trust system, and work together to resolve the trust crisis in internet donation.

Keywords: multi-player dynamic game; internet donation; evolutionary game; three-party game

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In the "Internet+" era, online donation has become a new form of charitable giving. This donation method has greatly improved public participation in charitable activities and is increasingly accepted by society. However, the inherent anonymity and concealment of online donation make it impossible to guarantee the authenticity of donation information, leading to frequent incidents of online fraud and deception that severely damage social trust. For instance, the Qingsongchou platform was originally established to help patients in need raise treatment funds quickly, yet it was exploited by ill-intentioned project initiators, resulting in incidents such as "a woman posting about her lavish lifestyle after fundraising"and "Lu Zhaoquan posting vacation photos from Malaysia."Another example is the Luo Yixiao incident in November 2016, where the individual involved, Luo Er, concealed partial truth and published a donation appeal via WeChat public platform, which was later exposed by the media as "bloody marketing." After the truth was disseminated through internet platforms, it attracted enormous social attention. According to a survey by the Zhiwei Event Platform, during the 12 days and 10 hours of the incident' s propagation, the average dissemination speed reached 78 posts/hour, with a peak speed of 692 posts/hour. The incident' s influence index reached 83.3, 34.7% higher than the average value of all events (see Figure 1 [Figure 1: see original paper]). Such extensive and high-level public attention led Xinhua News Agency to comment that the incident "corrupted the trust of the entire society."

Thus, due to the anonymity and concealment of the internet, serious information asymmetry exists among participants in internet donation. Based on this, this

paper constructs a multi-party dynamic evolutionary game model among three behavioral agents—donation subjects, internet donation platforms, and donors—uses replicator dynamic equations to obtain critical conditions for equilibrium, analyzes the strategic behaviors, evolutionary trends, and equilibrium states of each party in internet donation, and further employs Jacobian matrix analysis to examine evolutionary stability. The paper proposes a mechanism for multi-party coordination to build social trust and promote collaborative efforts to resolve the social trust crisis in internet donation.

1. Related Literature Review and Commentary

Western countries began applying the internet earlier, and relevant research literature on internet donation emerged as early as the late 20th century. P. Barber traced the management of charitable solicitation in the United States since 1954, noting that online donation began in the 1990s and became an important resource support pathway for nonprofit activities. S. D. Phillips, analyzing the evolution of charitable solicitation in Canada from regulation to co-governance and good governance, also pointed out that in an increasingly competitive environment, more charitable organizations are using the internet to compete for limited funds, and the internet is changing the nature of solicitation.

Regarding research on internet donation regulation, T. Onishi noted that the internet has changed the interactive relationship characteristics between charitable organizations and donors formed by traditional face-to-face solicitation methods, and while bringing benefits to charity, it also presents new challenges for legislators in regulating online donation. In terms of internet donation operation mechanisms, Wang Guohua and Zhang Xiaoguang classified network donation operation mechanisms into three categories—"enterprise advocacy type,""network spontaneous type," and "charitable organization-led type" —based on the characteristics of donation subjects. Li Dan et al. mentioned the "third-party donation model," which uses third-party B2C business models to achieve supervision of online donation platforms. In research on problems in internet donation, Ke Fenghua and Wang Miao analyzed the current situation and problems of online donation using governance theory and proposed solutions. Wang Dan et al. identified the main problems in China' s online donation as difficulty in confirming donation subjects, distinguishing true from false donation information, disclosing donation information, evaluating aid effectiveness, and lack of supervision. Ye Tuo pointed out that supervision of internet information platforms should be strengthened promptly to clarify responsibilities among civil affairs, internet information content management, telecommunications management, and other departments. Li Ying noted that due to the complexity and virtuality of the internet, some citizens naturally harbor distrust, which is amplified by fraud and deception behaviors.

