Research on the Mechanisms of News Communication in Food Safety Regulation

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Abstract: The influence of the media on food safety regulation has undergone significant changes compared to traditional media, and this influence has a dual nature. Faced with fraudulent practices by food companies, this paper constructs an evolutionary game model to study the impact of two major factors, the influence and authenticity of media reporting, on the strategic choices of government regulatory agencies and food companies. The conclusion shows that in the public opinion environment shaped by the media, government regulatory agencies and food companies will change their original strategic choices. Effective and accurate media supervision can effectively constrain fraudulent behavior by food companies and encourage the government to fulfill its regulatory duties. If the authenticity of media reports is low, it not only hinders effective government regulation but also provides opportunities for food companies to engage in fraudulent activities. Therefore, the government should not only vigorously develop the media but also strengthen the regulation and management of the media.

Keywords: News Communication; Media; Food Safety; Regulation; Game

1. Introduction

With the comprehensive opening of the Internet era, the 'Internet+' model has emerged, and e-commerce has become a new business model. According to the 47th China Internet Development Status Report, as of December 2020, there were 419 million online food delivery users in China, an increase of 21.3 million compared to March 2020, accounting for 42.3% of the total internet users; mobile online food delivery users reached 418 million, an increase of 21.06 million compared to March 2020, accounting for 42.4% of mobile internet users.

As e-commerce platforms have expanded and penetrated, coupled with the new model of agricultural product sales involving regional warehouses and live broadcasts [1], the combination of food and the internet has rapidly changed the public's consumption habits, offering convenience, efficiency, flexibility, and a touch of trendiness [2]. This transformation has led many traditional food companies to transition to the internet, reshaping public consumption patterns [3]. However, while online food business scales expand rapidly, the market entry barriers are low, operating locations are not fixed, and it is challenging to control processing and transportation. This has led to an increase in various food safety risks [4]. The uncertainty of food safety is on the rise. The ever-changing online transaction environment has driven the rapid development of online food businesses, while traditional food safety regulatory models are difficult to adapt, leading to significant differences between the two and becoming a challenge and bottleneck in online food safety regulation [5].

With the gradual increase in the level of social development in China, people have become increasingly concerned about food safety issues. In October 2015, the revised "Food Safety Law of the People's Republic of China" established the principle of "social governance" for food safety risks, providing a legal basis for achieving social governance of food safety [6]. In recent years, under the pressure of market competition, many food producers have relaxed their safety checks to enhance production efficiency, resulting in a continuous stream of various food safety issues [7]. In various food safety incidents, the news media has played a crucial role. Generally, the average person has difficulty accessing information about the food production process, and various food safety issues often come to the public's attention only after being widely reported by the news media. Therefore, it can be seen that there is a deep and intricate relationship between news communication and food safety issues [8]. Exploring the role of news in the food safety regulation mechanism is of paramount importance for understanding food safety.

2. Problem Description and Model Assumptions

The game model established in this paper involves three main entities: food companies, government regulatory agencies, and media. The government regulatory agencies act as food safety supervision authorities and oversee food companies through various means such as sampling inspections and entry controls. The media serves as a third-party monitoring entity and primarily conveys information related to food company behavior to the general public through reporting on food safety issues, thereby playing a role in supervising food companies. Food companies, on the other hand, determine their food safety behavior based on their cost-benefit analysis and the regulatory and supervisory environment. This behavior can either strictly adhere to relevant food safety laws and regulations (including production or distribution) to provide quality and safe food or, under the influence of economic interests, engage in non-compliant behavior by supplying unsafe food. All three entities are assumed to have bounded rationality based on real-world situations. Based on the analysis of the costs and benefits of the relevant food safety behaviors of these three entities (measured in the same currency unit), the following assumptions are proposed:

Assumption 1: Each of the food companies, government regulatory agencies, and the media have two corresponding strategies for their respective food safety behaviors. Food companies have two strategies: one is to supply quality and safe food with a probability denoted as xand the other is to supply unsafe food with a probability denoted as $1-x$. Government regulatory agencies have two strategies for monitoring food companies: one is strict oversight with a probability denoted as y, and the other is relaxed oversight with a probability denoted as $1-y$. The media has two strategies for supervising food companies: one is to expose relevant food safety issues with a probability denoted as z, and the other is not to expose relevant food safety issues with a probability denoted as $1-z$. Here, $0 \leq x, y, z \leq 1$.

Assumption 2: The cost incurred by a food company for supplying quality and safe food is denoted as C_1 , while the cost for supplying unsafe food is denoted as C_2, where $C_2 < C_1$. The revenue obtained by a food company from supplying food is represented as R. . The net profit for supplying quality and safe food is denoted as $R_1 = R - C_1$, and the net profit for supplying unsafe food is $R_2 = R - C_2$. If a food company supplying unsafe food is detected by government regulatory agencies, it incurs a fine denoted as F_1 . Additionally, if the media exposes food safety issues related to the food company, the company suffers economic losses, including damage to its reputation, denoted as F_2.

Assumption 3: The cost incurred by government regulatory agencies for supervising food companies is denoted as C_3. The cost incurred by government regulatory agencies for investigating and responding to media-exposed food safety issues is denoted as C_4. The benefit received by government regulatory agencies, such as gaining public trust and credibility in society, as a result of addressing food safety issues is represented as R_3 . If government regulatory agencies relax their oversight of food companies and the media exposes food safety issues, the loss incurred by government regulatory agencies due to damage to their credibility is denoted as F_3 . Based on the increased importance placed on food safety by the public, it is assumed that $C_4 < aF_3$, indicating that influential media exercising oversight has a greater benefit when government regulatory agencies address exposed issues.

Assumption 4: Media, as a third-party monitoring entity, incurs costs primarily from gathering information related to exposing food safety issues. The benefits resulting from media exposure of such issues include increased attention (e.g., higher website click rates) and enhanced reputation value due to increased public trust. The revenue obtained by the media from exposing food safety issues (economic benefits converted from increased attention and public trust) is denoted as R_4, and the cost of media exposure of food safety issues is represented as C_5. If a food safety issue exposed by the media is found to be false (such as fake news), the media incurs a loss to its own reputation, denoted as F_4. If a food company supplies unsafe food while government regulatory agencies strictly oversee it, and the media does not expose this, the loss of credibility incurred by the media is denoted as F_5 . It is assumed that the degree of media exposure's impact is a, where $0 \leq a \leq 1$, and the probability of the truthfulness of media exposure of food safety issues is b, where $0 \leq b \leq 1$.

Assumption 5: When a food company supplies quality and safe food, and the media exposes food safety issues related to the company, the losses incurred are as follows: the food company incurs a loss of $(1-b)aF_2$, government regulatory agencies incur a loss of $a(1-b)F_3$, and the media incurs a loss of aF_4. When a food company supplies unsafe food, and the media exposes food safety issues related to the company, the losses incurred are as follows: the food company incurs a loss of abF_2 , government regulatory agencies incur a loss of abF_3, and the media incurs a loss of aF_5. The specific meanings of all variables are shown in Table 1.