In research on internet donation supervision, Li Cheng proposed starting from the government perspective, highlighting government regulatory responsibilities, establishing a "relatively independent" regulatory agency to effectively guide

and regulate online donation behaviors, public reporting behaviors, and charitable organization activities. Zhang Xiaoling explored diversified regulatory path choices for public welfare online donation from the perspective of government-society co-governance. Chen Wanting suggested guiding and motivating more regulatory entities to participate in online donation behaviors and conducting third-party supervision and evaluation of online donation platforms and organizations.

It can be seen that an increasing number of scholars have begun to focus on internet donation as a new donation model. However, most literature still concentrates on macro-level research regarding management operation models or related legislative issues of internet donation. There is limited literature examining strategic behavior choices of participating agents from a micro perspective, especially from a three-party game perspective.

Three-party game theory has been applied in other academic fields, providing a foundation for this study. In internet donation, severe information asymmetry exists among donation subjects, internet donation platforms, and donors, affecting the healthy development of internet donation. False information released by donation subjects leads to distrust among donors toward both those seeking help and information release platforms. Due to the rapid dissemination effect of internet platforms, this distrust is quickly amplified and diffused, triggering a public trust crisis in society as a whole. To study how the strategic behaviors of various parties affect the development of internet donation, this paper employs three-party evolutionary game theory to construct a three-party dynamic game model among donation subjects, internet donation platforms, and donors, and uses Jacobian matrix analysis to examine evolutionary stability. This research method intuitively demonstrates how the joint changes in decision-making behaviors of multiple participants affect internet donation and further analyzes the development direction of internet donation under different behavioral actions through model analysis. This approach not only overcomes the limitations of previous studies that only analyzed two-party game modeling but also provides guidance for promoting the healthy development of internet donation.

2. Model Construction

2.1 Definition of Game Subjects

The actors participating in internet donation, i.e., the game subjects, mainly include donation subjects, internet donation platforms, and donors. Here we provide definitions for these three game subjects:

1. **Donation Subject:** According to the "Basic Technical Specifications for Internet Public Fundraising Information Platforms of Charitable Organizations" and "Basic Management Specifications for Internet Public Fundraising Information Platforms of Charitable Organizations" issued by the Ministry of Civil Affairs on July 20, 2017, the subject conducting

fundraising on platforms should be charitable organizations that have obtained public fundraising qualifications.

2. **Internet Donation Platform:** A network service provider that releases public fundraising information for charitable organizations with public fundraising qualifications via the internet.

3. **Donor:** Natural persons, legal persons, or other organizations that voluntarily and gratuitously participate in charitable activities by donating property to charitable organizations for charitable purposes.

2.2 Research Hypotheses

To objectively analyze the decision-making behaviors and interactive relationships among donation subjects, internet donation platforms, and donors, this paper makes the following three basic research hypotheses:

1. **Bounded Rationality Behavior of Donation Subjects.** Considering their own interests, donation subjects may not release authentic donation information when submitting fundraising applications, instead choosing to exaggerate or distort information, or even release false information. The behavioral decision-making of donation subjects to obtain maximum donation benefits aligns with their need to maximize self-interest and constitutes bounded rational behavior.

2. **Bounded Rationality Behavior of Internet Donation Platforms.** When donation subjects submit fundraising applications, internet donation platforms may choose not to verify released information to gain public attention, leading to the dissemination of inauthentic or even false information in cyberspace. The behavioral decision-making of internet donation platforms to increase public attention through fundraising events aligns with their need to maximize self-interest and also constitutes bounded rational behavior.

3. **Bounded Rationality Behavior of Donors.** When facing internet donation events, donors mainly choose to understand information authenticity through internet donation platforms or other online media platforms. Due to information asymmetry, donors may adopt non-donation behaviors toward authentic donation information under the guidance of donation information or through the push of online public opinion, yet issue donations to false donation information, as seen when numerous netizens donated to Luo Yixiao. Thus, donor behavioral decision-making in the internet donation model also constitutes bounded rational behavior.

2.3 Game Strategies and Model Construction

In internet donation, donation subjects, internet donation platforms, and donors all make corresponding behavioral decisions based on their own interests.

1. **Donation Subject:** The behavioral strategies of donation subjects can be divided into "publish authentic information" and "publish false information." Assume the probability that donation subjects choose "publish authentic information" is: x, $x \in [0,1]$. When donation subjects choose "publish authentic information" and obtain donations, they receive trust benefits from the public. The trust benefit obtained by donation subjects whose authentic information is verified is defined as parameter T_1. Similarly, internet donation platforms also receive trust benefits from the public for verifying authentic help-seeking information and exposing false help-seeking information, defined as T_2 and T_3 respectively.
2. **Internet Donation Platform:** As a network service provider for information release, internet donation platforms can choose between two behavioral strategies: "verify information" and "not verify information." Assume the probability that internet donation platforms "verify information" is: y, $y \in [0,1]$. When platforms verify donation information, they fulfill review and regulatory responsibilities and receive trust benefits from the public.
3. **Donor:** Due to information asymmetry, donors can choose between "donate"or "not donate"strategies. Assume the probability that donors choose the "donate" strategy is: z, $z \in [0,1]$.

The decision-making interaction problem among the three behavioral agents is a dynamic game problem. A multi-party dynamic game model can be constructed to describe the strategy selection process of the three parties, as shown in Figure 2 [Figure 2: see original paper].

2.3.1 Parameters and Payoff Matrix The decision-making behaviors of each game subject significantly impact social public trust. Therefore, three trust parameters are introduced here. The parameters and other definitions in the dynamic game among all parties are shown in Table 1 and Table 2 respectively.

Table 1. Multi-party game payoff matrix for donation subject–internet donation platform–donor

(Donation Subject, Internet Donation Platform, Donor)	Payoff
(Publish authentic information, Verify information, Donate)	$(U_1 + U_2 + T_1 - u, W + T_2 - w, R_1 + R_2 - r)$
(Publish authentic information, Verify information, Not donate)	$(U_1 + T_1 - u - a_1, T_2 - w, 0)$
(Publish authentic information, Not verify information, Donate)	$(U_1 + U_2, W, R_1 + R_2 - r)$
(Publish authentic information, Not verify information, Not donate)	$(U_1 - a_1, 0, 0)$

(Donation Subject, Internet Donation Platform, Donor)	Payoff
(Publish false information, Verify information, Not donate)	$(U_1 - a_2, T_3 - w, R_4)$
(Publish false information, Not verify information, Donate)	$(U_1 + U_2 - a_3, W - t, R_1 - R_3 - r)$
(Publish false information, Not verify information, Not donate)	$(U_1, 0, R_4)$

Table 2. Parameter definitions

Parameter	Definition
U_1	Normal benefit obtained by donation subjects through releasing donation information via internet donation platforms
U_2	Additional benefit obtained by donation subjects through receiving donations via internet donation platforms
u	Cost paid by donation subjects through platform review
T_1	Social trust benefit obtained by donation subjects publishing authentic information whose information is verified
a_1	Loss borne by donation subjects publishing authentic information due to failure to obtain donor trust and donations, leading to inability to raise sufficient funds and delayed treatment or project progress
a_2	Economic or legal penalties imposed on donation subjects publishing false information after being discovered
a_3	Risk of public condemnation and denunciation borne by donation subjects publishing false information
W	Positive economic and social benefits obtained by internet donation platforms for facilitating donations
T_2	Social trust benefit obtained by internet donation platforms for verifying authentic information

Parameter	Definition
T_3	Additional social trust benefit obtained by internet donation platforms for exposing false information
w	Cost paid by internet donation platforms for reviewing donation information
t	Risk of public condemnation and denunciation borne by internet donation platforms for not verifying false information
R_1	Normal benefit obtained by donors through donating to donation subjects via internet donation platforms
R_2	Additional benefit obtained by donors through donating to donation subjects publishing authentic information
R_3	Negative benefit including monetary loss and psychological gap experienced by donors due to donating to donation subjects publishing false information
R_4	Additional benefit obtained by donors for not donating to donation subjects publishing false information
r	Cost paid by donors for donating to donation subjects via internet donation platforms