Table 1. Parameter Symbols and Meanings

Parameter Symbol	Meaning and Description
x	Probability of a food company supplying quality and safe food, where $0 \leq x \leq 1$
y	Probability of government regulatory agencies strictly overseeing food companies, where $0 \leq y \leq 1$
z	Probability of the media exposing food safety issues related to food companies, where $0 \leq z \leq 1$
R	Revenue obtained by a food company from supplying food
R_1	Net profit for a food company supplying quality and safe food
R_2	Net profit for a food company supplying unsafe food
R_3	Benefit obtained by government regulatory agencies from addressing food safety issues in food companies
R_4	Revenue obtained by the media from exposing food safety issues related to food companies
C_1	Cost incurred by a food company for supplying quality and safe food
C_2	Cost incurred by a food company for supplying unsafe food
C_3	Cost incurred by government regulatory agencies for supervising food companies
C_4	Cost incurred by government regulatory agencies for investigating and responding to media-exposed food safety issues
C_5	Cost incurred by the media for exposing food safety issues
F_1	Fine paid by a food company supplying unsafe food when detected by government regulatory agencies
F_2	Economic loss suffered by a food company if the media exposes corresponding food safety issues
F_3	Loss incurred by the government after media exposure (reputation, credibility, etc.)
F_4	Loss incurred by government regulatory agencies due to damage to their credibility, etc.
F_5	Loss of credibility incurred by the media for not exposing actual food safety issues
a	Impact factor of media exposure, where $0 \leq a \leq 1$
b	Probability of the truthfulness of media exposure of food safety issues, where $0 \leq b \leq 1$

3. Equilibrium Strategy Analysis of the Game Model

Based on the assumptions mentioned above, the payoff matrix for media, government regulatory agencies, and food companies under different strategies is shown in Table 2.

3.1 Evolutionarily Stable Strategies for Food Companies

Based on Table 2, we can derive the expected profits for food companies as follows:

The expected profit for a food company supplying quality and safe food is $E_{a1} = R_1 - za(1-b)F_2$. Therefore, the expected profit for supplying unsafe food is $E_{a2} = R_2 - yF_1 -$

$zabF_2$. Hence, the average expected profit for food companies is $E_a = xE_{a1} + (1-x)E_{a2}$.

Replicator Dynamics Equations for Food Companies:

$$G_{(x)} = x(E_{a1} - E_a) = x(1-x)[R_1 - R_2 + yF_1 + (2b-1)zaF_2] \quad (1)$$

Analysis of Stable Strategies for Food Companies:

$$G'_{(x)} = (1-2x)[R_1 - R_2 + yF_1 + (2b-1)zaF_2] \quad (2)$$

Table 2. Payoff Matrix for Media, Government Regulatory Agencies, and Food Companies in the Game

Strategy		Media	Government Regulatory Agencies	
			Strict Oversight	Relaxed Oversight
Food Companies	Supply Quality and Safe Food	Exposure	$R_1 - a(1-b)F_2$	$R_1 - a(1-b)F_2$
			$R_3 - C_3 - C_4$	$-a(1-b)F_3$
			$R_4 - C_5 - aF_4$	$R_4 - C_5 - aF_4$
		No Exposure	R_1	R_1
			$R_3 - C_3$	0
			0	0
	Supply Unsafe Food	Exposure	$R_2 - abF_2 - F_1$	$R_2 - abF_2$
			$R_3 - C_3 - C_4 + F_1$	$-abF_3$
			$R_4 - C_5$	$R_4 - C_5$
		No Exposure	$R_2 - F_1$	R_2
			$R_3 - C_3 + F_1$	0
			$-C_5 - aF_5$	$-C_5$

Regarding the stability of strategies for food companies, the discussion of relevant parameters is as follows: when $0 < y \leq \frac{R_2 - R_1}{F_1}$, $b > \frac{1}{2}$ or $\frac{R_2 - R_1}{F_1} \leq y < 1$, $b < \frac{1}{2}$, we have $\frac{R_2 - R_1 - yF_1}{(2b-1)zF_2} \geq 0$. When $0 \leq y \leq \frac{R_2 - R_1 + zaF_2}{F_1}$, we have $\frac{R_2 - R_1 - yF_1 + zaF_2}{2zaF_2} \geq 0$.

From this, we can conclude:

(1) When $0 < y \leq \frac{R_2 - R_1}{F_1}$, $b > \frac{1}{2}$, the following scenarios arise:

a. When $a = \frac{R_2 - R_1 - yF_1}{(2b-1)zF_2}$ and $b = \frac{R_2 - R_1 - yF_1 + zaF_2}{2zaF_2}$, all values of x are evolutionarily stable.

b. When $a > \frac{R_2 - R_1 - yF_1}{(2b-1)zF_2}$ and $b > \frac{R_2 - R_1 - yF_1 + zaF_2}{2zaF_2}$, $x = 1$ is the evolutionarily stable strategy, meaning that food companies tend to supply quality and safe food.

c. When $a < \frac{R_2 - R_1 - yF_1}{(2b-1)zF_2}$ and $b < \frac{R_2 - R_1 - yF_1 + zaF_2}{2zaF_2}$, $x = 0$ is the evolutionarily stable strategy, indicating that food companies tend to supply unsafe food.

(2) When $\frac{R_2 - R_1 + zaF_2}{F_1} \leq y \leq 1$, and $b < \frac{1}{2}$, if $a > \frac{R_2 - R_1 - yF_1}{(2b-1)zF_2}$, then $x = 1$ is the evolutionarily stable strategy, meaning that food companies tend to supply quality and safe food.

(3) When $\frac{R_2 - R_1}{F_1} \leq y \leq \frac{R_2 - R_1 + zaF_2}{F_1}$, or $0 < y \leq \frac{R_2 - R_1}{F_1}$, $b < \frac{1}{2}$, if $b > \frac{R_2 - R_1 - yF_1 + zaF_2}{2zaF_2}$, then $x = 1$ is the evolutionarily stable strategy, indicating that food companies tend to supply quality and safe food.

(4) When $\frac{R_2 - R_1 + zaF_2}{F_1} \leq y \leq 1$ and $b > \frac{1}{2}$, $x = 1$ is the evolutionarily stable strategy, showing that food companies tend to supply quality and safe food.

Therefore, the following propositions can be derived:

Proposition 1: The strategy adopted by food companies depends on the influence and truthfulness of media reporting on food safety issues:

(1) When the probability of government regulatory agency oversight is low, indicating relaxed regulation, and media reporting has weak truthfulness, the following specific scenarios occur:

a. When the impact and truthfulness of media reporting are constant, food companies can adopt any food supply strategy.

b. When media reporting has a significant impact and relatively strong truthfulness, food companies adopt a strategy of supplying safe-quality food.

c. When media reporting has a minor impact and weak truthfulness, food companies adopt a strategy of supplying unsafe-quality food.

(2) When the probability of government regulatory agency oversight is relatively high, indicating strict regulation, and media reporting has weak truthfulness, food companies adopt a strategy of supplying safe-quality food when media reporting has a significant impact.

(3) When the probability of government regulatory agency oversight is relatively high, indicating strict regulation, and media reporting has strong truthfulness, or when the probability of government regulatory agency oversight is low, indicating relaxed regulation, and media reporting has weak truthfulness, food companies adopt a strategy of supplying safe-quality food when media reporting has strong truthfulness.

(4) When the probability of government regulatory agency oversight is relatively high, indicating strict regulation, and media reporting has strong truthfulness, food companies adopt a strategy of supplying safe-quality food.

3.2 Evolutionary Stable Strategy for Government Regulatory Department

Based on Table 2, the corresponding expected returns for the government regulatory department are as follows:

The expected return when the government regulatory department chooses strict regulation is $E_{b1} = R_3 - C_3 + F_1 - xF_1 - zC_4$. The expected return when the government regulatory department chooses relaxed regulation is $E_{b2} = 2xzabF_3 - xzaF_3 - zabF_3$. The government regulatory department's average expected return is $E_b = yE_{b1} + (1-y)E_{b2}$.

The replication dynamic equation for the government regulatory department is as follows:

$$F(y) = y(E_{b1} - E_b) = y(1-y)(R_3 - C_3 + F_1 - xF_1 - zC_4 - 2xzabF_3 + xzaF_3 + zabF_3) \quad (3)$$

The first-order derivative of the replication dynamic equation with respect to y is:

$$F'_y = (1-2y)(R_3 - C_3 + F_1 - xF_1 - zC_4 - 2xzabF_3 + xzaF_3 + zabF_3) \quad (4)$$

Now, we analyze the stability of the regulatory department's strategy based on the relevant parameters:

Regarding the discussion of stability strategy-related parameters:窗体顶端

When $\frac{R_3-C_3+F_1-xF_1}{C_4} \le z < 1$, it holds that $\frac{R_3-C_3+F_1-xF_1-zC_4}{zF_3(2xb-x-b)} \ge 0$ .When $0 < z \le \frac{R_3-C_3+F_1-xF_1}{C_4-xaF_3}$, $x > \frac{1}{2}$ or $\frac{R_3-C_3+F_1-xF_1}{C_4-xaF_3} \le z < 1$, $x < \frac{1}{2}$, it holds that $\frac{R_3-C_3+F_1-xF_1-zC_4+xzaF_1}{zaF_3(2x-1)} \ge 0$.

From this, it can be concluded:

(1) When $\frac{R_3-C_3+F_1-xF_1}{C_4-xaF_3} \le z < 1$ and $x < \frac{1}{2}$, the following holds:

a. When $a = \frac{R_3-C_3+F_1-xF_1-zC_4}{zF_3(2xb-x-b)}$, and $b = \frac{R_3-C_3+F_1-xF_1-zC_4+xzaF_1}{zaF_3(2x-1)}$, all values of y are evolutionarily stable.

b. When $a > \frac{R_3-C_3+F_1-xF_1-zC_4}{zF_3(2xb-x-b)}$, and $b > \frac{R_3-C_3+F_1-xF_1-zC_4+xzaF_1}{zaF_3(2x-1)}$, $y = 0$ is the evolutionarily stable strategy, meaning that the government regulatory agency adopts a completely relaxed regulatory strategy.

c. When $a < \frac{R_3-C_3+F_1-xF_1-zC_4}{zF_3(2xb-x-b)}$, and $b < \frac{R_3-C_3+F_1-xF_1-zC_4+xzaF_1}{zaF_3(2x-1)}$, $y = 0$ is the evolutionarily stable strategy, meaning that the government regulatory agency adopts a completely strict regulatory strategy.

(2) When $\frac{R_3-C_3+F_1-xF_1}{C_4} \le z \le \frac{R_3-C_3+F_1-xF_1}{C_4-xaF_3}$, if $a > \frac{R_3-C_3+F_1-xF_1-zC_4}{zF_3(2xb-x-b)}$, $y = 0$ is the evolutionarily stable strategy, indicating that the government regulatory agency adopts a completely relaxed regulatory strategy.

(3) When $0 < z \le \frac{R_3-C_3+F_1-xF_1}{C_4}$, and $x > \frac{1}{2}$, if $b > \frac{R_3-C_3+F_1-xF_1-zC_4+xzaF_1}{zaF_3(2x-1)}$, $y = 0$ is the evolutionarily stable strategy, indicating that the government regulatory agency adopts a completely relaxed regulatory strategy.

(4) When $0 < z \le \frac{R_3-C_3+F_1-xF_1}{C_4}$, and $x < \frac{1}{2}$, $y = 0$ is the evolutionarily stable strategy, indicating that the government regulatory agency adopts a completely strict regulatory strategy.

Therefore, the following propositions can be derived:

Proposition 2: The strategy adopted by the government regulatory agency depends on the influence and truthfulness of media reporting on food safety issues:

(1) When the probability of media exposure of

food safety issues is high, meaning a high media exposure rate, and the probability of food companies supplying safe food is low, the following specific scenarios occur: ①When the impact and truthfulness of media reporting are constant, the government regulatory agency may adopt any regulatory strategy. ② When media reporting has a significant impact and strong truthfulness, the government regulatory agency adopts a completely relaxed regulatory strategy. ③When media reporting has a minor impact and weak truthfulness, the government regulatory agency adopts a completely strict regulatory strategy.

(2) When the probability of media exposure of food safety issues is relatively high, meaning a relatively high media exposure rate, and media reporting has a significant impact, the government regulatory agency adopts a completely strict regulatory strategy.

(3) When the probability of media exposure of food safety issues is low, meaning a low media exposure rate, and the probability of food companies supplying safe food is high, the government regulatory agency adopts a completely relaxed regulatory strategy when media reporting has strong truthfulness.

(4) When the probability of media exposure of food safety issues is low, meaning a low media exposure rate, and the probability of food companies supplying safe food is low, the government regulatory agency adopts a completely relaxed regulatory strategy.

3.3 Evolutionarily Stable Strategies for Media

Based on Table 2, we can derive the corresponding expected returns for the media as follows:

When the media adopts the exposure strategy, the expected return $E_{c1} = R_4 - C_5 - xaF_4$. When the media adopts the non-exposure strategy, the expected return $E_{c2} = xC_5 - C_5 - yaF_5 + xyaF_5$. The media's average expected return $E_c = zE_{c1} + (1-z)E_{c2}$.

The media's replicator dynamic equation is

$$K(z) = z(E_{C1} - E_C) = z(1-z)(R_4 - xC_5 - xaF_4 - xaF_4 + yaF_5 - xyaF_5) \quad (5)$$

The first-order derivative of the replicator dynamic equation with respect to z is:

$$K'_{(z)} = z(1-2z)(R_4 - xC_5 - xaF_4 - xaF_4 + yaF_5 - xyaF_5) \quad (6)$$

Based on this, we can analyze the stability strategies of the media as follows:

Regarding the discussion of stability strategies: When $0 < x \leq \frac{R_4}{C_5}$, $0 < y < \frac{xF_4}{(1-x)F_5}$, or $\frac{R_4}{C_5} \leq x < 1$, $\frac{xF_4}{(1-x)F_5} < y < 1$, we have $\frac{R_4 - C_5}{xF_4 + xyF_5 - yF_5} \geq 0$.

From this, we can conclude the following when $0 < x \leq \frac{R_4}{C_5}$, $0 < y < \frac{xF_4}{(1-x)F_5}$, or $\frac{R_4}{C_5} \leq x < 1$, $\frac{xF_4}{(1-x)F_5} < y < 1$:

(1) When $a = \frac{R_4 - C_5}{xF_4 + xyF_5 - yF_5}$, all values of z are evolutionarily stable.

(2) When $a > \frac{R_4 - C_5}{xF_4 + xyF_5 - yF_5}$, $z = 0$ is the evolutionarily stable strategy, meaning the media adopts the non-exposure strategy.

(3) When $a < \frac{R_4 - C_5}{xF_4 + xyF_5 - yF_5}$, $z = 1$ is the evolutionarily stable strategy, meaning the media adopts the complete exposure strategy.

Therefore, the following propositions can be derived:

Proposition 3: The strategy adopted by the media depends on the influence and truthfulness of their reporting on food safety issues:

When the probability of food companies supplying safe-quality food is low, and the probability of government regulatory oversight is low, or when the probability of food companies supplying safe-quality food is high, and the probability of strict government regulatory oversight is low, meaning that the likelihood of both food companies supplying safe-quality food and strict government regulatory oversight is either low or high:

(1) When the impact of media reporting is constant, the media may adopt any exposure strategy.

(2) When the impact of media reporting is significant, the media adopts a strategy of not exposing the issue.