2.3.2 Replicator Dynamic Equations of the Evolutionary Game Model
Assume the benefit of donation subjects choosing the "publish authentic information" strategy is U_{11}, the benefit of choosing the "publish false information" strategy is U_{12}, and the average expected benefit of donation subjects is $\bar{U}_1$. The benefit of internet donation platforms choosing the "verify information" strategy is U_{21}, the benefit of choosing the "not verify information" strategy is U_{22}, and the average expected benefit of internet donation platforms is $\bar{U}_2$. The benefit of donors choosing the "donate" strategy is U_{31}, the benefit of choosing the "not donate" strategy is U_{32}, and the average expected benefit of donors is $\bar{U}_3$.

(1) Benefit analysis of donation subjects. From the following formulas, we can calculate the average benefit of donation subjects:

$$\bar{U}_1 = xU_{11} + (1-x)U_{12}$$

The replicator dynamic equation for donation subjects choosing to publish authentic information is:

$$F(x) = \frac{dx}{dt} = x(U_{11} - \bar{U}_1) = x(1-x)(U_{11} - U_{12})$$

Three cases are analyzed below:

- When $T_1 - u + a_2 + z(U_2 - a_3) = 0$, $F(x) \equiv 0$, and any value of x is a stable state.
- When $T_1 - u + a_2 + z(U_2 - a_3) > 0$, if $z > \frac{u-a_2}{U_2-a_3}$, then $F'(0) < 0$ and $F'(1) < 0$. At this point, $x = 1$ is an evolutionarily stable strategy, meaning donation subjects choose "publish authentic information."If $z < \frac{u-a_2}{U_2-a_3}$, then $F'(0) < 0$ and $F'(1) < 0$. At this point, $x = 0$ is an evolutionarily stable strategy, meaning donation subjects choose "publish false information."
- When $T_1 - u + a_2 + z(U_2 - a_3) < 0$, if $z > \frac{u-a_2}{U_2-a_3}$, then $F'(0) < 0$ and $F'(1) < 0$. At this point, $x = 1$ is an evolutionarily stable strategy, meaning donation subjects choose "publish authentic information."If $z < \frac{u-a_2}{U_2-a_3}$, then $F'(0) < 0$ and $F'(1) < 0$. At this point, $x = 0$ is an evolutionarily stable strategy, meaning donation subjects choose "publish false information."

Note: Figure 3 [Figure 3: see original paper] shows the replicator dynamic phase diagram when $T_1 - u + a_2 + z(U_2 - a_3) > 0$. When $T_1 - u + a_2 + z(U_2 - a_3) < 0$, the diagram is similar.

(2) Benefit analysis of internet donation platforms. From the following formulas, we can calculate the average benefit of internet donation platforms:

$$\bar{U}_2 = yU_{21} + (1-y)U_{22}$$

The replicator dynamic equation for internet donation platforms choosing to verify information is:

$$F(y) = \frac{dy}{dt} = y(U_{21} - \bar{U}_2) = y(1-y)(U_{21} - U_{22})$$

Three cases are analyzed below:

- When $T_2 - T_3 + z(W - t) = 0$, $F(y) \equiv 0$, and any value of y is a stable state.

- When $T_2-T_3+z(W-t)>0$, if $x>\frac{w-T_3}{T_2-T_3}$, then $F'(0)<0$ and $F'(1)<0$. At this point, $y=1$ is an evolutionarily stable strategy, meaning internet donation platforms choose "verify information."If $x<\frac{w-T_3}{T_2-T_3}$, then $F'(0)<0$ and $F'(1)<0$. At this point, $y=0$ is an evolutionarily stable strategy, meaning internet donation platforms choose "not verify information."
- When $T_2-T_3+z(W-t)<0$, if $x>\frac{w-T_3}{T_2-T_3}$, then $F'(0)<0$ and $F'(1)<0$. At this point, $y=1$ is an evolutionarily stable strategy, meaning internet donation platforms choose "verify information."If $x<\frac{w-T_3}{T_2-T_3}$, then $F'(0)<0$ and $F'(1)<0$. At this point, $y=0$ is an evolutionarily stable strategy, meaning internet donation platforms choose "not verify information."