(3) When the impact of media reporting is minor, the media adopts a strategy of complete exposure.

4. Stability Equilibrium Analysis of Three-Party Evolutionary Game

Based on the replication dynamic equations for the food companies, government regulatory agencies, and media regarding food safety behavior:

$$\frac{dx}{dt} = x(1-x)[R_1 - R_2 + yF_1 + (2b-1)zaF_2] \quad (7)$$

$$\frac{dy}{dt} = y(1-y)(R_3 - C_3 + F_1 - xF_1 - zC_4 - 2xzabF_3 + xzaF_3 + zabF_3) \quad (8)$$

$$\frac{dz}{dt} = z(1-z)(R_4 - xC_5 - xaF_4 - xaF_4 + yaF_5 - xyaF_5) \quad (9)$$

It can be observed from the replication dynamic equations that the strategies of food companies, government regulatory agencies, and media are interrelated. Therefore, this paper employs a step-by-step analysis approach to separately analyze the interactions between food companies and government regulatory agencies, food companies and media, and government regulatory agencies and media. When analyzing food companies and government regulatory agencies, the media's strategy z is treated as a constant; when analyzing food companies and media, the government regulatory agencies' strategy y is held constant, and when analyzing government regulatory agencies and media, the food companies' strategy x is kept constant.

4.1 Stability Equilibrium Analysis of Food Companies and Government Regulatory Agencies

From the replication dynamic equations of food companies and government regulatory agencies, it is known that there are five equilibrium points for their replication dynamics: $(0,0)$, $(0,1)$, $(1,0)$, $(1,1)$, and $\left(\frac{R_3-C_3-zC_4+F_1+zabF_3}{2zabF_3-zaF_3+F_1}, \frac{R_2-R_1-(2b-1)zaF_2}{F_1}\right)$. These conditions hold true if and only if $0 \le \frac{R_2-R_1-(2b-1)zaF_2}{F_1} \le 1$ and $0 \le \frac{R_3-C_3-zC_4+F_1+zabF_3}{2zabF_3-zaF_3+F_1} \le 1$.

The stability of equilibrium points in the evolutionary dynamics is analyzed using the Jacobian matrix (Jacobi Matrix).

For the dynamic game between food companies and government regulatory agencies, the Jacobian matrix J_1 is given by: $J_1 = \begin{bmatrix} \frac{\partial G(x)}{\partial x} & \frac{\partial G(x)}{\partial y} \\ \frac{\partial G(y)}{\partial x} & \frac{\partial G(y)}{\partial y} \end{bmatrix}$, Specifically,

$$J_1 = \begin{bmatrix} (1-2x)[R_1 - R_2 + yF_1 + (2b-1)zaF_2] & x(1-x)F_1 \\ y(1-y)(-F_1 - 2zabF_3 + zaF_3) & (1-2y)(R_3 - C_3 + F_1 - zC_4 + zabF_3 - 2xzabF_3 + xzaF_3) \end{bmatrix} \quad (10)$$

The determinant of J_1 is:

$$DetJ_1 = (1-2x)[R_1 - R_2 + yF_1 + (2b-1)zaF_2]\,(1-2y)(R_3 - C_3 + F_1 - xF_1 - zC_4 - 2xzabF_3 + xzaF_3 + zabF_3) - x(1-x)y(1-y)F_1(-F_1 - 2zabF_3 + zaF_3) \quad (11)$$

The trace of J_1 is:

$$TrJ_1 = (1-2x)[R_1 - R_2 + yF_1 + (2b-1)zaF_2] + (R_3 - C_3 + F_1 - zC_4 + zabF_3 - 2xzabF_3 + xzaF_3) \quad (12)$$

By substituting the five equilibrium points into the determinant J_1 and trace J_1, the stability analysis results are obtained as follows. Here, $x^* = \frac{R_3-C_3-zC_4+F_1+zabF_3}{2zabF_3-zaF_3+F_1}$, and $y^* = \frac{R_1-R_2-(2b-1)zaF_2}{F_1}$.

Table 3. Stability Analysis of Food Companies and Government Regulatory Agencies

Equilibrium Point	$DetJ_1$ Sign	TrJ_1 Sign	Determination Result	Stability Condition
(0,0)	+	-	ESS	$b < \frac{C_3 + zC_4 - R_3 - F_1}{zaF_3}$
(0,1)	-	-	Unstable Point	
(1,0)	-	-	Unstable Point	
(1,1)	+	-	ESS	$b > \frac{R_3 - C_3 - zC_4 + zaF_3}{zaF_3}$
(x^*, y^*)	Non-negative	0	Saddle Point	Saddle point under any conditions

From Table 3, we can determine the stable evolutionary strategies for food companies and government regulatory agencies as follows:

When $b < \frac{C_3+zC_4-R_3-F_1}{zaF_3}$, meaning that the expected benefits of government regulation are lower than the expected costs, the final outcome of the game between food companies and government regulatory agencies will converge to the stable equilibrium state $(0,0)$. In this scenario, food companies adopt the strategy of supplying unsafe food products, while government regulatory agencies adopt a completely relaxed regulatory approach.

When $b > \frac{R_3 - C_3 - zC_4 + zaF_3}{zaF_3}$, indicating that the expected benefits for government regulatory agencies exceed the expected costs, the final outcome of the game between food companies and government regulatory agencies will converge to the stable equilibrium state $(1,1)$. Here, food companies choose to supply safe food products, and government regulatory agencies opt for strict regulatory measures.

Based on the above analysis, we can formulate Proposition 4 as follows:

Proposition 4: Given media supervision strategies, the equilibrium strategy combinations for food companies and government regulatory agencies are as follows:

(1) When $b < \frac{C_3 + zC_4 - R_3 - F_1}{zaF_3}$, the replicator dynamics for food companies and government regulatory agencies tend to the equilibrium point $(0,0)$. Therefore, the equilibrium strategy combination is (supplying unsafe food products, complete relaxation of regulation).

(2) When $b > \frac{R_3 - C_3 - zC_4 + zaF_3}{zaF_3}$, the replicator dynamics for food companies and government regulatory agencies tend to the equilibrium point $(1,1)$. Hence, the equilibrium strategy combination is (supplying safe food products, strict regulation).

4.2 Stability Equilibrium Analysis of Food Companies and Media

From the replicator dynamics equations for food companies and government regulatory agencies, we can identify five equilibrium points in their dynamic game: $(0,0)$, $(0,1)$, $(1,0)$, $(1,1)$ and $\left(\frac{R_4 + yaF_5}{C_5 + aF_4 + yaF_5}, \frac{R_1 - R_2 + yF_1}{(1-2b)aF_2}\right)$. These equilibrium points hold true only when $0 \le \frac{R_4 + yaF_5}{C_5 + aF_4 + yaF_5} \le 1$, and $0 \le \frac{R_1 - R_2 + yF_1}{(1-2b)aF_2} \le 1$.

The Jacobian matrix J_2 for the dynamic game between food companies and government regulatory agencies is given by: $J_2 = \begin{bmatrix} \frac{\partial G(x)}{\partial x} & \frac{\partial G(x)}{\partial z} \\ \frac{\partial K(z)}{\partial x} & \frac{\partial K(z)}{\partial z} \end{bmatrix}$, Specifically,

$$J_2 = \begin{bmatrix} (1-2x)[R_1 - R_2 + yF_1 + (2b-1)zaF_2] & x(1-x)(2b-1)aF_2 \\ z(1-z)(-C_5 - aF_4 - yaF_5) & (1-2z)(R_4 - xC_5 - xaF_4 + yaF_5 - xyaF_5) \end{bmatrix} \quad (13)$$

The determinant of J_2 is calculated as follows:

$$DetJ_2 = (1-2x)[R_1 - R_2 + yF_1 + (2b-1)zaF_2](1-2z)(R_4 - xC_5 - xaF_4 + yaF_5 - xyaF_5) - x(1-x)(2b-1)zaF_2(1-z)(-C_5 - aF_4 - yaF_5) \quad (14)$$

The trace of J_2 is calculated as:

$$TrJ_1 = (1-2x)[R_1 - R_2 + yF_1 + (2b-1)zaF_2] + (1-2z)(R_4 - xC_5 - xaF_4 + yaF_5 - xyaF_5) \quad \underline{(15)}$$

By substituting the five equilibrium points into the determinant and trace of J_1 and conducting stability analysis, we obtain the following results. Here, $x^* = \frac{R_4 + yaF_5}{C_5 + aF_4 + yaF_5}$, $z^* = \frac{R_1 - R_2 + yF_1}{(1-2b)aF_2}$.

The stable evolution strategies of food enterprises and media can be determined from Table 4 as follows:

When $a < \frac{R_2 - R_1 - yF_1}{(2b-1)zF_2}$, where the expected profit of food enterprises supplying unsafe food is less than the expected profit of supplying safe food, the final outcome of the game between food enterprises and media converges to the equilibrium state $(0,1)$. This means that food enterprises adopt the strategy of supplying unsafe food, while the media adopts the strategy of complete exposure.

When $a > \frac{R_2 - R_1 - yF_1}{(2b-1)zF_2}$, which means that the expected profit of government regulatory agencies is greater than their expected cost, the final outcome of the game between food enterprises and government regulatory agencies will converge to the stable equilibrium state $(1,0)$. In this case, food enterprises will choose to supply safe food, and government regulatory agencies will implement strict supervision.

Table 4. Stability Analysis of Food Companies and Media

Equilibrium Point	$DetJ_2$ Sign	TrJ_2 Sign	Determination Result	Stability Condition
$(0,0)$	+	+	Unstable Point	

$(0,1)$	+	-	ESS	$a<\frac{R_2-R_1-yF_1}{(2b-1)zF_2}$
$(1,0)$	+	-	ESS	$a>\frac{R_2-R_1-yF_1}{(2b-1)zF_2}$
$(1,1)$	+	+	Unstable Point	
(x^*,y^*)	Non-negative	0	Saddle Point	Any condition is a saddle point

Based on the above analysis, Proposition 5 can be formulated as follows:

Proposition 5: given the strategy of government regulatory agencies, outlines the equilibrium strategy combinations for food enterprises and media as follows:

(1) If $y<\frac{R_2-R_1-(2b-1)zaF_2}{F_1}$ and $b>\frac{1}{2}$, the replicator dynamic equations for food enterprises and media tend toward the equilibrium point $(0,1)$. This implies that the equilibrium strategy combination is (supplying unsafe food, complete exposure).

(2) If $y>\frac{R_2-R_1}{F_1}$ and $b<\frac{1}{2}$, there are two scenarios:

a. When $a<\frac{R_2-R_1-yF_1}{(2b-1)zF_2}$, the replicator dynamic equations for food enterprises and media tend toward the equilibrium point $(0,1)$. In this case, the equilibrium strategy combination is (supplying unsafe food, complete exposure).

b. When $a>\frac{R_2-R_1-yF_1}{(2b-1)zF_2}$, the replicator dynamic equations for food enterprises and media tend toward the equilibrium point $(1,0)$. This corresponds to the strategy combination of (supplying safe food, not exposing).

(3) If either $y<\frac{R_2-R_1}{F_1}$ and $b<\frac{1}{2}$, or $y>\frac{R_2-R_1}{F_1}$ and $b>\frac{1}{2}$, , the replicator dynamic equations for food enterprises and media tend toward the equilibrium point $(1,0)$. In both of these cases, the equilibrium strategy combination is (supplying safe food, not exposing).

4.3 Government Regulatory Agencies and Media Stability Equilibrium Analysis

From the replicator dynamic equations for government regulatory agencies and media, it is known that there are five equilibrium points in the dynamic game, which are $(0,0)$, $(0,1)$, $(1,0)$, $(1,1)$ and $\left(\frac{R_4-xC_5-xaF_4}{xaF_5-aF_5},\frac{R_3-C_3+F_1-xF_1}{C_4+2xzabF_3-xaF_3+abF_3}\right)$. These equilibrium points exist only when the following conditions are met: $0\le\frac{R_4-xC_5-xaF_4}{xaF_5-aF_5}\le 1$ and $0\le\frac{R_3-C_3+F_1-xF_1}{C_4+2xzabF_3-xaF_3+abF_3}\le 1$.

The Jacobian matrix J_3 for the dynamic game between government regulatory agencies and media is given by: $J_3=\begin{bmatrix}\frac{\partial F(y)}{\partial x} & \frac{\partial F(y)}{\partial z}\\ \frac{\partial K(z)}{\partial y} & \frac{\partial K(z)}{\partial z}\end{bmatrix}$,

Specifically, it is as follows:

$$J_3=\begin{bmatrix}(1-2y)(R_3-C_3+F_1-zC_4+zabF_3-xF_1-2xzabF_3+zaF_3) & y(1-y)(xaF_3+abF_3-2xabF_3-C_4)\\ z(1-z)(aF_5-xaF_5) & (1-2z)(R_4-xC_5-xaF_4-xyaF_5+yaF_5)\end{bmatrix} \quad (16)$$

The determinant of J_3 is given by:

$$DetJ_3=(1-2y)(R_3-C_3+F_1-zC_4+zabF_3-xF_1-2xzabF_3+zaF_3)(1-2z)(R_4-xC_5-xaF_4-xyaF_5+yaF_5)-y(1-y)(xaF_3+abF_3-2xabF_3-C_4)\,z(1-z)(aF_5-xaF_5) \quad (17)$$

The trace of J_3 is given by:

$$TrJ_3=(1-2y)(R_3-C_3+F_1-zC_4+zabF_3-xF_1-2xzabF_3+zaF_3)+(1-2z)(R_4-xC_5-xaF_4-xyaF_5+yaF_5) \quad (18)$$

By substituting the values of the five equilibrium points into the determinant and trace of J_3 and conducting stability analysis, the results are obtained as follows. Where $x^*=\frac{xC_5+xa(1-b)F_4-R_4}{bC_5+xbF_5}$ and $z^*=\frac{R_3-C_3+F_1-xF_1}{C_4+2xzabF_3-xaF_3+abF_3}$.

Table 5. Stability Analysis of Government Regulatory Agencies and Media

Equilibrium Point	$DetJ_3$ Sign	TrJ_3 Sign	Determination Result	Stability Condition
(0,0)	+	-	ESS	$a>\frac{C_4}{(1-b)xF_3+(1-x)bF_3}$ $b>\frac{C_4}{aF_3-2axF_3}$

(0,1)	+	-	ESS	$a<\frac{C_4}{(1-b)xF_3+(1-x)bF_3}$ $b<\frac{C_4}{aF_3-2axF_3}$
(1,0)	+	+	Unstable Point	
(1,1)	+	+	Unstable Point	
(x^*,y^*)	Non-negative	0	Saddle Point	Any condition is a saddle point

From the above analysis and table 5, we can derive the following proposition 6:

Proposition 6, given the food company's strategy, the equilibrium strategy combinations for the government regulatory department and the media are as follows:

(1) If $x>\max\left\{\frac{C_4-bF_3}{F_3(1-2b)},\frac{1}{2}\right\}$ and $b<\frac{1}{2}$, when $a>\frac{C_4}{(1-b)xF_3+(1-x)bF_3}$, the government regulatory department and the media's replicator dynamics tend towards the equilibrium point $(0,0)$, i.e., the strategy combination is (relaxed regulation, no exposure).