Note: Figure 4 [Figure 4: see original paper] shows the replicator dynamic phase diagram when $T_2-T_3+z(W-t)>0$. When $T_2-T_3+z(W-t)<0$, the diagram is similar.

(3) Expected benefit analysis of donors. From the following formulas, we can calculate the average benefit of donors:

$$\bar{U}_3=zU_{31}+(1-z)U_{32}$$

The replicator dynamic equation for donors choosing to donate is:

$$F(z)=\frac{dz}{dt}=z(U_{31}-\bar{U}_3)=z(1-z)(U_{31}-U_{32})$$

Three cases are analyzed below:

- When $R_1+R_2-r-(1-x)(1-y)(R_1-R_3-r-R_4)=0$, $F(z)\equiv 0$, and any value of z is a stable state.
- When $R_1+R_2-r-(1-x)(1-y)(R_1-R_3-r-R_4)>0$, if $x>\frac{R_1-R_3-r-R_4}{R_1-R_3-r-R_4+y(R_1-R_3-r-R_4)}$, then $F'(0)<0$ and $F'(1)<0$. At this point, $z=1$ is an evolutionarily stable strategy, meaning donors choose "donate."
- When $R_1+R_2-r-(1-x)(1-y)(R_1-R_3-r-R_4)<0$, if $x<\frac{R_1-R_3-r-R_4}{R_1-R_3-r-R_4+y(R_1-R_3-r-R_4)}$, then $F'(0)<0$ and $F'(1)<0$. At this point, $z=0$ is an evolutionarily stable strategy, meaning donors choose "not donate."

Figure 5 [Figure 5: see original paper] shows the replicator dynamic phase diagram for donor strategy evolution.

2.4 Evolutionary Stability Analysis

Based on the above replicator dynamic equation analysis, we can see that the strategy choices of game subjects will change over time under certain dynamic conditions, thereby altering evolutionary equilibrium points. However, which

equilibrium point the dynamic process will tend toward depends on the initial state of the strategy proportion adopted by the game parties and the positive/negative conditions of the dynamic differential equations in the corresponding intervals. Therefore, the Jacobian matrix can be used to analyze the local stability of each equilibrium point and find stable points that enable the game to reach a continuously stable state.

According to stability analysis, if a certain proportion is stable, then this proportion corresponds to an evolutionarily stable strategy (ESS). Further, according to J. Hirshleifer, an evolutionarily stable strategy z^* must be such a stable point: given a small perturbation to this stable point, the replicator dynamics will still restore it to z^*. According to the stability theorem of differential equations, the Jacobian matrix is constructed to judge the evolutionary stability of equilibrium points. Only when the determinant $DetJ > 0$ and trace $TrJ < 0$ of the Jacobian matrix does the point have local stability. Such a dynamically stable equilibrium point is the evolutionary equilibrium.

The Jacobian matrix for this game problem can be obtained as:

$$J = \begin{pmatrix} \frac{\partial F(x)}{\partial x} & \frac{\partial F(x)}{\partial y} & \frac{\partial F(x)}{\partial z} \\ \frac{\partial F(y)}{\partial x} & \frac{\partial F(y)}{\partial y} & \frac{\partial F(y)}{\partial z} \\ \frac{\partial F(z)}{\partial x} & \frac{\partial F(z)}{\partial y} & \frac{\partial F(z)}{\partial z} \end{pmatrix}$$

If donation subjects choose "publish false information" and internet donation platforms choose "verify information," then donors will definitely not choose the "donate" strategy. Therefore, excluding $(0, 1, 1)$, this game has 7 equilibrium points. Substituting each equilibrium point yields:

- When $E_1 = (0, 0, 0)$: $DetJ_1 = -a_1(T_3 - w)(R_1 - R_3 - r - R_4)$, $TrJ_1 = -a_1 + (T_3 - w) + (R_1 - R_3 - r - R_4)$
- When $E_2 = (0, 0, 1)$: $DetJ_2 = -a_3(T_3 - w - W + t)(R_1 - R_3 - r - R_4)$, $TrJ_2 = a_3 + (T_3 - w - W + t) + (R_1 - R_3 - r - R_4)$
- When $E_3 = (0, 1, 0)$: $DetJ_3 = (T_1 - u + a_2 - a_1)(T_3 - w)R_4$, $TrJ_3 = (T_1 - u + a_2 - a_1) - (T_3 - w) - R_4$
- When $E_4 = (1, 0, 0)$: $DetJ_4 = a_1(T_2 - w)(R_1 + R_2 - r)$, $TrJ_4 = a_1 + (T_2 - w) + (R_1 + R_2 - r)$
- When $E_5 = (1, 0, 1)$: $DetJ_5 = a_3(T_2 - w)(R_1 + R_2 - r)$, $TrJ_5 = -a_3 + (T_2 - w) - (R_1 + R_2 - r)$
- When $E_6 = (1, 1, 0)$: $DetJ_6 = (T_1 - u + a_2 - a_1)(T_2 - w)(R_1 + R_2 - r)$, $TrJ_6 = -(T_1 - u + a_2 - a_1) - (T_2 - w) + (R_1 + R_2 - r)$
- When $E_7 = (1, 1, 1)$: $DetJ_7 = -(T_1 - u + a_2 + U_2)(T_2 - w)(R_1 + R_2 - r)$, $TrJ_7 = -(T_1 - u + a_2 + U_2) - (T_2 - w) - (R_1 + R_2 - r)$

Analyzing the payoff matrix, we obviously have: (1) $T_2 - w > 0$, $T_3 - w > 0$, $R_1 + R_2 - r > 0$, $R_1 - R_3 - r < 0$; (2) When donation subjects choose "publish false information"$(x = 0)$, regardless of donors'strategy choices, the benefit of internet donation platforms choosing "verify information"should be greater than choosing

"not verify information," i.e., $T_3 - w - W + t > 0$; (3) Similarly, when internet donation platforms choose "verify information" ($y = 1$), regardless of donors' strategy choices, the benefit of donation subjects choosing "publish authentic information" should be greater than choosing "publish false information," i.e., $T_1 - u + a_2 + U_2 > 0$, $T_1 - u + a_2 - a_1 > 0$.

Based on Jacobian matrix analysis for stability determination of equilibrium points, the results are shown in Table 3 .

Table 3. Stability determination of equilibrium points in the evolutionary game model

Equilibrium Point	Det J Sign	Tr J Sign
$(0, 0, 0)$	+	To be further analyzed
$(0, 0, 1)$	-	To be further analyzed
$(0, 1, 0)$	+	To be further analyzed
$(1, 0, 0)$	-	To be further analyzed
$(1, 0, 1)$	+	To be further analyzed
$(1, 1, 0)$	-	To be further analyzed
$(1, 1, 1)$	-	To be further analyzed

From Table 3, although the evolutionarily stable point of the game cannot yet be determined, when the equilibrium points are $(1, 1, 0)$ and $(1, 1, 1)$, the determinant $DetJ < 0$, indicating these equilibrium points are saddle points. This shows that selecting these two strategy combinations, while unable to make the game reach an evolutionarily stable state, places the game in a locally stable state. However, if subjected to small external influences, the game will tend toward opposite strategies, causing overall stability fluctuations. Meanwhile, equilibrium points $(0, 0, 1)$ and $(1, 0, 0)$ are unstable evolutionary points.