(2) If $x<\min\left\{\frac{C_4-bF_3}{F_3(1-2b)},\frac{1}{2}\right\}$ and $b<\frac{1}{2}$, or $x<\frac{1}{2}$ and $b>\frac{1}{2}$, when $b<\frac{C_4}{aF_3-2axF_3}$, the government regulatory department and the media's replicator dynamics tend towards the equilibrium point $(0,1)$, i.e., the strategy combination is (relaxed regulation, exposure).

5. Numerical Simulation Analysis

Through the analysis of the three-party evolutionary game involving food companies, government regulatory agencies, and the media, the stable equilibrium points in the three-party evolutionary game are obtained under certain conditions of media reporting influence and truthfulness. The corresponding parameter conditions for these stable equilibrium points are presented in Table 6 below:

Table 6. Parameter Conditions for Stable Equilibrium Points in the Three-Party Evolutionary Game

Value	Parameter Conditions
(0,0,0)	$\frac{C_4}{(1-b)xF_3+(1-x)bF_3}<a<1$
(0,0,1)	$0<a<\frac{R_2-R_1-yF_1}{(2b-1)zF_2}$ $0<b<\frac{C_3+zC_4-R_3-F_1}{zaF_3}$
(1,0,0)	$\max\left\{\frac{R_2-R_1-yF_1}{(2b-1)zF_2},\frac{C_4}{(1-b)xF_3+(1-x)bF_3}\right\}<a<1$ $\frac{C_4}{aF_3-2axF_3}<b<1$
(1,1,0)	$\frac{R_2-R_1-yF_1}{(2b-1)zF_2}<a<1$ $\max\left\{\frac{R_3-C_3-zC_4+zaF_3}{zaF_3},\frac{C_4}{aF_3-2axF_3}\right\}<b<1$

Numerical simulation analysis is conducted based on the parameter value ranges corresponding to different stable points in the three-party evolutionary game. Variations in the influence and truthfulness of media reporting on food safety lead to different cost and benefit conditions for food companies, as well as different benefits and costs for government regulatory agencies and the media. Consequently, the stable equilibrium points in the three-party evolutionary game change. By using parameter value conditions for media reporting influence and truthfulness, and ensuring that the corresponding conditions for stable equilibrium are met, different combinations of their values are set to reflect the real differences in media reporting influence and truthfulness. The specific numerical analysis is provided below.

5.1 Numerical Analysis of Stable Point $(0,0,0)$

Based on the actual meanings and conditions of the corresponding parameters in this paper, let's assume R1=4, R2=6, R3=2, R4=1, C3=9, C4=5, C5=13, F1=5, F2=12, F3=8, F4=11, F5=10. To reflect a relatively objective initial strategy state, we set the initial probabilities for food companies, government regulatory agencies, and the media to adopt their respective strategies at 50%, i.e., x(0)=0.5, y(0)=0.5, z(0)=0.5. Due to the varying influence and truthfulness of media reporting on food safety, the rate at which the strategies in the three-party evolutionary game converge to equilibrium points changes. Considering that the stable point for all three of them is (0,0,0), we set a=0.7, b=0.7, a=0.7, b=0.9, and a=0.9, b=0.7. Below, numerical simulations are conducted for the three sets of different values of media reporting influence and truthfulness, and the results are shown in Figure 1.

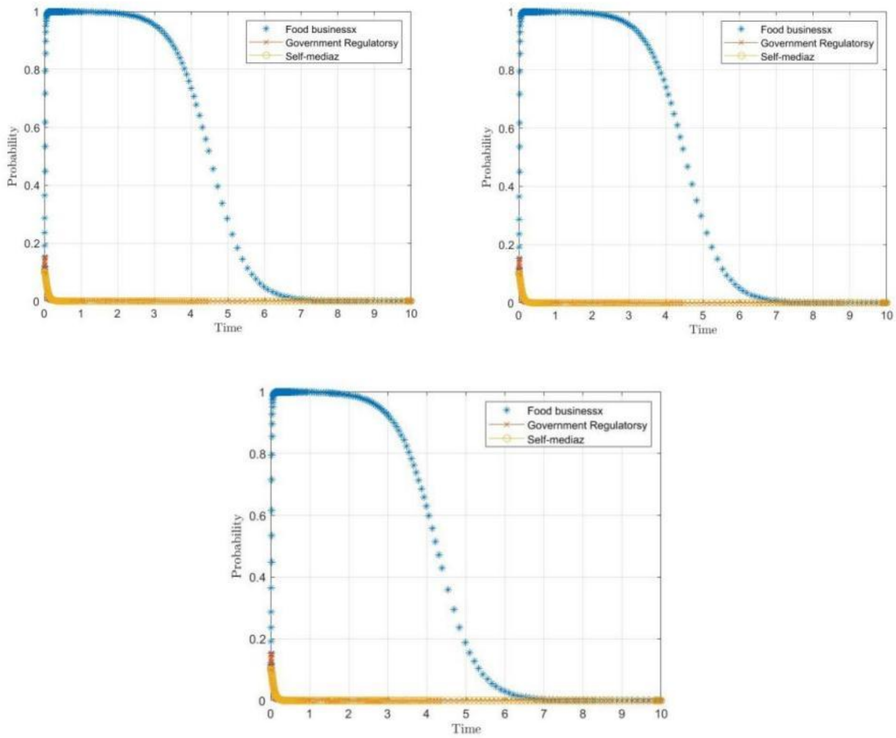

Figure 1. Evolutionary Simulation Results of Stable Point (0, 0, 0) under Different Levels of Influence and Truthfulness in Media Reporting

Under various parameter values reflecting different levels of influence and truthfulness in media reporting, the equilibrium strategy for food companies, government regulatory agencies, and media regarding food safety behavior all eventually converge to the extreme situation of (food companies supplying unsafe food, government regulatory agencies completely relaxing regulation, and media not exposing). Media approaches its equilibrium strategy more rapidly, followed by government regulatory agencies, and food companies adjust to their equilibrium strategy relatively slowly. Over time, the probability of food companies supplying safe food increases initially and then gradually decreases to zero. The probabilities of government regulatory agencies implementing regulation and media exposure both gradually decrease to zero, with the rate of decrease being initially faster and later slower, and media exposure probability decreasing faster than that of government regulatory agencies.

From Figure 1, it is evident that changes in the influence and truthfulness of media reporting on food safety do not affect the equilibrium strategies or their trends in the three-party evolutionary game. However, under different combinations of influence and truthfulness parameters, the rates of convergence to stable point (0,0,0) vary slightly, with the most significant impact on the rate at which food companies approach the stable point. Comparing Figure 1(1) with Figure 1(2), when media reporting has higher truthfulness, the probability of food companies supplying safe food increases significantly, initially exceeding 0.6, and then gradually decreasing to 0, with the rate of decrease being slightly slower. Comparing Figure 1(1) with Figure 1(3), it can be observed that the influence of media reporting truthfulness on the rate at which food companies approach the stable point is greater than the influence of media reporting influence. When media reporting has greater influence or higher truthfulness, the rate at which food companies approach the stable point becomes slower.