2.5 Guiding Significance of the Model

From Table 3, although the evolutionarily stable point cannot yet be determined, three equilibrium points—$(0, 0, 0)$, $(0, 1, 0)$, and $(1, 0, 1)$—have $DetJ > 0$, while TrJ requires further analysis. Analyzing the strategy combinations, among the three strategy combinations, $(1, 0, 1)$ represents donation subjects choosing "publish authentic information,"internet donation platforms choosing "not verify information,"and donors choosing "donate."Obviously, this strategy combination is more conducive to the healthy development of internet donation. Therefore, if we hope this strategy combination can constitute an evolutionarily stable strategy of the game, we need to further satisfy the condition $TrJ_5 < 0$, i.e., $TrJ_5 = -a_3 + (T_2 - w) - (R_1 + R_2 - r) < 0$.

From formula analysis, the following measures can be taken:

1. **Reduce the value of r.** Minimize the cost paid by donors for donating to donation subjects via internet donation platforms. In practice, the cost

for donors to conduct fundraising through network platforms is not high —in many cases, the fundraising cost is basically zero.

2. **Increase the values of R_1, R_2, and a_3.** R_1 represents the normal benefit obtained by donors through donation, which can be understood as the return donors receive after donating. For example, the government can adopt tax reduction measures for enterprises or individuals who donate, or commend and award donors to increase their donation returns. R_2 represents the additional benefit obtained by donors through donating to authentic donation subjects, which can be understood as the psychological satisfaction donors receive after donating. For instance, internet platforms can promptly disclose to donors the usage progress, destination, and list of donated funds to satisfy donors' right to know and monitor, thereby increasing their psychological satisfaction. a_3 represents the risk of public condemnation and denunciation borne by donation subjects publishing false information. Increasing a_3 means strengthening supervision of internet donation by social media or the public. Introducing supervision from all sectors of society on internet donation and increasing the social condemnation faced by false donation subjects will help promote equilibrium point $(1, 0, 1)$ to constitute an evolutionary stable point of the game.

3. Conclusions and Recommendations

From the above game model analysis, compared with traditional two-party game models, the dynamic evolutionary game based on a three-party perspective considers the joint effects of decision-making behaviors of donation subjects, internet donation platforms, and donors, better reflecting how the behavioral choices of multiple participating subjects involved in internet donation affect the development direction of donation. If the government or relevant regulatory agencies take appropriate measures to control the values of certain parameters—such as increasing donors' donation returns and strengthening supervision of internet donation by social media or the public—this will help form a benign operation mechanism for internet donation where donation subjects choose to publish authentic information, donation platforms choose not to verify information, and donors choose to donate.

Based on this, we argue that it is necessary to construct a social mechanism for multi-party behavioral coordination, establish a sound trust system, and work together to effectively guarantee the healthy development of internet donation.

1. **Civil affairs departments and regulatory agencies at all levels should review the qualification of donation subjects for help-seeking and establish a "trustworthiness list."** Regulatory departments should accelerate the establishment of an internet trustworthiness system, create a "trustworthiness list" for donation subjects publishing authentic information, place donation subjects publishing false information on a "blacklist," and regularly disclose this to the public to eliminate

online fraud and deception at the source.

2. **Internet donation information platforms should strengthen internal management and ensure transparent and open donation information.** Internet donation platforms themselves should enhance their ability to review and screen donation information, help donors obtain comprehensive information and accurately judge its authenticity. Simultaneously, they should develop and establish a donation information tracking database to continuously disclose the usage progress, destination, and list of donated funds, satisfying donors' right to know and monitor, and enhancing trust in internet donation platforms and public welfare organizations among donors and the general public.

3. **Donors and the general public should actively participate in supervising internet donation, assist the government and civil affairs departments in improving the operation of internet donation, and establish a universal supervision management mechanism.** Through the power of media and all sectors of society, we can jointly promote the healthy development of internet donation.

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Author Contributions

Bin Ning: Determined the paper framework, wrote, revised, and finalized the manuscript;
Ke Xiaoping: Conducted data collection and analysis, wrote and revised the paper;
Tan Guoqi: Conducted data collection and analysis, revised the paper.

Note: Figure translations are in progress. See original paper for figures.