The numerical results at this stable point indicate that when media reporting has greater influence and higher truthfulness, food companies will be deterred by media involvement in food safety supervision, leading to an improvement in their own supply of food safety. At the same time, media supervision will have a certain substitutive effect on the food safety supervision level of government regulatory agencies, causing a decrease in the level of government regulatory oversight. Media exposure behavior will also gradually decrease under the influence of its reporting impact and truthfulness. Media supervises food safety by exposing food safety issues and exerts a deterrent effect on food companies' supply of safe food. However, over time, media's supervisory role weakens due to its partial regulatory substitution effect on government regulatory agencies. Eventually, it loses its value. Nevertheless, under the same circumstances, media reporting with greater influence and higher truthfulness results in a more significant supervisory effect.

5.2 Numerical Analysis of Stable Point $(0, 0, 1)$

Assuming R1=3, R2=7, R3=4, R4=7, C3=8, C4=6, C5=4, F1=5, F2=10, F3=12, F4=2, F5=2. Initial probabilities for food companies, government regulatory agencies, and media adopting their respective strategies are all set to 50%, meaning (x(0)=0.5, y(0)=0.5, z(0)=0.5). According to the stable point (0,0,1), parameters are set as follows: a=0.3, b=0.6; a=0.3, b=0.7; a=0.6, b=0.7. The simulation results for stable point (0,0,1) are shown in Figure 2.

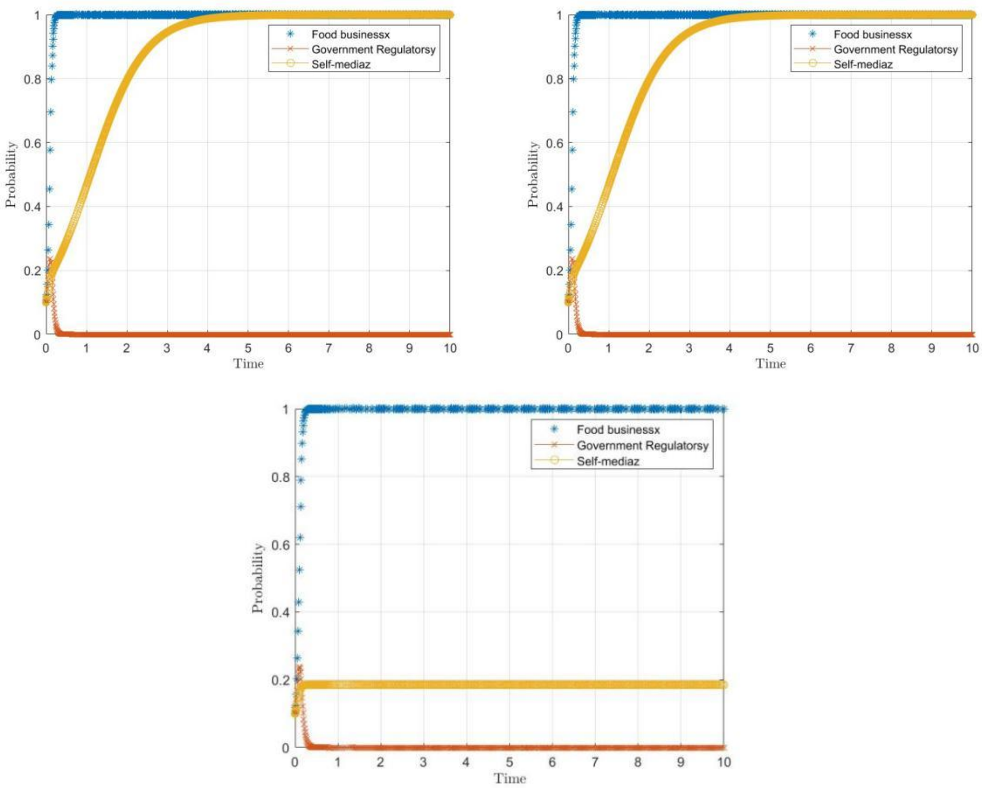

Figure 2. Evolutionary Simulation Results of Stable Point (0,0,1)

5.3 Numerical Analysis of Stable Point $(1, 0, 0)$

Assuming R1=4, R2=5, R3=3, R4=3, C3=6, C4=5, C5=6, F1=18, F2=10, F3=14, F4=6, F5=7. Initial values are assumed to be x(0)=0.5, y(0)=0.5, z(0)=0.5. Based on the stable point being (1,0,0) for all three, different values of a and b are considered: a=0.7, b=0.2, a=0.7, b=0.4, a=0.9, b=0.2, a=0.9, b=0.4, and simulations are conducted to obtain the results as shown in Figure 3.

Under the given parameter conditions, the equilibrium strategy for food companies and government regulatory agencies regarding food safety behavior ultimately tends towards 0. The media's behavior strategy ultimately tends towards 1, meaning that food companies supply unsafe food, government regulatory agencies completely relax their oversight, and the media exposes these actions. Additionally, the media converges faster to its equilibrium strategy, while government regulatory agencies and food companies converge more slowly to their respective equilibrium strategies. Over time, the probability of food companies supplying safe food and the probability of government regulatory agencies regulating gradually decrease and eventually reach 0, with a decreasing rate that starts high and then decreases. The rate at which government regulatory agencies reduce their oversight probability is faster than the rate at which food companies reduce their probability of supplying safe food. The probability of media exposure gradually increases to 1, with an increasing rate that starts high and then decreases.

Figure 2 shows that changes in the media's influence and truthfulness in reporting on food safety issues do not affect the equilibrium strategy and its trends in the three-party evolutionary game. However, the rates of convergence to stable point (0,0,1) vary slightly depending on different combinations of impact and truthfulness parameters. Specifically, when comparing Figure 2(1) with Figure 2(2) and Figure 2(2) with Figure 2(3), it is evident that the impact of media reporting influence on the rate of convergence of food companies and government regulatory agencies to the stable point is greater than the impact of media reporting truthfulness. When media reporting influence is greater or truthfulness is stronger, the rates of decrease in the probability of food companies supplying safe food and government regulatory agencies' oversight slow down.

The numerical results at this stable point indicate that, under similar conditions, higher media reporting influence and truthfulness lead to a more significant supervisory role. The impact of media reporting influence is more important for its role in food safety supervision.

Under the aforementioned parameter conditions, the equilibrium strategy for media and government regulatory agencies in food safety behavior eventually converges to 0. The equilibrium strategy for food companies' behavior ultimately converges to 1, indicating the situation where food companies supply safe-quality food, government regulatory agencies completely relax their oversight, and the media does not expose any issues. Food companies and the media converge relatively quickly to their respective equilibrium strategies, while government regulatory agencies gradually approach their equilibrium strategy at a slower pace. Over time, the probability of media exposure gradually decreases until it reaches 0. On the other hand, the probability of government regulatory oversight initially increases and then gradually decreases to 0, with a faster decrease rate initially and then slowing down. The probability of food companies supplying safe-quality food gradually increases to 1, with an initial rapid increase followed by a slower rate of increase. The decrease in media exposure probability occurs more rapidly compared to the decrease in government regulatory oversight probability.

From Figure 3, it can be observed that changes in the influence and authenticity of media reporting on food safety issues do not affect the equilibrium strategies and their trends in the three-way evolutionary game. They all converge to the stable point (1,0,0) eventually. However, under different combinations of influence and authenticity values, the rate of convergence to the stable point (1,0,0) varies. Comparing Figure 3(3) with Figure 3(1), when media influence increases, the probability of government regulatory oversight initially significantly increases to above 0.7 and then gradually decreases to 0, with a slower decrease rate. The numerical results at this stable point indicate that, under similar circumstances, when the media's influence is relatively higher than its authenticity, media supervision has a more significant impact on increasing the level of government regulatory oversight in a shorter time. However, with the passage of time, the regulatory substitution effect produced by media supervision leads to a sharp decline in the level of government regulatory oversight.

5.4 Numerical Analysis of Stable Point $(\mathbf{1},\mathbf{1},\mathbf{0})$

Assuming R1=4, R2=6, R3=6, R4=3, C3=5, C4=4, C5=5, F1=6, F2=8, F3=7, F4=4, F5=4. Initial values are assumed to be 50% for the probabilities of food companies, government regulatory agencies, and media adopting their respective strategies. Set initial values as x(0)=0.5, y(0)=0.5, z(0)=0.5. Based on the stable point of (1,1,0), set a=0.7, b=0.3, a=0.7, b=0.4, a=0.9, b=0.3, and simulate to obtain the simulation results of the stable point (1,1,0) as shown in Figure 4.

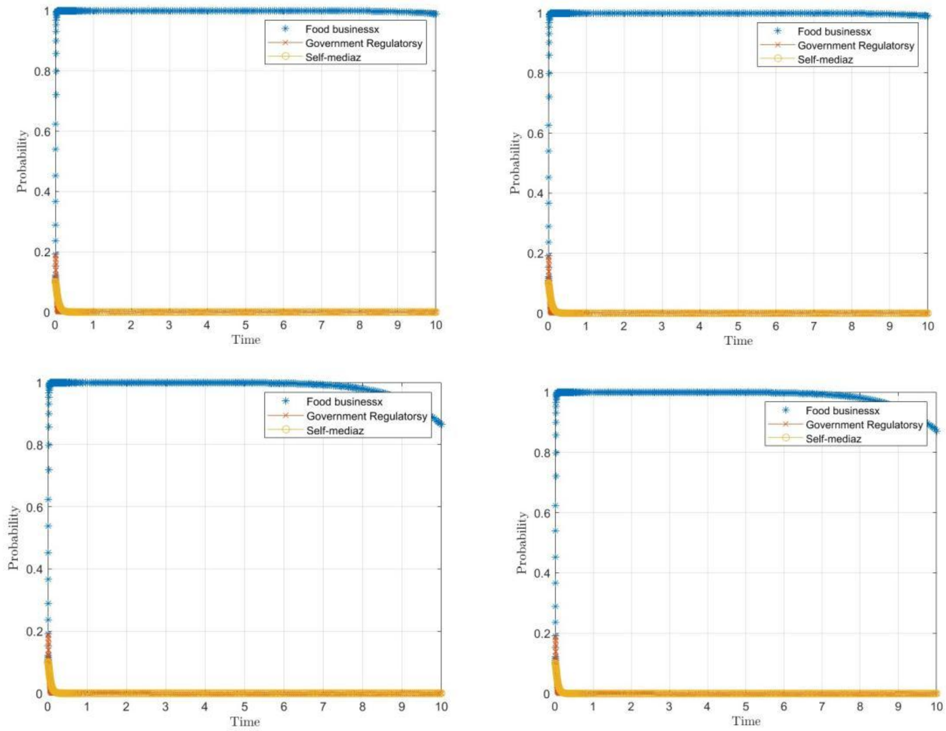

Figure 3. Evolutionary Simulation Results of Stable Point (1,0,0)

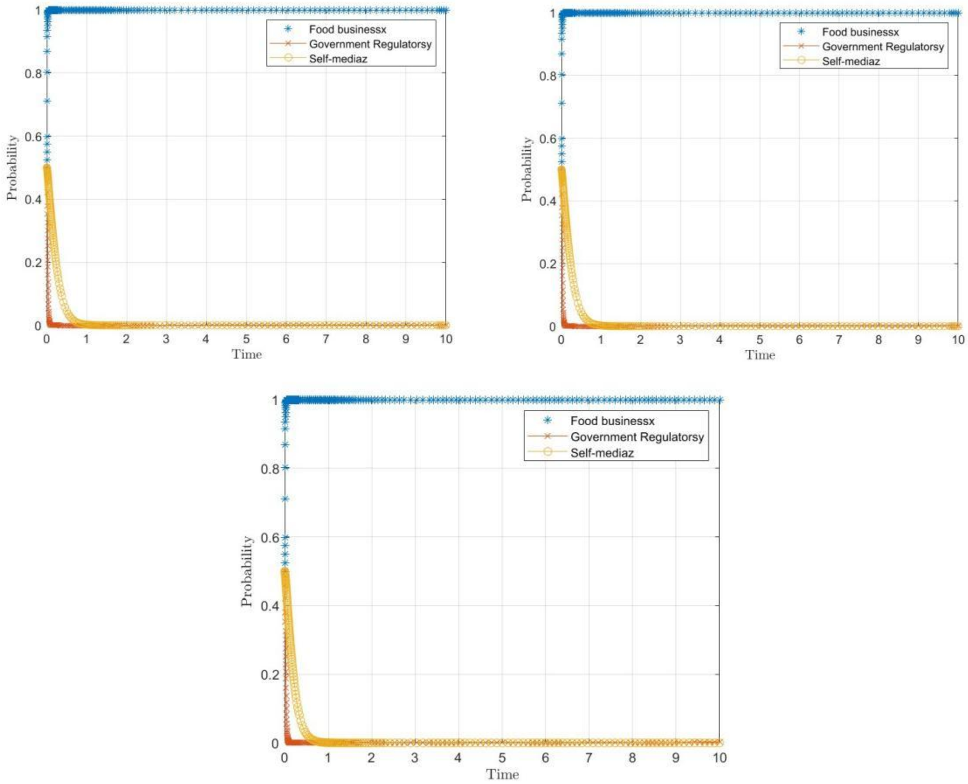

Figure 4. Evolutionary Simulation Results for the Stable Point (1,1,0)

Under the specified parameter conditions, the equilibrium strategies for food companies and government regulatory agencies both eventually approach 1, while the equilibrium strategy for media behavior ultimately approaches 0. In other words, food companies supply safe-quality food, government regulatory agencies strictly enforce regulations, and the media does not expose issues. Additionally, food companies and government regulatory agencies converge to equilibrium strategies earlier than the media. As time progresses, the probabilities of food companies supplying safe-quality food and government regulatory agencies enforcing regulations gradually increase towards 1. The rate of increase is initially high and then slows down, with government regulatory agencies increasing their enforcement rate faster than food companies increase their probability of supplying safe-quality food. Meanwhile, the probability of media exposure gradually decreases until it reaches 0, with the rate of decrease initially high and then slowing down.

From Figure 4, it is evident that changes in the impact and authenticity of media reports on food safety issues do not affect the equilibrium strategies of the three-party evolutionary game or their changing trends. All eventually converge to the stable point $(1,1,0)$. However, different combinations of impact and authenticity values lead to varying rates of convergence to the stable point $(1,1,0)$. When comparing Figure 4(1) and Figure 4(2), an increase in media authenticity results in a slower increase in the probability of government regulatory agencies enforcing regulations. Likewise, when comparing Figure 4(1) and Figure 4(3), an increase in media impact leads to a slower increase in the probability of government regulatory agencies enforcing regulations. The numerical results at this stable point suggest that, under similar conditions, higher media impact or stronger authenticity enhances its supervisory role, having a certain substitutive effect on the regulatory activities of government regulatory agencies.

6. Conclusion

Aiming at the existing problems of media participation in food safety supervision in China, this paper constructs a multiple regression model of media participation in supervision on the economic interests of food enterprises and a tripartite evolutionary game model of media, government supervision departments and food enterprises. At the same time, using the stability equilibrium strategy, the paper focuses on analyzing the influence of media exposure on food safety issues and the influence of authenticity on the equilibrium strategy of related subjects.

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